# IENICA

Interactive European Network for Industrial Crops and their Applications

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# REPORT FROM THE REPUBLIC OF IRELAND

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# METHODOLOGY

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# EXECUTIVE SUMMARY

Interest in non-food crop production has been limited in Ireland. Unlike most other EU countries, Irish agriculture is dominated by grass-animal enterprises, with less than 10% of agricultural land devoted to arable crops. The set-aside area is therefore relatively small and mainly in grassland.

The non-food crop option chosen for review as having most relevance in Ireland is focused on crop production for processed board use. There are also some small-scale enterprises such as herb production for medicinal purposes.

Of the non-energy industrial crop uses, the most promising appears to be hemp and Miscanthus for fibre or insulating board production. Its high yield, low dry matter and ease of establishment would be useful advantages. Demand will be dependant on the rate of expansion of the fibre board industry in relation to the availability of forest thinnings and saw-milling wastes.

# CURRENT SITUATION

## 1.1 Introduction

Restrictions on the volume of production of most food crop and animal enterprises have led to an increasing interest among farmers in non-food crop production. In the early nineties when unemployment rates in Ireland were high, non-food crops were seen as a means of generating additional rural activity and employment and helping to maintain the production capacity of agriculture. However, the main focus was on energy crop production.

## 1.2 Current land use

Of the 7 million hectare area of Ireland, 72% (5 Mha) is devoted to agriculture and forestry. In 1999, 11% of this area (0.6 Mha) was in forestry, leaving 4.4 Mha in agriculture. This area was devoted predominantly to grass (83% or 3.7 Mha) for milk, beef and mutton production. Arable crops were produced on less than 0.4 Mha, the main crops being cereals (0.3 Mha), sugar beet (34,000 ha), potatoes (18,000 ha), silage maize (8,000 ha), linseed (8,000 ha), and oilseed and protein crops (5,000 ha). Apart from an increase in the area under forestry, no other major changes in this land use pattern are envisaged in the near future. Virtually all agricultural production is for food or animal feed purposes, with no industrial use at this time.

The area breakdown between cereal crops in recent years is shown in Table 1. Spring barley and winter wheat predominate.

**Table 1: Areas of various cereal crops, 1996-1998 ('000 ha)**

| Year | 1996 | 1997 | 1998 |
|---|---|---|---|
| Winter wheat | 67.2 | 70.2 | 65.5 |
| Spring wheat | 18.5 | 23.7 | 18.4 |
| Winter barley | 40.9 | 41.1 | 39.0 |
| Spring barley | 140.5 | 148.6 | 151.7 |
| Winter oats | 12.5 | 11.2 | 12.1 |
| Spring oats | 8.4 | 9.4 | 7.3 |
| Other cereals | 5.5 | 5.6 | 6.6 |
| **Total area** | **293.5** | **309.9** | **300.6** |

Source: Department of Agriculture, Food and Forestry

Cereal yields over the past three years have been as in Table 2. Yields of winter wheat have been among the highest in Europe. In 1998 the average yield of sugar-beet was 45 t/ha, and of potatoes 31 t/ha.

**Table 2: Cereal yields, 1996-1998 (Average yield, t/ha)**

| Year | 1996 | 1997 | 1998 |
|---|---|---|---|
| Winter wheat | 9.4 | 8.0 | 8.1 |
| Spring wheat | 7.5 | 6.8 | 7.4 |
| Winter barley | 8.0 | 7.0 | 6.4 |
| Spring barley | 6.4 | 5.4 | 5.5 |
| Winter oats | 7.6 | 7.4 | 6.9 |
| Spring oats | 6.1 | 5.2 | 5.7 |

Source: Department of Agriculture, Food and Forestry

## 1.3 Arable set-aside

The main spur to the search for industrial uses for crops in Ireland has been the desire to find alternative uses for set-aside land, with a view to sustaining output and employment on arable farms. However, the availability of set-aside land in sufficient quantities for a substantial non-food industry has always been uncertain.

The total area of set-aside increased to 36,600 ha in 1994, but had halved by 1997 (Table 3). While it increased again to 30,000 ha in 1999, the equalisation of the set-aside requirement for rotational and permanent set-aside in 1996 led to a sharp increase in the proportion of permanent set-aside. The present breakdown between permanent and rotational is not known, but it is estimated to be about two-thirds permanent. Most of this is in grassland, and is unlikely to be readily available for non-food crop production.

Within the remaining set-aside pool (currently about 10,000 ha), farmers with very small areas of set-aside, or with a high proportion of sugar-beet, or growing continuous winter wheat, may have reservations about growing industrial crops on their set-aside. Frequent changes in set-aside requirements and regulations have also generated uncertainty about future supplies of crops from set-aside to support a non-food industry.

To date, the use of set-aside land for non-food crop production has been confined to very small areas of oil-seed rape and wheat, which were exported for industrial use.

