Forage Grain Event

Kildalton College, Piltown, Co Kilkenny

16 July, 2003

INTRODUCTION

Feed costs are a major cost in producing beef or milk. Alternative feed sources may provide opportunities to reduce feed costs and thereby increase income. Decisions to alter feeding programmes cannot be based on unit feed costs alone as there are opportunity costs associated with land, premia and labour. **Risk** and extra management time required are also factors which will influence the uptake of alternative feed production systems.

Grazed grass is the cheapest fodder. It will produce very good yields in most locations and of course it is extremely convenient to produce and utilise. However, many grass fields are not producing their potential grass yields due to a combination of weeds and poor grasses. New swards will deliver an average yield increase of 25% in the first year, i.e. 2.5 tonne/ha additional dry matter. Choosing the most appropriate seeds mixture and establishment technique are vital for efficient grass/clover production.

Grass silage has been the mainstay of winter feeding systems for many years and will continue to be so. However, the competitiveness of grass and grass silage is of major importance to Irish producers. Grass silage is not without its limitations in terms of consistency of quality, cost of production and availability of contractors. It also suffers from high dependence on weather for harvesting and for growing conditions.

There is an increased range of alternative forages and feeds available to farmers. Improvements in breeding, growing, harvesting and storage technology in this area have helped the expansion of alternatives to grass silage.

As the image of the beef and dairy industry is vital, all production systems and practices must bear scrutiny in terms of their impact on the environment and the welfare of animals. They must also be in line with best practices in terms of food safety and quality assurance. Finally labour and convenience are becoming more important from the farmers point of view.

This Event will help farmers decide which options best suit their situations. The potential financial returns that may accrue from changing to alternative forage and feed options will be evaluated. Recommendations for growing alternative forages will be discussed as well as the options for harvesting and low cost storage. The processing of grain on-farm, feeding and supplementation will also be discussed.

Teagasc would like to thank the Department of Agriculture and Food for their substantial input to this Event.

WHOLE CROP CEREALS – MANAGEMENT GUIDELINES

Jim O'Mahony, Chief Tillage Adviser, Teagasc Oak Park
Michael Hennessy, Crops Specialist, Teagasc Kildalton
Derek O'Donoghue, Crops Specialist, Teagasc Moorepark

To get the best out of wholecrop cereals, they should always be treated as if the crop is being grown as a high yielding grain crop.

To achieve this, they must be regarded as an arable crop and utilise arable skills, which can be bought in if not available on the farm. It does not pay to grow and/or utilise the worst crops on the farm, such crops should be harvested for grain rather than wholecrop, as a high grain to straw ratio gives the best end product.

Whole crop cereals are very flexible, allowing the decision to have the crop ensiled as fermented wholecrop some 3-4 weeks before the normal combinable grain harvest date or harvested as a combinable grain crop later in the growing season.

Site

- Crops can be difficult to establish on very heavy clay soils. However, with adequate attention to detail, they can be grown on most soils in lowland areas of Ireland.
- Weather during ripening is less important than for grain crops, so wholecrop cereals, particularly Triticale, may be grown in areas normally considered marginal for grain production.

Cultivations

- Aim to produce a seedbed as if it were a normal grain crop. It should be firm and fairly fine, so as to allow good even plant stands to be achieved quickly. This is vitally important to minimise losses due to crows feeding on seed when sowing late in the autumn or early in spring.
- Direct drilling may be used where no compaction problems exist but most situations will require ploughing.
- After drilling, roll if ground conditions permit. This reduces slug damage by limiting their movement.

Sowing

- Sow from early October until late November for winter cereal crops. Spring sown crops should be put in as early as possible in February or March. Be wary of out of season sowing (December to late January) due to the likelihood of increased bird damage.
- If an undersown crop is desired, then a reduction in seeding rate will be required. However, this crop would only be suitable for spring-sown cereals and the final crop yield would be compromised. If possible avoid this practice.

Fertiliser and Sprays

- Fertilise as if the crop were an arable grain crop. Allowances need to be made for previous cropping history and the use of slurry or FYM.
- Herbicide and fungicide sprays should be used according to best arable management practices. The aim is to achieve a crop with a healthy flag leaf that will enable good grain fill to take place. A healthy plant that is disease free will provide a wholecrop forage or grain harvest of high feed value. Ultimately it is the yield of grain that will determine feed value and the cost per unit of feed.

Crop Management

- The objective is to maximise wholecrop yield and grain content. A high grain content is vital to ensure an adequate energy level is achieved.
- Keep the crop clean. Weed and disease infestations reduce the feeding value and may affect the ensiling process.
- Consider employing a Teagasc tillage crop adviser to walk the crops and ensure that spray applications are optimised – especially if your arable experience is limited and that cost effective spray applications are applied.

Further Information

Further information on the detailed growing of arable crops and a discussion forum is available on the website for Teagasc clients at www.client.teagasc.ie

List of Specialist Tillage Advisers

County	**Tillage Adviser**	**Teagasc Office**	**Contact Number**
Carlow	*Ciaran Hickey*	Tullow	0503-51210
Donegal	*Matthew Marren* *Bob Kavanagh*	Letterkenny Ballybofey	074-21555 074-31189
Dublin	*Shay Phelan*	Corduff	01-8437703
Cork East	*John Hayes* *Eamon Lynch* *Conor O'Mahony*	Farranlea Road Midleton Mallow	021-4545055 021-4631898 022-21936
Galway	*John Reidy*	Athenry	091-845800
Kerry	*Edward O'Mahony*	Tralee	066-7125077
Kildare	*Hugh McCreevy* *Ivan Whitten*	Athy Naas	0507-31719 045-879203
Kilkenny	*Ger Power*	Kilkenny	056-21153
Laois	*John Challoner*	Portlaoise	0502-21326
Louth	*Conor Dobson*	Drogheda	041-9833006
Meath	*Terry Carroll* *Cyril D'Arcy* *Jim O'Neill*	Navan Drogheda Grange	046-21792 041-9833006 046-25214
Offaly	*John O'Hanlon*	Tullamore	0506-21405
Tipperary NR	*John Healy*	Thurles	0504-21777
Tipperary SR	*Jarlath Harte*	Clonmel	052-21300
Waterford	*Owen Power*	Dungarvan	058-41211
Westmeath	*John Smyth*	Mullingar	044-40721
Wexford	*Michael Higgins* *Larry Murphy*	Enniscorthy New Ross	054-33332 051-421404
Wicklow	*Martin Bourke*	Wicklow	0404-67315

Protein Crops

Wholecrop Peas

Whole crop peas can provide homegrown protein (18-22%) to complement whole crop cereal diets or replace bought in protein.

Varieties	Choose semi leafless varieties, as they have better standing and maturity qualities than traditional forage pea varieties.
Site Selection	Can be grown on a wide range of soils in the drier areas of the country. Choose free draining, fertile soil with a pH above 6.0.
Sowing Date	Drill in April/early May once the soil temperature has reached 8ºC.
Seeding Rate	A target plant population of 75 plants per m^2 is required or a sowing rate of 90-120 kg/ha (6-8 stone/ac). Drill at 3.5-5.0 cm depth.

