

TEAGASC TECHNOLOGY FORESIGHT 2030

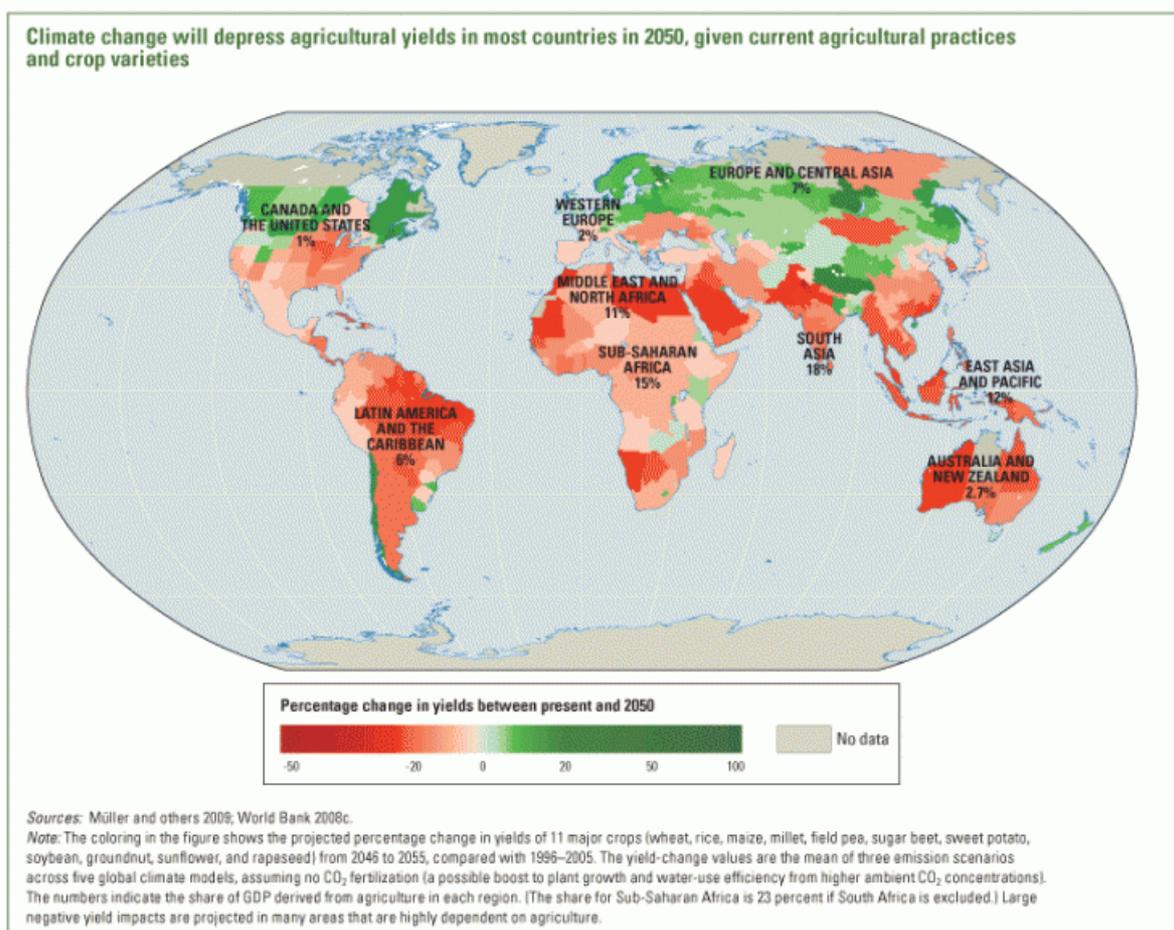
Irish Crop Production:

Current situation, future prospects to 2030 and development needs

Overview of the Tillage Sector

By the middle of the century the global population is predicted to rise to nine billion. In conjunction with this, diets in developing countries are changing to include a greater proportion of animal protein. It is now recognised globally that these two factors together are likely to result in up to a doubling in demand for arable commodities in the next 40 years, as arable crops form essential components of human and animal diets. It is also widely recognised that agriculture as it is currently practiced will struggle to increase supply to meet this demand, resulting in steadily increasing commodity prices. Whilst prices will rise, the absence of market controls, as previously operated in Europe, will mean that this general trend in rising prices will be accompanied by greater seasonal price volatility as supply fluctuates from year to year.