**Table 3: Set-aside areas in Ireland ('000 ha)**

| Year | Set-aside area | | |
|---|---|---|---|
| | Rotational | Non-rotational | Total |
| 1994 | 22.9 | 13.7 | 36.6 |
| 1995 | 19.1 | 13.1 | 32.2 |
| 1996 | | | 25.2 |
| 1997 | | | 18.4 |
| 1998 | | | 20.2 |
| 1999 | | | 30.4 |

Source: Department of Agriculture, Food and Forestry

## 1.4 Work-force employment

There has been a rapid increase in work-force employment levels in Ireland in recent years. Unemployment has fallen from 12.1% in 1995 to 5.6% in 1999, in a period when the total labour force grew from about 1.6M to 1.8M (Table 4). Labour availability is now seen as a production constraint on many farms, and this has somewhat reduced interest in alternative uses for set-aside land.

**Table 4: Average annual unemployment rate 1995-1999**

| Year | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|
| Unemployment rate (%) | 12.1 | 11.5 | 9.8 | 7.4 | 5.6 |

Source: Central Statistics Office

## 1.5 Potential industrial uses

Neither oil crops nor carbohydrate crops are grown in Ireland for industrial uses, nor are they likely to be developed within the next five years. The most promising large-scale industrial uses for crops in Ireland at present are as follows:

**Processed board manufacture:**

Four existing plants produce chip-board, medium density fibre-board and oriented strand board from forest thinnings and saw-milling waste. At full capacity they would require about 1.5 Mt of raw material per year. There is an interest in alternative raw materials, especially for fibre-board manufacture.

**Flax fibre production:**

Ireland had a substantial flax industry in the first half of the twentieth century. The possibility of re-starting this industry using modern production and processing technology is worthy of consideration.

# CROPS FOR FIBRE AND BOARD MANUFACTURE

## 2.1 Introduction

Short-rotation forestry, straw, cereal grains, and whole-crop cereals and rape have potential for fibre board manufacture, to supplement supplies of forest thinnings and sawmill residues. Miscanthus also has attractions for this purpose given its high dry matter yields, but little is known to date about its moisture at harvest or the problems of storing/drying. Flax has potential for the production of high-quality fibre for spinning and weaving, or short fibres as a plastic reinforcement.

## 2.2 Feed-stocks

**Straw:**

The total area of cereals in Ireland was 274,000 ha in 1995. This would give an estimated straw production of about 1 million tonnes, with a calorific value of 13,000 TJ. The mushroom industry requires 1 tonne of straw per 2.5-3 tonnes of compost, so the current production of about 200,000 tonnes of compost requires about 70,000 tonnes of straw. The remainder is either used on the farm or sold for animal feed or bedding. The decline in the area of cereals (down from 336,000 ha in 1987) and the expansion of the mushroom industry has led to increased straw prices; in particular, it has strengthened the price for wheaten straw, about 20% of which goes to compost production. It may be expected that straw prices will continue to fluctuate widely, but large supplies are unlikely to be available at prices that would make its widespread use as a fuel economical.

**Annual arable crops:**

These crops would have their best opportunity on set-aside land on arable farms, where the existing machinery complement could cope with the extra area, and where opportunities for the non-food utilisation of the set-aside area are limited. The most likely possibilities are hemp and whole-crop cereals and rape. The decline in the area of rotational set-aside has dampened the

short-term prospects for the production of any non-food annual crop in sufficient volumes to support a new industry (Table 2).

*Hemp*

The reported high yields and large number of potential uses of hemp prompted a re-examination of its production, starting in 1995. In an earlier evaluation in 1960-66, stem yields of 10 t/ha and fibre yields of 2.5 t/ha were reported. A reasonable quality fibre was achieved, but the establishment of an industry did not seem viable. The objectives of the re-evaluation were to establish the yields attainable with low-THC varieties and to identify any industries with potential uses for the material.

Typical yields from these trials are shown in Table 5. Total yields of more than 20 t/ha of dry matter have been common, although about a quarter of this was leaf material. Total yield could be increased by reducing the seed rate, though this also had the effect of increasing the stem diameter, which would in turn reduce the quality of the fibre produced (Table 6). Sowing date also had an important influence on stem yields (Table 6).

**Table 5: Hemp total and stem yields (mean of five low-THC varieties, 1997)**

| Total DM yield (t/ha) | Leaves (%) | Stem yield (t/ha) |
|---|---|---|
| 21.2 | 24.5 | 16.0 |

**Table 6: Effect of sowing date and seed rate on hemp stem yields, 1998**

| Sowing date | Seed rate (kg/ha) | | | |
|---|---|---|---|---|
| | **20** | **30** | **40** | **50** |
| Apr 1 | 15.3 | 14.0 | 14.6 | 12.8 |
| Apr 17 | 11.2 | 11.1 | 11.1 | 10.8 |
| May 7 | 10.5 | 10.0 | 9.2 | 9.6 |
| May 13 | 8.4 | 9.6 | 9.9 | 8.8 |
| Stem diam (mm) | 10.6 | 10.2 | 9.8 | 7.9 |

In each year it has been possible to bale the harvested crop at moisture contents of less than 20%. Crop heights have been about 3 metres, and the high yield, crop height and fibre strength can lead to many problems for harvesting machinery.