Management of the Crop

Fertilisers No nitrogen required. Incorporate P and K into the seedbed. Apply 370kg/ha of 0:7:30 pre-ploughing or pre-cultivation at soil index 2 for P and K, or as per soil analysis.

Weed Control Pre-emergence any time from drilling up to 5% crop emergence.

Pest Control Crows and pigeons are major pests, crows post sowing and pigeons at emergence.

Fungicide Control Botrytis can be controlled by spraying at early flowering, on a dry day, with a follow up spray 2 weeks later.

Advantages Harvested 12-15 weeks after sowing. Low input crop to grow. High protein content feed. Fields can be reseeded after harvest (late July/August) taking advantage of residual N.

Disadvantages It does require wilting for 24-48 hours to achieve a dry matter of 22-25%. Will not tolerate compaction. Peas should not be grown more often than once in every 5-6 years in the rotation.

In Brief	
Yield	8.0t DM/ha
Arable Aid	441/ha
Cost/tonne DM (no Aid)	102
Cost/tonne DM (incl. Aid)	47
Management input	Low
Site selection	Important

Production Costs

Operations	**Cost /ha**
Materials	423
Machinery Hire	195
Harvesting	188
Miscellaneous	14
Total Variable Costs	820

Lupins

Lupins are easy to grow and have a higher protein content (30-35%) than peas or beans. Three harvesting options are available:

1. Combining when the grain is moist (30% MC) followed by crimping and ensiling.
2. Dry combining at 19-24% MC as for cereals.
3. Whole crop harvesting once pod filling is complete.

The introduction of spring sown (mid March to end April) early maturing varieties (late August) e.g. Prima has made the growing of lupins for grain attractive. The growing of Autumn (September) sown lupins for wholecrop is less attractive.

Trials at Teagasc Oak Park indicate that yield potential is 3.75 t/ha at 14% MC and a protein of 30%.

Site selection Most soils are suitable but pH must be between 5.0 and 7.0. Allow 4 years between successive crops in the rotation. Lupins are not related to either peas or beans.

Sowing Drill in late March or April. Use 150-162 kg/ha for single stem types, e.g. Prima and 125-150 kg/ha for branched varieties. Always use the inoculant supplied with the seed. Create a fine seedbed and drill to 2.0-3.5 cm deep.

Management of the Crop

Fertilisers No N required. P & K should be applied as per soil test. Lupins are responsive to K so apply at least 35 kg/ha.

Weed control Use a pre emergence herbicide such as Stomp at 4L/ha. Opoguard and Simazine are other pre-emergence alternatives. Lentagran can be used post emergence.

Pests Monitor crop for slug and leatherjacket attack at emergence.

Disease control Apply fungicide for Botrytis control at mid to late flowering, e.g. Bravo 2L/ha + MBC 1L/ha.

In Brief	
Yield	4.0 t/ha at 20% MC
Arable Aid	441/ha
Cost/tonne (14% MC) no Aid	175
Cost/tonne (14% MC) incl. Aid	65
Management Input	Moderate
Site Selection	Moderate

Production Costs

Operations	Cost /ha
Materials	324
Machinery Hire	232
Harvesting	119
Miscellaneous	25
Total Variable Cost	700

Simple Agronomy Guide to Wholecrop Forages

	Sowing Date	Sowing Rate (Kg/ha)	Varieties	Site Selection	Management Input	Fungicide Applications	Nitrogen (Kg/Ha)	Harvest Period	Fresh Yield (T/Ha)	% DM	Total DM Yield (T/Ha)
Wholecrop Cereals											
Winter Wheat	Oct to late Nov	130-180	Good septoria resistance	Medium-heavy soil, pH 6.4-7.0	Very High	3	60-225	Late July to early August	22-35	35-55	12.5
Spring Wheat	Mid Jan to mid March	130-180	Good septoria and mildew resistance	Medium to heavy soil, pH 6.4-7.0	High	3	40-175	Late August	18-28	35-55	10.0
Spring Barley	Mid Feb to mid April	125-140	Good rhynchosporium and net blotch resistance	pH >6.3	High	2	60-160	Late July to early August	15-23	35-55	8.0
Winter Triticale	Oct to late Nov	155-185	Semi dwarf or short strawed	Most soils	Moderate	1	60-175	Late July to early August	20-31	35-55	11.0
Maize	Mid April, earlier if using plastic	Acre packs	High starch content, early maturing. Only late maturing if using plastic	South facing, pH > 6.3	Low	0	75-150	Mid Sept to late Oct	35-50	25-35	12.5
Protein Crops											
Wholecrop Peas	April/early May	90-120	Semi leafless due to better standing ability	Free draining, pH >6.0	Moderate	2	None	Late August to early Sept	32-36	22-25	8.0
Spring Lupins	Late March/ early April	150-160	Single stem	pH 5.0 to 7.0	Moderate	1	None	Late August to early Sept	4.3-4.6	76-81	3.5

This table gives a brief summary of the agronomy of whole crop cereals and protein crops. The figures are only intended as a guide as the actual yield achieved will depend on such factors as the growing conditions, timeliness of operations and the season. The sowing rates may also need to be varied according to the individual variety used, date of sowing and local climatic conditions.

In order to maximise yield and quality at an economic cost, consult with your local Teagasc tillage adviser for a completely independent and professional service.

Whole Crop Growing Costs incl. VAT (/hectare) – 2003

	Winter Wheat	Spring Wheat	Spring Barley	Winter Triticale	Maize	Wholecrop Peas	Lupins
Materials	**554**	**408**	**344**	**426**	**407**	**418**	**324**
Seed	63	74	68	95	188	148	142
Fertilisers	192	142	113	190	185	70	78
Sprays:	61	44	44	50	34	121	50
Herbicides	182	121	91	45	0	73	23
Fungicides	41	22	28	31	0	6	31
Insecticides	15	5	0	15	0	0	0
Growth Regulator							
Contractor	**581**	**566**	**496**	**550**	**502**	**480**	**351**
Plough, Till, Sow	136	136	136	136	136	136	136
Spray	79	64	48	48	32	48	48
Fert., Spreading	48	48	32	48	16	16	16
Harvesting + Covering	318	318	280	318	318	280	151
Miscellaneous	**28**	**13**	**9**	**9**	**12**	**14**	**25**
Interest (7%)	28	13	9	9	12	14	25
Total Variable Costs	**1163**	**987**	**849**	**985**	**921**	**912**	**700**
Arable Aid	383	383	383	383	157*	441	441
Target Yield (t DM/ha)	12.5	10.0	8.0	11.0	12.5	8.0	3.5

**Rate of Aid for maize based on rate payable in 2002. Full rate is 365/ha if no overshoot of NBA. A land charge of 250/ha (rented or owned where there is a similar opportunity cost) is included in /ton DM.*