In addition, over the same period, climate change is expected to affect productivity and in some areas of the world there will be significant reductions. Predictions for North Western Europe and Ireland are, however, generally positive.



Tillage crop production in Ireland has traditionally been largely based around the provision of feedstuffs to the livestock sector and feedstock to industries such as malting, milling, sugar, breakfast cereal, distilling, food etc., although in recent years we have lost our sugar industry. Interest in break crops has increased due to a number of factors; firstly, high world prices drove interest in oilseed rape; more recently, an EU deficit in protein production has resulted in the introduction of support payments for protein crops and the need for crop rotation to improve profitability has been identified. A greater diversity of cropping is likely to exist for the next few years driven by the greening requirement for three or more crops on most tillage farms as part of the revision of the CAP.

The majority of our combinable crops provide grains for our livestock feed market. Because of this, our industry has identified scope for further development of cheaper processing options for on-farm use of cereals, such as crimping and whole crop, and the production of feed crops like triticale, forage maize, fodder beet, kale etc. for livestock feed.

There is considerable scope for increased production from tillage to replace much of the imported foodstuffs used for animal feed. These provide cost effective, home-grown traceable feed to help underpin expansion in our dairy and livestock sectors and to support the Brand Ireland image of food produced on our green island. The tillage sector also provides high quality traceable raw material for malting, milling, distilling, breakfast foods and oils etc. There is scope to increase these markets considerably through marketing of Irish produce in export markets.

The National Tillage Development Plan of 2012 suggested potential to increase combinable crop area by up to 37% from the 308,580 ha average of 2008-2011. This would result in combinable crop production rising from an average of 2.3 million tonnes during this period to 3.7 million tonnes by 2020. Should this level of expansion occur, it would displace the bulk of imported starch products and help enhance the Brand Ireland image.

Ireland has amongst the highest levels of crop productivity, with the highest average wheat yields and the second highest barley yields in the world. This is largely due to the benign maritime climate; however, this same climate bestows high costs of production in terms of machinery capacity and control of wet weather diseases, in particular.

At farm level, the 2011 National Farm Survey (¹Hennessy *et al.*, 2012) indicated that the average family farm income for mainly tillage farms was €35,800 compared with an average family farm income for all farms of €25,000. In addition, while income per labour unit is still highest on the specialist dairy system, the specialist tillage system follows closely in second position at €48,000 per labour unit.

Size and Shape of Sector

The Irish arable sector is characterised as follows:

- Total cropped area amounts to 378,000 ha and accounts for 9% of the area farmed in Ireland.
- 51% of arable crops are grown on leased/rented land.
- Crop production (including horticulture) contributes €700 million to agricultural output at farm gate price in addition to €150 million Single Farm Payment.

- Approximately 30% of the 51,500 jobs in the food processing sector depend on tillage crops.
- Grower numbers have stabilized at 11,000 in recent years, following rationalization from 100,000 in the mid 1970's.
- Annual combinable crop production varies significantly from year-to-year, but averages 2.3 million tonnes per annum.
- Over 3 million tonnes of feed ingredients, including 1.5 million tonnes of proteins, are imported annually.
- Grain exports are very variable, but amounted to 247,388 tonnes in 2011, mainly to Northern Ireland.
- Irish cereal yields are among the highest in the world, and despite a recent stagnation, have the potential to increase at close to 1% per annum.
- 23.4% of Irish agricultural soils are deemed very suitable for tillage crops while a further 11.7% are deemed moderately suitable.

¹*Hennessy T., Kinsella A., Moran B., and Quinlan G. (2012) National Farm Survey 2011. Agricultural and Farm Survey Department, Teagasc*

Market Prospects

Extreme world cereal price volatility has been witnessed over the past 15 years due to high levels of trading, variable world stocks, the rise in global cereal consumption and biofuel production. This volatility is expected to continue into the medium term, hence uncertainty about the production response and price stability is expected to stay with us for some time.