These results suggest that for fibre-board, hemp should be sown in early April at a seed rate of 20-30 kg/ha. Consistently high yields of low-moisture biomass can be achieved. Some improvement to the harvesting system would be required before a commercial operation could be got under way.

*Flax for fibre production*

A three-year study was made in 1988-90 of the feasibility of flax production for fibre use in Ireland. The crop had been widely grown in the northern portion of the country early in the century, but this had died out when the costs and water pollution risks associated with traditional water retting system became unacceptable, and the climate in that region was too cool for successful dew retting.

The objective of the study was to examine the feasibility of producing high yields of high quality long-fibre flax by dew retting in any part of Ireland. Trials were located at various sites in the south and south-east of the country, where it was felt the temperatures would be adequate for dew retting. The produce was retted, baled and exported to Belgium for scutching and final assessment.

It was found that the achievement of high yields of long fibre required adequate rainfall during the stem extension period in May and early June. On the other hand, successful retting required mainly dry weather in Aug-Sept, otherwise the fibre had low strength and poor quality. This combination of conditions occurred infrequently at any site. It was therefore concluded that it would not be possible to establish flax production based on dew retting in Ireland.

*Miscanthus production for energy or fibre-board use*

*Miscanthus giganteus* is a C4 perennial plant which has given high dry matter yields in many countries. Evaluation in Ireland began in 1993, when in-vitro propagated plants were used, many of which were killed by frost in winter 1993-4. Further planting was done in 1994 and 1995.

In 1995, dry matter yields of the 1993 and 1994 crops were 6.6 and 2.6 t/ha respectively. In 1996, the most favourable year to date, yields of the 1993, 1994 and 1995 crops were 26.9, 16.5 and 9.0 t/ha respectively. In 1997, the corresponding yields were 16.4, 16.7 and 9.0 t/ha. A major problem with all these crops was that moisture levels remained high at harvest. Dry matter contents at harvest were typically between 35% and 40%. This is much lower than the levels recorded in most other countries, and is presumably caused by the mild winters in Ireland. Since the crop is harvested in spring, it would be very difficult to reduce this moisture by field drying.

## 2.3 Conclusions

The rapid expansion of the board processing industries has increased the demand for raw materials for board manufacture and process heat. If this outstrips the supply of forest thinnings and saw-milling residues, opportunities may arise for crops to make up the deficit. Of the crops that might be considered for this purpose (hemp, miscanthus, cereal straw and short-rotation coppice), hemp appears to be the most attractive option. In addition to a high yield, its low moisture would ease storage problems and transport costs. As an annual crop, it would also be easier to adjust production to meet annual demand.

# SPECIALITY CROPS

Due to the overwhelming dominance of grass-animal enterprise in Irish agriculture industrial crops are grown on a very small scale and are usually speciality crops. Non-food crop enterprises include herb growing for medicinal purposes, hurley making from ash trees, lemon balm production, charcoal production from alder and various 'exotic' foliage for the cut-flower market.

There is a small herb farm (10ha) producing herbs for medicinal purposes in the north east of the country but the owners preferred not to be involved. Their policy was not to openly promote the company; they preferred to publicise by word of mouth.

Hurling is the Irish national sport and hurleys are used, similar to hockey sticks to play the game. The hurleys are made from ash but the wood is generally weak and therefore they need to be replaced several times during the playing season. Promotion of ash growing by farmers is currently under way to aid farm income.

Trials of lemon balm production, for oil, were carried out in south-west Cork. The climatic conditions, warm and wet, were perfect for growth but the enterprise failed due to competition from cheaper import prices. There are two fields of lavender grown near Dublin but on investigation it was discovered it was for promotional use only and was not harvested for essential oil. It has transpired that the Irish climate is not conducive to essential oil production. As far back as 1937, investigations into 'oils from Irish grown plants' reported that very little information was available in Ireland and that most essential oils were imported. Camelina has been grown successfully in Ireland for biodiesel but could also be used for cosmetics and paint if more research was conducted.

Foliage Ireland grow various exotic species of plant including 20 ha of eucalyptus and provide foliage especially for the cut flower industry.

If an industrial use for grass could be found, we'd hit the jackpot!

# GENERAL CONCLUSIONS

Of the non-energy industrial crop uses, the most promising appears to be hemp and Miscanthus for fibre-board production. Its high yield, low dry matter and ease of establishment would be useful advantages. Demand will be dependant on the rate of expansion of the fibre board industry in relation to the availability of forest thinnings and saw-milling wastes or the decline in the availability of these. Speciality crops such as herb production are grown on a small scale and possibilities for industrial application is limited at present.