Arable Aid Payable

	Winter Triticale	Maize	Winter Wheat	Spring Wheat	Spring Barley	Wholecrop Peas	Lupins
/ ton DM	77	81	82	85	90	90	145
Relative Cost	100	105	106	110	116	116	188

No Arable Aid Payable

	Winter Triticale	Maize	Winter Wheat	Spring Wheat	Spring Barley	Wholecrop Peas	Lupins
/ ton DM	94	112	113	124	137	145	271
Relative Cost	100	120	121	132	147	155	288

Zero Land Charge and Arable Aid Payable

	Winter Triticale	Maize	Winter Wheat	Spring Wheat	Spring Barley	Wholecrop Peas	Lupins
/ ton DM	55	58	60	61	62	59	74
Relative Cost	100	106	110	112	114	108	135

Zero Land Charge and No Arable Aid Payable

	Winter Triticale	Maize	Winter Wheat	Spring Wheat	Spring Barley	Wholecrop Peas	Lupins
/ ton DM	74	90	93	99	106	114	200
Relative Cost	100	122	126	134	144	155	270

FORAGE MAIZE VARIETY EVALUATION PROGRAMME

J. Claffey, DAF, Crop Variety Testing Centre, Backweston, Leixlip, Co. Kildare

Introduction

The maize variety evaluation programme is undertaken by the Crop Variety Testing Division of DAF, which is headquartered at Backweston, Leixlip, Co Kildare. The current programme involves a total of 8 to 10 trials per year. The trials are grown at 6 locations in the principal maize growing areas, with 3 of those at private farms (Waterford, Tipperary and Meath) and 3 at locations where DAF staff are based (Kildalton, Moorepark and Backweston).

Testing Procedure From Application to Full Recommendation

New varieties are submitted annually to the Department by Agents/Breeders. The most promising of these enter screening trials of 20 varieties grown at two centres (Backweston and Moorepark) where they are assessed for 1-2 years and exceptionally 3 years, as to their suitability under Irish conditions for dry matter yield, dry matter content, starch content and other traits.

The most promising varieties from the screening trials are advanced to the National List / Recommended List trials of 15 varieties grown at 6 centres where they are assessed for 3 years. Control varieties and assessment criterion are the same as for the screening trials. After completing 3 years in the National List/Recommended List trials, new varieties showing superior performance are given positive Value for Cultivation and Use (V.C.U.) status. Those varieties can then be National Listed by the breeder, thus allowing them to be considered for Provisional Recommendation (PR). If these Provisionally Recommended varieties continue to perform well, they may be upgraded to Full Recommendation (R) after 1, 2 or occasionally 3 years further trialling.

The screening trials and the National List/Recommended List trials are grown without the use of plastic cover.

Variety trials using plastic cover have been grown at 1 to 2 locations since 2000. This year they are located at Kildalton and Backweston and have 15 varieties.

Characteristics Evaluated

Yield (calculated on a dry matter basis) is based on the harvested yield of whole crop silage. A weighing scales located on the harvester measures the fresh yield of each plot. Dry matter content for each plot is determined from a sample of the whole crop silage taken from the harvester and subsequently oven dried. Starch content for each plot is determined from the dried samples, ground to 1mm and subsequently analysed by an outside commercial analytical service. Other characteristics such as resistance to lodging, early vigour and plant height are determined by examination in the field.

Analysis of Results

Trial results are analysed using appropriate statistical methods that make use of the trial design, facilitate critical appraisal of the results and help ensure that the varietal performance information provided is reliable.

Table 1: Recommended List of Forage Maize varieties (2003)

Actual yield data is shown for the mean of the control varieties, and the relative yield data (as % of controls) is shown for all varieties. The data is based on results of 18 trials (6 trials x 3 years) grown without the use of plastic cover in the period 2000 to 2002.

	Yield of Dry Matter	Dry Matter Content	Starch Content	Lodging Resistance Score (1 - 9) (9 = best, 1 = worst)	Plant Height (metres)	Year First Recommended
Controls* (actual)	11.7 t/ha	30.1 %	25.7 %	6.9	2.24	---
Controls (relative)	100	100	100	---	---	---
Andante (PR-1)	100	105	101	7	2.42	2003
Avenir (R)	101	109	101	8	2.06	2000
Crescendo (PR-2)	97	101	102	8	2.31	2002
Hudson (R)	98	99	99	7	2.30	1997
Loft (R)	103	101	101	8	2.10	1999
Melody (R)	99	100	100	6	2.31	1996
Tassilo (PR-1)	100	104	101	8	2.09	2003

** Control varieties: Hudson, Loft, and Melody.*
Starch analysis by FBA Laboratories, Fermoy.
(R): Recommended for general use. (PR): Provisionally Recommended (the number after the PR indicates the number of years provisionally recommended).

Important notice: The Department of Agriculture and Food has taken all due care in evaluating the performance of the listed varieties for yield, quality, disease resistance and the important agronomic characters over a wide range of soils and environmental conditions, for a minimum period of 3 years. The Department of Agriculture and Food cannot, however, accept responsibility for any loss or inconvenience arising from any future variation in absolute or relative varietal performance.

HERBAGE VARIETY EVALUATION PROGRAMME

D.A. McGilloway, DAF, Crop Variety Testing Centre, Backweston, Leixlip, Co. Kildare

The current herbage variety evaluation programme as carried out by DAF is headquartered at the Crop Variety Testing Centre, Backweston, Leixlip, Co. Kildare. Ongoing development to this program in recent years has resulted in a robust and cost effective trialling protocol that is looked favourably upon by many of our EU colleagues. Trials are conducted at Backweston; Kildalton, Co. Kilkenny; Moorepark, Co. Cork; Athenry, Co. Galway and Raphoe, Co. Donegal, which represents a total of five regional locations. A complete set of replicated trials is sown at each site each year.

Perennial ryegrass, Italian ryegrass and White clover account for nearly all the grass/clover seed sold for forage production in Ireland, with perennial ryegrass by far the most important. Consequently, the trialling of 'early', 'intermediate', and 'late' maturing perennial ryegrass varieties makes up the bulk of the varieties on trial at any one time. An 'intermediate' and 'late' trial is sown each year, but it is only every two years that an 'early' trial, combined 'Italian/hybrid' and clover trials are sown.

A recent addition to this portfolio has been the inclusion of a 'screening trial' at Backweston. This allows breeders the opportunity to trial under Irish conditions, an array of new varieties still in the early stages of selection. The intention here is that material better suited to Irish conditions will be more readily identified, and consequently if/when such material is offered for inclusion in official trials, informed data is available on which to make selection decisions.

On acceptance for inclusion in trial, each new variety is sown either in successive or alternate years depending on the trial. Figure 1 shows a simplified diagram of the evaluation protocol for intermediate and late varieties.