The “Prospects for agricultural markets and income in the EU 2011-2020”, published in December 2011, projects that the medium-term prospects for EU cereal markets will be characterised by tight market conditions, low stock levels and prices remaining above long-term averages. However, greater fluctuations in future cereal prices are also expected compared with the past. These developments are driven by moderate supply growth reaching 305 million tonnes by 2020, mainly the result of low yield growth rates (0.5% per year on average), and an increase in the global use of cereals.

Potential for Future Development

The need for a strategic plan for the development of the tillage sector was identified by tillage crop stakeholders in 2011, resulting in the development of a strategy document. Projections up to 2020 for nine major crop categories were developed in the Tillage Sector Development Plan (2012), which are summarised below. This is followed by an analysis of the prospects for the overall tillage sector. As crop yields and areas sown can be quite volatile from year to year, the base-line figures for area and output are based on the four year average from 2008 to 2011. The individual crop projections in 2020 are based on the potential for that crop under favourable conditions while the overall sectoral projections, while ambitious, are tempered somewhat by overall limitations such as land availability and other enterprise profitability. For this reason, the projections are also reasonable for 2040, unless there are some currently unpredictable changes in other enterprises.

Barley

There is potential to increase the area under barley production by 39,660 ha to 223,660 ha with output expected to increase by 466,800 tonnes to 1,755,500 tonnes.

Barley is the largest cereal crop in Ireland. The total area of this crop fell for many decades, but this has levelled off and increased somewhat in recent years. In the period 2008-2011, we grew an average of 184,000 ha of barley to produce nearly 1.3 million tonnes through a combination of winter and spring varieties. The winter crop is increasing in popularity in recent years as a result of improved varieties and supporting agronomy research/advice. This is increasing the overall yield and total barley production.

Barley is primarily used for feed production, with a significant proportion of the area (23,500 ha) used for malting and roasting. Demand for feed is likely to increase, given increasing production in the dairy/livestock sector. Demand for malting barley is also increasing with planned expansion by the Malsters and increasing demand for barley and malt for distilling at home and abroad. This will require increased focus on achieving the necessary quality standards.

The principal constraint to the potential expansion in area is the availability and cost of land and the competition for land between crop and animal enterprises. The greening measures in CAP Reform are also increasing the requirements for crop rotation, thereby challenging the growing of continuous barley. However, some reductions in area on continuous barley land may be off-set to some extent due to yield increases through rotation.

Wheat

There is potential to increase the area under wheat by 14,000 ha to 105,800 ha with output expected to increase by 289,000 tonnes to 1,109,400 tonnes.

Wheat production has been somewhat erratic in recent years due to a combination of area planted and yield. The main area constraint relates to winter wheat planting, which is often constrained by wet weather.

Wheat has two main market outlets – feed and milling. The feed wheat market provides wheat for use in feed and for export. Overall demand can be expected to increase in the face of increasing livestock production and there is potential to displace some or all of the wheat and corn imports in feed rations.

Winter wheat is the main part of the crop and accounts for about 75% of total production. Despite high yields, the competitiveness of winter wheat is reduced by high production cost, which can be compounded by yield fluctuations in some years. Average yield is adversely affected by the proportion of second and continuous wheat in the total acreage. As we move forward, a much higher proportion of the total wheat acreage is likely to be first wheat, thus improving the average yield.

While there is a market for up to 50,000 tonnes of milling wheat per annum, the generally high yield potential of wheat means the necessary milling grain protein levels are hard to reach. In addition, bad harvests can result in the total rejection of the Irish crop due to a combination of low Hagberg falling numbers and inadequate specific weights.

Wheat is a high-cost crop and one of the principal constraints to maintaining or increasing wheat acreage is its vulnerability to increasing input costs such as fertiliser, fuel, crop protection products, machinery and land. Fungicide resistance and the threatened loss of at least a number of the triazole fungicides also pose a considerable threat.