Figure 1. Evaluation protocol for new intermediate and late varieties selected for inclusion in the Irish evaluation programme

2000	2001	2002	2003	2004
1st Sowing	Harvest year 1	Harvest year 2		
	2nd Sowing	Harvest year 1	Harvest year 2	
			4 Harvest result	2005 RL published in Oct 2004

A new variety sown in 2000 will be harvested in 2001 and 2002, and from the 2001 sowing, in 2002 and 2003. Consequently it is only at the end of 2003 that a full complement of data is available on which to evaluate a variety's merit for inclusion on the combined National/Recommended List. This data is then pooled with that from all sites, so that depending on a variety's performance it may (or may not) appear on the Irish recommended list to be published the following autumn, i.e. in 2004. In addition to all 1st and 2nd sowings within a trial, each current recommended listed variety within the designated maturity class is also sown each year.

Within a harvest year, plots are harvested six times with the exception of grass/clover plots, which are harvested eight times. A typical cutting schedule is shown in Figure 2.

Figure 2. Typical cutting regime for grass herbage trials

CUT					
1	2	3	4	5	6
Spring growth	Silage Cut 1	Silage Cut 2	Rotational grazing	Rotational grazing	Rotational grazing
				Autumn growth	

Under the current system, the yield recorded in early April is taken as a measure of spring growth, i.e. that material that has grown from Christmas to harvest date. The two silage cuts are taken in late May and early July respectively. Cuts four, five and six follow in early August, mid September and late October respectively. The combined yield from cuts five and six are taken as a measure of autumn growth. Although no quality parameters are taken into account under the current system of evaluation, this situation is under review, and pending developmental work where samples are being screened for a number of quality parameters, such data may be presented in the future.

GRASS AND CLOVER VARIETIES

Vincent Connolly, Crops Research Centre, Teagasc, Oak Park

Herbage Breeding - Perennial Ryegrass

Approximately 90% of the farmed land area in the country is devoted to grassland and is the primary resource for almost all of our agricultural output. While sward composition, especially for old pastures, is often complex, ***perennial ryegrass*** and ***white clover*** are the key components of the most productive pastures. Genetic improvement of these species by breeding varieties with superior yields and quality is a valuable contribution to increasing the potential productivity of our grasslands.

Breeding and selection of perennial ryegrass is done at two ploidy levels - diploid and tetraploid. The principal objectives are:

- Increased total annual yield
- Improved seasonal yield in Spring and Autumn
- Increased persistence
- Improved sward density
- Reduced stem in the aftermath regrowth
- Improved quality
- Improved disease resistance (mildew, drechslera, rust, rhynchosporium)

Varieties released: The following varieties have been released and are included in Recommended Lists in Ireland and elsewhere.

Intermediate:	**MAGICIAN**	
	GREENGOLD	
	CASHEL	
Late:	**MILLENNIUM**	
	SARSFIELD	
	GLENCAR	(new variety; commercial seed available 2004)

Herbage Breeding – White Clover

In terms of nutritional value (intake, digestibility, protein and mineral content) white clover is much superior to grass. In addition it fixes atmospheric nitrogen and reduces requirement for inorganic N_2 fertilizer. Intake increases in linear proportion to the percentage clover in the pasture up to the optimum level of approximately 35% (annual dry matter basis). Varieties that are persistent, high yielding and adapted to a range of managements are required to underpin the exploitation of good grass/clover production systems.

The principal objectives of the programme are:

- Increased persistence, especially in the medium and large leaf size categories
- Increased yield, both seasonal and annual
- Improved stolon density (medium and large leaf types)
- Improved disease/pest resistance
- Good seed production potential

Varieties released: The following varieties have been released and are included in the Recommended Lists in Ireland and elsewhere.

ARAN
AVOCA
SUSI
CHIEFTAIN

PIROUETTE (new variety; special purpose amenity clover)

GRASS SEED MIXTURES

Matt Ryan, Teagasc Nenagh

Sociologists say we should choose our parents wisely because of the 'chances' in life we get as a result. Similarly, farmers must carefully choose the varieties of grass to sow – seldom done. But a must! What are the trends in grassland farming that should dictate our choice?

Trends in Grassland Farming

These are driven by profit and simplified farming systems, because grazed grass is the cheapest and easiest way of feeding animals. The following issues are likely to continue to influence the varieties of grass being sown:

- Reseeding once every 10-25 years
- Early grazing
- Late grazing
- High quality mid-season grazing
- Ease of management
- Improved animal performance
- One-cut silage, probably the 5th - 15th June cutting
- Silage ground being grazed twice (or at least once) before closing
- Lower stocking rates 2.05 livestock units (LU) per hectare (1.2 acres per LU)
- Lower nitrogen inputs and more clover in the sward

Discussion

Grass seed characteristics can be examined in "Grass and Clover Recommended List Varieties for Ireland 2003" (Department of Agriculture and Food).

Because reseeding is expensive and interferes with current grassland management, reseeding of pastures will probably only be done every 15 - 25 years. Therefore, very persistent varieties will be required and farmers must demand them. The most persistent varieties are 'Late heading perennial ryegrasses'.

Due to farmers needs to extend the grazing season, varieties of grass that produce good yields both early and late in the season will have merit. Early and intermediate grass varieties generally will do best but are harder to manage during mid summer, when they tend to run to seed more quickly. However, many new late heading varieties produce respectable yields of grass on both shoulders of the year.

Ease of management (less topping) and improved animal performance are critical factors in modern day farming. Research has shown that 'late heading' varieties of grass seeds out-perform both early and intermediate varieties. That means more milk (Moorepark) and higher weight gains (Johnstown Castle) are achieved.

The most persistent varieties are late heading diploid perennial ryegrasses. Late heading diploid perennial ryegrasses also give a denser sward, produce fewer seed heads and give excellent quality silage and mid-season grazing.

Tetraploids, indicated by 'T' on the recommended list, have higher sugar content, are more palatable, are more tolerant to drought conditions, and establish faster, but they have (a) fewer tillers (not thick on the ground), (b) lower persistency and (c) higher moisture content. Because of these characteristics the proportions of late heading tetraploid grasses in most mixtures should not exceed 20-30% and should not be included in mixtures for "heavy" land, but there are exceptions.

White clover should be included in all mixtures for its' nutritive value (always over 80% DMD) and nitrogen fixing ability (worth up to 4 bags CAN per acre). Large leaf varieties can tolerate high nitrogen use and compete better in silage swards.

Italian grasses are best suited to 1-2 year leys but they run to seed faster and have very little to offer in permanent grass seed mixtures.

Table 1. Suggested Grass Seed Mixtures (kg/acre) for Permanent Pastures

	Mixtures			
	Grazing	Silage *		REPS
		Early	Late	
Late diploid ryegrass	7.4	5.0	8.5	6.3
Late tetraploid ryegrass	3.5	1.5	2.4	2.5
Intermediate diploid ryegrass	-	3.0	-	-
Intermediate tetraploid ryegrass	-	1.5	-	-
Clover: large leaf	0.45	0.45	0.45	0.75
Clover: medium leaf	0.45	0.45	0.45	0.75
Total (kg/acre)	11.8	11.9	11.8	11.8

**1st Cut: Early 15 - 30th May / Late 5 - 15th June*

Mixture

Based on the above discussion the main varieties of grass seed to be sown in new permanent pasture reseeds should be late heading varieties. Table 1 suggests various quantities of seeds to be sown at 11.8 kg in total per acre. It would be advisable to sow 3 - 4 different grasses per mixture just in case unusual weather or ground conditions caused the partial failure of any particular variety. Current late varieties that might be considered would be: Cancan, Umbria, Portsteward, Twystar, Dromore, Gilford, Millennium (T) and Sarsfield (T).

The mixture for 'early silage' would cover the period 15th – 30th May cutting, while late silage would be defined as 5th – 15th June cutting. With the correct heading varieties the latter cut silage would have a DMD of 70 - 74%. Where farmers are rotating the silage ground from grazing to silage every second year (a good practice where possible), then all late heading varieties should be sown.

The intermediate varieties to consider in the early silage mix might be Spelga, Magician (T) or Napolean (T), because they produce an extra 6-8% more early spring growth.

Clovers, Aran and Avoca would seem to have most to offer with reasonable levels of nitrogen.

Finally, high sugar grasses in mixtures would seem to have merit but these grasses must contain significant levels of sugar to recommend them over other late heading grasses. Use the Recommended List for the current year to make your choice – but also use your Agricultural Adviser to make this vital long-term decision.

IMPROVING SWARD PRODUCTIVITY BY RESEEDING

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Reseeded pastures are significantly more productive than old pastures. An extra 2–3 t DM / hectare (ha) / year can be yielded from new pastures over what is possible to achieve from old neglected pastures. Digestibility of silage can be 2–3 units higher in reseeded pastures. In grazing land reseeded pastures have excellent growth in early spring and late autumn. They have excellent regrowth potential in April and the most commonly used new varieties are very leafy in mid summer when old pastures tend to get stemmy and deteriorate in quality. Reseeding alone presents the ideal opportunity to rid the fields of weeds and also, if required, to level land.

Principles of Successful Establishment

There are many methods of reseeding grassland, ranging from ploughing and tilling in the conventional way to direct seeding. For successful establishment all methods must provide an environment in the seedbed which allows the seeds to germinate and establish.

Germination: The essential pre-requisite is to have adequate soil moisture to allow the seeds to absorb water and develop roots and shoots. In direct drilling seeds are often susceptible to drought conditions, where there is adequate water for germination, but not enough to sustain early seedling growth. A firm seedbed helps to conserve moisture.

Emergence: Seeds provide sufficient energy for shoots to push their way through the soil and emerge above ground. If buried too deeply, seeds will not have sufficient energy to emerge and seedlings die. This can arise from sowing the seed too deeply, or covering the seeds with too much soil after sowing. Seeds should be covered with 1–2cm of soil.

Root development: Seedlings depend on their own energy reserves until the roots gain their own feed supply from the soil. Rapid and good seed-soil contact is essential. The ideal seed bed should be firm, fine and level.

For plant nutrition, phosphorus is essential for root development. Therefore an adequate supply of phosphorus needs to be readily available in the soil with a pH level of about 6.5. The fertiliser requirements at sowing in soils with various levels of fertility are outlined in Table 1.

Table 1. Nutrient requirements at establishment (kg/ha) of a grass/white clover sward*

Soil Index	N	P	K
1	60	60	120
2	50	50	90
3	40	30	50
4	40	0	40

** kg/ha x 0.8 = units/acre*

Tiller development: When the main shoot appears above ground level leaf formation should proceed rapidly. At the three to four leaf stage, a tiller normally develops in the axil of the first leaf. Once tillering proceeds the grass crop has safely established.

At normal seeding rates there are approximately 1000 seeds / m^2. A well-established grass crop has 10,000–15,000 tillers / m^2. Therefore, tillering is an essential process. The two factors that influence tillering are nitrogen and light reaching the sward base. It is critical that nitrogenous fertiliser be used at sowing and again after each grazing. It is vital that after establishment the sward is grazed on a few occasions before being closed for silage. Taking silage cuts too soon after grass establishment is the biggest single factor that leads to open swards and weed establishment.

Ploughing and Tilling

Ploughing and tilling in the conventional way is the most reliable method of reseeding in that it provides the ideal environment in which the seeds can establish successfully. If glyphosate herbicide is not used prior to ploughing, it is vital that the ploughing is sufficiently good to ensure that the old sward does not reappear in the furrows. The main disadvantage with ploughing, especially in fields that have not been ploughed in living memory, is that deep ploughing leads to impoverished soils in the immediate environs of the seed. Ploughing should only be to a depth of 15cm. Once the field is ploughed, the field can be tilled with whatever machinery is available. One-pass machines provide excellent seedbeds provided time is taken to ensure forward speed, PTO speed and depth of sowing are correct. Watch out for burying seeds too deeply.

Minimal Cultivation

Many farmers for a whole range of reasons cannot or prefer not to plough. Reseeding can be carried out by direct drilling and provided care is taken an excellent job can be done. The normal approach is to spray glyphosate on the crop. There should be adequate green leaf to ensure that glyphosate works.

The seedbed is then prepared by use of either a power harrow and seed drill combination (one-pass), or the use of a power harrow, rotovator, etc., followed by a grass seed drill/fertiliser spreader for sowing the seed. Application of 2.5 t lime/ha helps to provide a good environment for seed establishment.

The normal causes of failure with this technique are:

1. Too much trash in the seed bed
2. Too low a rate of glyphosate used
3. Seed bed that is too 'loose'
4. No lime used
5. Sowing too deeply
6. Sowing in a very dry time

Costs & and Methods of Reseeding 2003* (€ per ha)

Cost Item	Conventional	One–Pass	One–Pass + Grubber
Soil Test (S1)	6	6	6
Cultivation			
Glyphosate (4 L / ha) + spraying	55	55	55
Ploughing	65	-	-
Heavy duty grubber	-	-	35
Cultivation	70	-	-
Roll before sowing	20	-	20
Power harrow / one pass	-	100	75
Roll after sowing	20	20	20
Fertiliser and Lime			
Fertiliser (7.5 bags / ha x 10:10:20)	100	100	100
N top dressing + spreading	28	28	28
Lime (5t / ha + spreading)	87	87	87
Grass Seeds	140	140	140
Weed control + spraying	55	55	55
Frit Fly control + spraying	25	25	25
Total cost / ha	**671**	**616**	**646**
Total cost / ac	**270**	**250**	**260**

** All prices include V.A.T.*
** Contractor charges used for machinery operations.*
** Some costs may <u>not</u> arise e.g. adequate pH / soil fertility, no frit fly etc.*

Observations on Reseeding - Kildalton College 2002

Conventional:

1. Slower method of reseeding.
2. All trash buried giving good level field.
3. Very even & fast establishment.
4. Huge germination of weeds post sowing.
5. Stones brought to surface.