Oats

There is potential to increase the area under oats by 13,760 ha to at least 34,860 ha with output expected to increase by 87,900 tonnes to 246,320 tonnes.

Oats is a very traditional Irish crop grown historically to fuel the working horses of Ireland, but now mainly to feed people and sport horses. The current market for oats is about 140,000t, and this is used for feed, milling, seed and export. The feed market is split into the high quality product which is sold at a premium and the basic feed market for sheep and other ruminants which is sold at a discount price.

With all markets performing well and successful exports of Gluten-free and horse feed being developed, the future looks bright for Irish oats, especially as production is contracting in the US and Canada, both potentially big markets for Irish oats. As a result, we see the total demand for oats increasing by at least 50% over the next eight years. These are quality markets and the industry needs adequate storage and processing facilities to store all of the crop in food-grade facilities to meet exacting food trading specification every year.

In terms of constraints to expansion, there has been over-reliance on the variety Barra for the high quality market. In tandem with this, there has been little genetic improvement in terms of disease resistance, standing power and yield. Agronomy research has been lacking to date.

Pulses

There is potential to increase the area under pulses from 3,560 ha to 10,300 ha with output expected to increase by 46,000 tonnes to 64,700 tonnes.

Production of pulses in this country has traditionally been low. The two main crops of importance are field beans and combining peas. For tillage farming, pulses bring a rotational benefit through nitrogen fixing and soil conditioning, thus benefiting the performance of the following crop and decreasing the amount of nitrogen required to grow it.

While we are small producers of pulses, we have a very big requirement for protein sources to supplement our native grains for our livestock sector, which imports over 1.3 million tonnes of protein feeds annually.

If demand for feed is increased by the implementation of the FH2020 targets, then more protein will be required. So while there is no issue on the demand side, the majority of constraints are on the production and processing sides. The current high world prices for protein and support payments introduced as part of the revision of the

CAP may increase the attractiveness of pulses, as higher prices would compensate for the variability in their performance.

Pulse crops for temperate climates are limited by the relatively low spend on genetic improvement compared to that of the internationally competitive soya crop. Similarly, agronomy research in these regions has been limited in recent years. These constraints have been compounded at national level by a lack of critical production mass and consequent limited processing capacity. However, a realisation of the need for rotation, research and development at EU and national level, coupled with the introduction of production support, has increased the crops potential from 2015. .

Oilseed Rape

There is potential to significantly increase the area under oilseed rape from 8,100 ha to 59,900 ha with output increasing from 32,300 tonnes to 287,300 tonnes.

The area sown to oilseed rape remained low for many years due to the lack of price-related profitability of the crop. This changed in recent years and resulted in a significant expansion phase, with acreage having increased from 2,300 ha in 2003 to 17,000 ha in 2012. However, this has since fallen due to declining prices and an unfavourable growing season in 2013. To fully exploit the crop's potential, a market must be opened up for oilseed rape oil so that this crop can be crushed and utilized in this country leaving the protein feed in situ for use in our expanding livestock sector.

The area available to the crop means that the development of a large scale solvent extraction plant to compete with the economies of scale of established plants in the UK and elsewhere is unlikely. It would be opportune, therefore, to encourage home crushing for the high value cold pressed food markets. There is increasing interest in the use of oilseed rape oil as a food ingredient for cooking, salads etc. Expansion in this area looks likely to continue with potential for exports of the processed oil. With access to non-GM protein sources likely to become increasingly limited, retention of meal through home crushing will become increasingly valuable.

As with pulses, the current small scale of oilseed rape has resulted in a shortfall in terms of the necessary infrastructure and a lack of investment in research and development. As the area increases, there is likely to be increased disease pressure challenging yields.

Break crops note:

Break crops such as pulses and oilseeds need sustained development support from all sectors of the crop industry and at policy level to ensure the development of viable levels of production needed to sustain a processing sector. Break crops are needed to sustain arable crop production.

Potatoes

There is limited potential to increase the current 2012 area under potatoes by 1,470 ha while output is projected to increase by 67,000 tonnes to 482,000 tonnes.