One–pass:

1. Fast method of reseeding – one-pass cultivation and sow.
2. Slow forward speed and good tines essential.
3. Very accurate and uniform seed distribution.
4. Small population of weeds post sowing.
5. Can graze reseed with heavier stock.

One–pass + grubber:

1. Extra machine and cultivation takes time.
2. Grubber will bring up stones and clods.
3. Rolling of ground necessary pre sowing (uneven + open).
4. No difference in germination / establishment over the one-pass.
5. Huge germination of annual weeds etc., post sowing.

HARVESTING AND ENSILING – FORAGE GRAIN CROPS

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Padraig O'Kiely, Teagasc Grange

There are a number of options available to farmers for harvesting and storing of whole crop cereals and moist grains on-farm. The harvesting, processing and storage of these options is outlined in this paper. First time growers of cereals for whole crop and moist grain harvest may require some guidance in deciding optimum harvest date. The table below is a guide to crop dry matter (DM) for whole crop or moist grain harvest.

Guide to DM Content for Whole Crop and Moist Grain Harvest

<table>
<tr><th>Whole Crop DM %</th><th colspan="2">Description</th><th>Crop Colour</th><th>Grain Texture</th><th>Grain Moisture %</th></tr>
<tr><td>36-38</td><td rowspan="4">Fermented whole crop</td><td rowspan="4"></td><td>Green ear
Green stem</td><td>Soft dough</td><td rowspan="3"></td></tr>
<tr><td>39-42</td><td>Ear starting to yellow, stem green</td><td>Soft cheddar</td></tr>
<tr><td>43-46</td><td>Ear mainly yellow, stem starting to yellow</td><td>Soft cheddar</td></tr>
<tr><td>47-54</td><td>Ear and stem mainly yellow, some green on stem</td><td>Hard cheddar, grains easily split with thumbnail. Assume crop moisture loses 1-2% per day</td><td>> 45</td></tr>
<tr><td>55-65</td><td>Urea treated whole crop</td><td rowspan="2">Crimped grain (60-70% DM)
Urea treated grain (65-72% DM)</td><td>Ear and stem yellow, hint of green on stem</td><td>Hard cheddar, moist grains can still be split with thumbnail</td><td>35</td></tr>
<tr><td>66-70</td><td rowspan="3">Whole crop processed (e.g. alkalage)</td><td>Ear and stem yellow/golden brown, some green on nodes</td><td>Mature grains hard, difficult to split</td><td>≤ 30</td></tr>
<tr><td>71-80</td><td rowspan="2">Combinable grain</td><td>Ear and stem completely yellow/golden brown</td><td>Grains very hard, some heads bending over</td><td>> 25</td></tr>
<tr><td>>80</td><td>Ear and stem completely yellow/golden brown</td><td>Full maturity, ready to combine</td><td>< 20</td></tr>
</table>

Fermented Whole Crop Cereal (WCC) Silage

Whole crop wheat or barley silages should ideally be produced from crops that would have yielded at least 8 tonnes harvested grain DM / hectare.

Harvesting

- Harvesting should not take place until after the cereal grain has progressed beyond the milky-ripe growth stage – until it has at least reached the soft-cheddar consistency (i.e. above 35% DM).

- The crop nutritive value is effectively constant from the "soft-cheddar" stage until the cereal grain has reached the hard-cheddar consistency (approx. 55% DM) – this is a window of almost three weeks.
- A direct-cut precision chop harvester is preferable. Minimise losses during harvesting and ensiling. Trailers should have solid sides and backs to avoid grain losses.
- Crops cut with high stubble will have lower yields but higher feeding value. Crops cut with low stubble will have higher yields but lower feeding value.
- A short chop length (c. 2.5cm) will help reduce aerobic deterioration.

Ensiling

- Preservation should be straightforward. Silos need to be filled quickly.
- High DM will limit effluent discharge.
- Whole crop needs to be well-compacted and weighed down. Double sheet the pit to prevent aerobic fermentation.
- A narrow pit is preferable to reduce aerobic deterioration.
- Results from Grange indicate losses during feed-out are no greater than with grass silage, where good management practices prevail. Additives may be used where WCC silage is being used as a buffer feed in late spring or early autumn.
- The silo should be protected from wildlife such as birds, rodents etc. Laying down bait around pits is important.

Processed Whole Crop Cereal (PWCC) Silage

Processed whole crop cereal silage (e.g. alkalage) is produced from cereal crops that are harvested at a minimum of 60% crop dry matter, or less than 35% grain moisture. At this stage grain fill is complete. Cereal crops can be harvested right up to the stage that the combine would enter the field.

Harvesting

- The crop is cut with a self-propelled silage harvester with a grain processor specifically installed to process / crack the grain. Harvest windows are typically 30 days. Harvesting can be carried out in damp or dewy conditions without significantly reducing crop DM. A level of moisture at harvest time will reduce the loss of high value flour and chaff particularly in high dry matter crops.

Ensiling

- The additive Home 'N' Dry is applied to the crop in the pit at ensiling with a fertilizer spreader. Home 'N' Dry additive is based on urea and urease enzyme.
- If harvesting is stopped for example a breakdown or harvesting over a number of days the clamp should be sheeted down to contain the ammonia which is released within 20 minutes of application to the pit.
- PWCC ensiled in this manner does not ferment, so in-storage losses i.e. heating moulds, are negligible.
- Good airtight sealing of the pit is essential to achieve good preservation.
- In general, vermin do not attack or infest the processed urea treated wholecrop.

High Moisture Grains (Teagasc Grange)

Harvesting research work at Teagasc Grange has shown that:

- As cereal grains went through the final stages of ripening and their moisture content decreased from approximately 43 to 17%, the average yield of grain DM started at 7.7 t/ha and finished at 7.5 t/ha. Therefore there was a wide window where the harvested yield of grain DM was constant.
- The mean digestibility (DMD) of the harvested barley grains was 84 and 87% in 2001 and 2002, respectively, with corresponding values for the wheat of 86 and 89%. The average value recorded for the triticale grains was 89% DMD (single year).
- Neither the protein nor starch content changed while the moisture content decreased from approximately 43 to 17%. (data only available for 2001 crops yet). These finding indicate that there is a wide window within which the nutritive value of the cereals grains is likely to be constant and during which the grains are really just drying.
- Once the settings on the combine-harvester and its forward speed were set appropriately, grain losses at the front of the harvester or via the straw were similar to what is achieved with conventional dry grain.
- Grain moisture content can change very rapidly when an extended period of wet weather is followed by dry weather conditions. Therefore, changes such as those highlighted above mean that the optimal window of time within which to harvest can sometimes be quite short. This can be quite restrictive and place great importance on the timeliness of harvesting.

Ensiling (Teagasc Grange)

- Store high moisture grain in an air-free environment and/or treat with additives that restrict mould activity. So as to maintain feed value, limit DM losses, avoid the human and livestock health challenges and avoid the animal productivity problems potentially caused by the ingested mycotoxins.