In 2012, 8,722 ha of potatoes were grown by some 700 growers, of which Meath, Dublin, Louth and Wexford accounted for 62% of the production area planted. Yields

have remained relatively static over the past nine years at 38 tonnes/ha. However, highs and lows around this average of 45 tonnes/ha and 32 tonnes/ha respectively were recorded in individual years.

The total potato production output normally ranges from 350,000-430,000 tonnes per annum. Early potato production accounts for 9%, main crop 87.5% and seed production 3.5%.

There is potential for diversification of current potato output from mainly ware/processing to increased production of seed potatoes for export, salad potatoes for increasing domestic market and chipping for local markets, thereby increasing the total value of potato production in Ireland by €2.8 - €4.1 million per year.

Reorganising the supply chain to closely match production and market supply would reduce market volatility.

This market volatility, combined with high costs of production, potential for cheap imports and low margins, represents the main threat to the potato sector. There is also an over-reliance on cv. Rooster, and the development of new varieties for domestic supply to these alternative markets will be required.

Beet

Sugar beet production ceased in Ireland in 2006 when production stood at 1.2 million tonnes of sugar beet produced from 35,000 ha. Fodder beet acreage of 8,000 ha has remained relatively stable since 2006. Most of this production is used as animal feed, with the majority used on the producers' farms and approximately 25% available for sale.

Investor and grower interest is high in re-establishing a sugar beet industry, but a suitable processing facility must be developed. Should the re-establishment of the industry be successful, there is potential to increase the area under beet from 8,000 ha to 30,000 ha, with output increasing from 480,000 tonnes to 1,800,000 tonnes.

The potential for fodder beet growth is limited due to transport costs and poorly developed contract/pricing structure for inter-farm trading.

The high cost base of the crop, developments in yield potential and future sugar prices will determine the feasibility of sugar production in this country, as will the willingness of growers to invest in a new processing facility.

Maize

There is potential to increase the area under maize by 10,000 ha to 30,875 ha with output expected to increase by 150,000 tonnes of dry matter.

Maize is grown almost entirely for whole crop silage production, and can produce a high value high energy feed. Increasingly, maize has been grown under plastic mulches to extend the growing season and productivity. Because there is only one harvest a year at a different time to other harvests, and as it has a greater transport density than grass, maize can offer a less costly option for fodder production on

outlying land than grass. Consequently, it can be a major feed resource on expanding dairy farms with a limited grazing platform.

The principal constraint to growth in the area under maize is the significant seasonal yield/quality variability which can only be addressed through improved varieties. Satisfactory trading/pricing structures are also needed to encourage production of maize by specialist crop producers for use by livestock enterprises. Maize is also vulnerable to increasing input costs such as fertilizer, fuel, chemicals etc. Greening in CAP reform may also force rotation and decrease maize area on grassland farms but may increase potential on arable farms.

Energy Crops

While national and EU policy will be the main constraint/driver, the tillage sector development plan identified the potential to increase the area under energy crops from 4,486 ha to 66,800 ha, with output increasing from 36,000 tonnes to 628,000 tonnes. Recent support for the forestry sector and stagnant or declining bioenergy crop production indicates however, that it could be the source of a significant proportion of this increased demand.

Ireland has been slow to embrace bioenergy crops as a potential renewable energy resource. There are around 4,500 ha of energy crops planted in Ireland, mainly through the 'Bioenergy Scheme', but much of this is currently without a market as a result of poorly developed supply and use chains. Nevertheless, the Government is committed to producing 16% of our total energy from renewables by 2020. The most challenging part of this target is achieving the 12% renewable heat target.

Energy crops can produce a high output from a relatively small area. By using energy crops, it is possible to meet over 50% of the renewable heat target from just 2% of the agricultural grassland area (66,800 ha).

This could boost the Irish economy by saving Irish consumers €100 million per year on their heating costs and would deliver approximately €957 million of investment in biomass boiler projects. This would help Ireland generate 532 new jobs in the biomass sector.

One of the main constraints to achieving this potential has been the failure to develop a proper marketing structure and the associated infrastructure. Farmers are also concerned regarding the long term nature of these crops and the relatively poor cash flow in the early years.