- Poorly packed processed grains are susceptible to air infiltration and thus to extensive mould growth. Thus, most processed (e.g. crimped) high-moisture grain is stored at between 30 and 40% moisture.
- Additive treatments are imposed to preserve (in particular prevent mould growth) or modify its nutritive value (e.g. disrupt the seed-coat). Among the current options are the following two main approaches:

- **Crimping** (grain acidification and rolling). Organic acids (or acid mixtures) are applied to facilitate preservation and temporarily inhibit mould growth. This grain can be rolled/crimped at ensiling or at feedout - usually the former. Maintaining strictly air-free conditions throughout storage and minimising the duration of access to air during feedout is critical. The treated grain is usually sealed beneath the type of plastic used for sealing conventional grass silage.
- **Urea treatment**. This grain is normally stored under sealed, air-free conditions (e.g. sealed beneath conventional silage plastic sheeting) to prevent the rapid loss of the ammonia produced from the urea. The ammonia prevents mould growth and when it binds with moisture in the seed coat of the grain the resultant hydroxide effect should replace the need for mechanically rolling the grain. This treatment also increases the concentration of crude protein in the grain - however, the extra N is non-protein N and may be of limited value to the animal.

High Moisture Grain Treatments

	Crimping	Urea	Innoculant
Grain moisture	35 to 50%	25 to 35%	30 to 40+ %
Processing	Yes	No	No
Machinery	Crimper	Wagon / auger	Wagon
Additive	Yes	Yes	Yes
Storage	Clamped	Clamped	Clamped

Processing / Additive Costs

Process	Treatment / tonne DM, assuming 35% moisture content	
Crimping	Processing Additive	15 9
Urea treatment	Wheat Barley	20 20
Innoculant treatment	Processing Additive	5 15

THE NUTRITION VALUE OF ALTERNATIVE FORAGES AND HIGH MOISTURE GRAINS

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A series of studies are on-going at both Teagasc Grange and Teagasc Moorepark on harvesting, conservation and the feeding value of alternative forages and high moisture grain. The most recent data from both research centres is presented below.

Teagasc Moorepark – Dairy

Previous results from the UK on feeding both fermented and urea-treated whole crop wheat (WCW) silage to dairy cows showed that these forages increased intake significantly but had only small effects on milk production or composition relative to feeding a good quality grass silage. The reason for the lack of a response in production was partly attributed to decreased digestibility, particularly of the grain component of the WCW silage. A grinding box attached to the harvester which processes (grinds) the grain prior to ensiling has been developed in the UK and this potentially should improve the digestibility of the grain in the WCW.

The objective of the study reported here is to compare grass silage, fermented WCW, urea treated processed WCW and maize silage. These are only preliminary findings because laboratory analysis and final statistical analysis have not yet been completed. The experiment was conducted with cows calving in September (October 2002) in a Latin Square design with four treatments as follows:

1. Grass silage *ad-libitum*
2. A mixture of grass silage and fermented WCW silage (33% / 67% on a DM basis)
3. A mixture of grass silage and urea-treated processed WCW silage (33% / 67% on a DM basis)
4. A mixture of grass silage and maize silage (33% / 67% on a DM basis)

Concentrate supplement was offered at 8 kg per head per day in an out of parlour feeder (2 kg in each 6 hour period) and 1 kg per head per day at each milking. Cows were milked twice daily.

Forages

1. Grass silage was a 2nd cut of mainly perennial ryegrass. Analysis of DM 27%, pH 3.8, CP 12% DM and DMD 69%.
2. Fermented WCW was harvested on July 30, 2002 with a self-propelled forage harvester fitted with a combine header and treated with Biotal additive through the harvester at the recommended rate. Mean stubble height remaining was 24 cm. Analysis of DM 42%, CP 7.5% DM, and NDF 47.8% DM.
3. Urea-treated processed WCW silage was harvested, from the same field as the fermented WCW silage, on August 23, 2002 with a self-propelled forage harvester fitted with a combine header and a grain processing box. The crop was treated with an additive containing urea plus urease enzyme ("Home 'N' Dry", Volac Ltd) in the pit at an estimated rate of 40 kg/t. Mean stubble height remaining was 27cm. Analysis of DM 73%, CP 14% DM and NDF 49.9% DM.
4. Maize silage was harvested on November 4 / 5th 2002. Analysis of DM 22%, pH 3.6, CP 7.9% DM and NDF 46.2% DM.

Table 1. The DM intake (kg/day) and milk yield (kg/day) for the 4 treatments

	Grass Silage	Fermented WCW	Processed WCW	Maize Silage
Forage DM intake	8.8	12.8	14.8	11.2
Concentrate DM intake	7.8	8.1	7.9	8.5
Total DM intake	16.6	20.9	22.7	19.7
Milk yield	27.7	30.0	29.4	29.8

- Mixing another forage with grass silage increased intake in all cases (table 1).
- The largest forage intake was achieved with processed WCW, which was 68 %, 32 % and 16 % greater than grass silage alone, maize silage mixture and fermented WCW mixture, respectively.
- Milk yield was significantly higher on all forage mixtures compared to grass silage but was not significantly different between forage mixtures.
- Laboratory analysis needs to be completed in order to assess the starch contents of the feeds in this study but the DM content of the maize silage would indicate that it was, at best, of moderate quality.
- Further trial work is required to confirm these results and to determine not only milk yield and composition on such mixtures of feedstuffs, grain digestibility but also their effects on body condition score and live weight changes.

Teagasc Grange – Beef Cattle

Alternative Forages

Grass is the predominant forage ensiled in Ireland, and is likely to remain so for the foreseeable future. High yields of quality grass ensiled with minimal losses and produced/conserved/fed with restrained input costs are essential in order to provide cattle with economically attractive feedstuff and to support sustainable systems on most farms. Besides providing winter feed, grass silage also facilitates grazing management, permits efficient and hygienic recycling of animal manures and can be used to help reduce the internal parasite challenge to grazing cattle. However, the relatively modest yields achieved in a single harvest allied to variability in digestibility and ensilability (and thus in intake and animal performance response) and the likelihood of effluent production create disadvantages for grass silage compared to some alternative forage crops. Thus, alternative forages are worthy of consideration on many farms. However, it is important to remember that their function is to improve farm profits and not simply to increase intake or levels of animal production. Thus, the role for these alternative forages needs to be considered in terms of relative total costs of production, relative revenues from the sale of meat/milk, relative payments of eligible EU funds and ultimately farm profits.

Experiments with **maize silage** have shown its nutritive value for beef cattle to range from being inferior (Table 2) to good grass silage to being superior (Table 3), with the difference in nutritive value relativity being predominantly determined by the content of developed grain in the maize hybrids grown. The digestibility of the forage portion of the crop (i.e. stover) would also influence nutritive value. Thus, we know that highly digestible maize silage of high grain (i.e. starch) content can support rates of carcass gain by beef cattle that are superior to what are achieved with good grass silage, but with a lower efficiency of converting forage dry matter (DM) to carcass.