Overall Sector

Table 1.1 below summarises the baseline (2008/11) area and output for each of the eight major crop categories, as well as projected area and output in 2020.

Table 1.1 : Crop Yield and Area Potential 2008/11-2020

Crop	2008/11 Tonnes	2020 Tonnes	2008/11 Ha	2020 Ha	2020 Increase Ha
Barley	1,288,900	1,755,500	184,000	223,660	39,660

Wheat	820,400	1,109,400	91,800	105,800	14,000
Oats	158,420	246,320	21,100	34,860	13,760
Pulses	18,700	64,700	3,560	10,300	6,740
OSR	32,300	287,300	8,100	59,900	51,800
Energy	36,000	628,000	4,500	66,800	62,300
Potatoes	415,000	482,000	* 8,700	10,170	1,470
Beet	480,000	1,800,000	8,000	30,000	22,000
Maize	313,000	463,000	20,875	30,875	10,000

*** 2012 area**

As can be seen from these figures, the total tillage area has the potential to increase from 337,435 ha to 505,565 ha, an increase of 159,430 ha or 47%. The potential increase in bioenergy area (should the industry take off) would require a further 62,300 ha. In reality, this is unlikely to happen and the increase in area should be considered in the context of each individual crop, as the increase in area of any one crop will depend on how it compares competitively with other crops, as well as how it fits within the crop rotation. The degree to which an overall increase in tillage area is realised will ultimately depend on availability of land. This, in turn, will depend on the relative competitiveness of tillage crops (dependent partially on global commodity prices) compared to alternative land use enterprises. The total potential increase in the production of combinable crops amounts to 1.14 million tonnes.

It must be stressed, however, that all of these potential increases in production are exactly that – the potential. Ultimately the realisation of any of these potentials will require action across the value chain – growers, merchants, processors and end users, in conjunction with technical support from research and advisory activities, as well as, in some instances, political support either at a national or international level.

Actions Needed to Achieve the Potential

The achievement of these ambitious targets will require sustained and co-ordinated action from the entire industry, including; policy makers, researchers and advisers as well as farmers, input suppliers, buyers and processors.

Industry-wide issues and actions

- A focused industry-wide development strategy that would target development needs such as: policy; research/technology transfer; market development; industry processing needs; trading standards (farm-to-farm) and other development areas on a sector and crop by crop basis is necessary to optimise the potential from this efficient production sector.
- Access to land at reasonable cost is a major inhibiting factor for tillage farmers. Currently, where growers attempt to expand, economy of scale benefits are usually eroded by land costs. Every effort must be made to secure the economy of scale benefits

needed to be competitive by supporting share farming, collaborative partnerships, leasing arrangements and other novel scale mechanisms.

- The role of appropriate risk management strategies such as production insurance and price risk management tools to offset production and market volatility should be considered by growers/industry/policy makers.
- Encouraging the use of native feed ingredients would underpin a more stable and reliable feed supply as global production fluctuates due to climate change. It would also enhance the achievement of the FH2020 targets. This, in turn, would enhance the Brand Ireland image and Bord Bia's Origin Green Ireland campaign.
- Any significant increase in crop production will require a significant investment in storage, handling, drying and processing facilities, both at producer level and at merchant/processor level.
- Steps must be taken to enable crushing of oilseed rape oil on this island to ensure that valuable oilseed rape meal is retained for the feed market.
- There is a need for active promotion of regional niche and export opportunities for our crops/ crop products with high-value food grade potential (e.g. Oats and Rapeseed oil). There is also a need for investment in processing facilities to upgrade the harvested product to the trading specifications.
- The re-establishment of the sugar beet industry will require significant capital investment to erect processing facilities.
- There is need for a carefully considered, cross departmental support structure incorporating producers, processors and end users, in conjunction with the mainstream agri-sector, to foster the development of the energy crop sector.

Research Technologies and Innovations to Improve Efficiency of Production

Intensive research is needed across the entire sector to remain competitive, meet continuously evolving challenges and to exploit/develop new crop/market opportunities. We must return to a target of a minimum of 1.0% per annum yield increase from the current Europe-wide yield plateau. Research to reduce production costs will be essential to cope with volatility, and with our particular production structure, where scale remains a challenge. Particular threats to our production system such as evolving disease pathogens and reduced disease control options must be addressed. Every effort must be made to refocus EU research funding on sustainable intensification. Research deficits in minor crops must be addressed. Post-harvest technologies from crop processing to food product need to be developed to maximise value and market opportunities.

Knowledge transfer strategies need to be continually developed to reflect the increasing complexity of the research information available to the industry. While existing models will continue, alternative models including combinations of group methods, ICT-aided decision support, web-based resources and more effective use of industry advisors, will need to be considered and developed. The DEP and BTAP models should also be considered for the tillage sector. A strong emphasis on financial performance will be required.

The following actions will be required from research and knowledge transfer:

- The crop research objective of developing productive, competitive and sustainable production systems will be achieved by focusing primarily on maximising crop yield potential by developing our understanding of the soil, crop, management and climate factors that limit crop yield;
- Reducing crop production costs by focusing on nutrient use efficiency, integrated disease control and machinery use, as well as weed, pest and lodging control;
- There is a need to develop more specific/precise crop and soil-type based fertiliser recommendations to more accurately target input between and within fields, so that productivity can be optimised whilst reducing the risk of nutrients escaping to water.
- Crop production in Ireland will be seriously challenged if we cannot cope with the serious fungal disease threat which our temperate climate bestows. Restrictions on the development, availability and use of certain chemicals, combined with increasing resistance to pesticides, will pose increasing pressures on tillage farmers. These issues need to be addressed through research and development into Integrated Pest Management, including disease resistance/tolerance, sustainable agronomy practices and variety selection. Specifically, we need:
 - To develop improved prediction systems which determine the impact of key pests/pathogens of crops in Irish conditions and to develop improved Integrated Pest Management (IPM) strategies.
 - To improve targeting of PPP (plant protection products) according to the risk of yield or product quality loss, perhaps through a precision farming approach.
 - To improve the efficiency of PPP (plant protection products) through approaches such as the use of nanotechnology to improve delivery and uptake.
- Development of a precision farming approach based on understanding variation in crop input requirements, will improve targeting of inputs and profitability of crop production.
- Improved varieties are critical for the sustainable intensification of production, particularly for ‘minor’ crops such as pulses and oats which have received little breeding effort.
- Modern breeding and biotechnology approaches, which offer scope for developing/incorporating key market/region specific attributes (e.g. disease resistance) in genotypes, will be critical for the development varieties of potatoes, cereals and other crops better suited to Irish tillage systems.
- Developing high-value markets for tillage crop products: this has the potential to improve economic viability and provide a wider range of rotational options. It can also help build the Brand Ireland/Origin Green approach. Quality oats for the feed/food market, barley for the distilling and malting markets, oilseed rape for food oil products etc. can help average product prices whilst providing added-value opportunities through the food chain. For example, a concerted industry-wide initiative is necessary to increase the level of domestic protein production and its incorporation into feedstuffs to offset the level of dependence on imports of high protein products.
- The tillage crop sector needs to play its part in the stated ambition for Irish Agriculture to achieve Carbon neutrality by 2050. This will involve practices such as optimum use of organic waste, crop rotation, greening, less intensive, more carbon efficient tillage etc., many of these will also contribute to the sustainability of the sector in the longer term.

- Improved efficient technology transfer models need to be developed taking into account the structure of tillage farms and the technology adoption capacity of crop producers. This includes:
 - Advanced use of ICT-based information transfer
 - More emphasis on financial performance
 - Specifically developed discussion group / BETTER farm approaches
 - Developed feedback approach to research
- To improve competitiveness, efficiency in labour and machinery use on tillage farms must be pursued and exploited. The current short-term ‘con-acre’ approach is not appropriate for the development of the sector. The following options need to be developed:
 - Long-term leasing options, including share-farming, partnership and other scale-increasing approaches, need to be developed and supported by national and EU policy.
 - Machinery and labour utilisation practices that achieve economies of scale need to be developed and supported.