A target of 13 tonnes harvested DM per hectare (in the absence plastic mulch) is appropriate for commercially viable crops, with subsequent conservation losses being restricted to below 15%. Target harvested whole-crop DM concentration would be 30% DM with a corresponding starch concentration above 25% of the DM.

Table 2. Intake, performance and feed conversion efficiency for maize silage (low starch content)

	% Grass Silage in mix with Maize Silage			
	100	**67**	**33**	**0**
Silage DM intake (kg/day)	6.1	7.2	7.1	6.1
Live weight (LW) gain (g/day)	1385	1384	1371	1068
Carcass weight gain (g/day)	870	829	745	633
Kill-out rate (g/kg LW)	526	520	509	515
Kidney & channel fat weight (kg)	12.2	10.8	10.7	9.7
Feed conversion efficiency (FCE)				
Dietary DM intake/LW gain	6.3	7.0	7.0	8.1
Dietary DM intake/carcass gain	10.0	11.8	12.8	13.5

Source: Teagasc, Grange Research Centre

Table 3. Intake, performance and feed conversion efficiency for maize silage (high starch content)

	% Grass Silage in mix with Maize Silage		
	100	**50**	**0**
Silage DM intake (kg/day)	5.1	6.8	6.8
Liveweight (LW) gain (g/day)	846	950	979
Carcass weight gain (g/day)	653	698	737
Kill-out rate (g/kg LW)	552	548	554
Kidney & channel fat weight (kg)	13.8	12.8	12.2
Feed conversion efficiency (FCE)			
Dietary DM intake/LW gain	9.4	10.2	9.9
Dietary DM intake/carcass gain	12.0	13.6	13.0

Source: Teagasc, Grange Research Centre

Experiments with **whole (small grain – wheat / barley) crop cereal silage** conserved using conventional technologies indicate that:

- The crop nutritive value is effectively constant from the "soft-cheddar" stage until the cereal grain has reached the hard-cheddar consistency (approx. 55% DM) – this is a window of almost three weeks.
- The nutritive value of whole-crop cereal silage for beef cattle can range from being inferior (Table 3) to good grass silage to being superior (Table 4), with the difference in nutritive value relativity being predominantly determined by the content of developed grain. Again, the digestibility of the straw component of the crop also has to be important. However, the proportion of grain in the crop will have a major bearing on whole crop nutritive value, and higher grain yields and/or lower yields of harvested straw (including elevated cutting height) can significantly influence this.
- Whole crop wheat or barley silages should ideally be produced from crops that would have yielded at least 8 tonnes harvested grain DM /hectare. Depending on the (conventional) system adopted,

the crop would be between 40 and 55% DM. Conservation losses should be limited to below 15%, producing aerobically stable silage with negligible mould presence.

Table 4. Intake, performance and feed conversion efficiency for whole crop wheat (modest grain yield)

	Whole-crop wheat silage			Grass silage
Crop DM% at harvest	35% DM	50% DM		
Additive applied	Alone	Alone	Urea	
Silage DM intake (kg/day)	5.14	5.76	5.45	4.98
Live weight (LW) gain (g/day)	889	921	894	1051
Carcass gain (g/day)	575	577	529	747
Kill-out rate (g/kg LW)	529	524	515	552
Kidney & channel fat weight (kg)	10.0	9.5	10.3	11.1
Feed conversion efficiency (FCE)				
Dietary DM intake/LW gain	8.95	9.21	9.30	7.34
Dietary DM intake/carcass gain	13.7	14.8	15.8	10.2

Source: Teagasc, Grange Research Centre

Table 5. Intake, performance and feed conversion efficiency for whole crop wheat (good grain yield)

	% grass silage (GS)		% GS with whole-crop wheat ensiled at 361gDM/kg			% GS with whole crop wheat ensiled at 506gDM/kg plus urea	
	100	67	33	0	67	33	0
Intake (kg silage DM/day)	4.81	5.35	6.27	6.33	6.26	6.01	5.96
Liveweight (LW) gain (g/day)	866	941	1019	987	1031	968	869
Carcass gain (g/day)	596	684	706	695	710	711	636
Kill-out rate (g/kg LW)	534	539	534	534	533	542	537
Kidney & channel fat weight (kg)	11.4	9.4	10.7	9.3	8.5	9.0	10.5
Feed conversion efficiency (FCE)							
Dietary DM intake/carcass gain	12.6	11.7	12.8	13.1	12.5	12.4	13.7

Source: Teagasc, Grange Research Centre

High Moisture Grains*

Whole cereal grain with a moisture content below 14% usually will not support mould growth during an extended duration of aerobic storage. As grain moisture content increases towards 22%, the duration of safe storage decreases rapidly, and the requirement for aeration initially, and subsequently for drying or treatment with preservatives such as propionic acid based products, increases progressively. Whole grain treatment with sodium hydroxide can also confer stability during aerobic storage, as well as avoid the need to mechanically roll or grind the grain. A series of ongoing collaborative experiments between Teagasc Grange, Teagasc Oak Park and UCD are investigating various aspects of high-moisture grain.

Beef Production Studies*

Finishing steers were offered grass silage alone or with wheat-based concentrates at the equivalent (standardised for moisture content) of 3, 6 or 10 kg/head daily for 144 days. Wheat had been either:

a) harvested at 32% moisture, crimped (i.e. rolled), treated with a mixture of organic acids and ensiled.
b) harvested at 28% moisture, treated with urea solution and stored under plastic sheeting. This was offered whole (i.e. unrolled).
c) harvested at 18% moisture, treated with propionic acid and rolled in weekly requirements during feedout. This was considered the standard control or reference treatment.

The results indicate that:

- Cattle adapted to the conserved high-moisture grains at least as readily as to the conventional dry/rolled wheat.
- Increasing rates of supplementation with wheat, as expected, lead to progressively higher rates of live weight gain and heavier final carcass weights.
- Grain was visible in the faeces of cattle offered urea-treated whole grain, and this became more evident at increasing rates of supplementation. Further work is quantifying the scale of this apparent loss. Relatively little grain loss was evident with the dry/rolled or crimped/acid-treated systems.
- Cattle offered crimped/acid-treated wheat had similar total DM intakes (8.9 and 9.0 kg/day), growth rates (857 and 856 g/day) and carcass weights (324 and 326 kg) to cattle offered the control dry/rolled grain.
- Cattle offered the urea-treated whole grain had comparable total DM intakes (9.5 kg/day) but lower growth rates (730 g/day) and lighter carcass weights (309 kg) compared to those offered either the control dry/rolled grain or the crimped/acid-treated grain.

Conclusion

- Harvesting, storing and feeding high-moisture grain is a viable option on some farms. An excellent standard of management is required to restrict grain loss in the field, prevent mould development in the silo and to attain optimal animal productivity during feedout.
- Urea-treated whole wheat was highly resistant to mould growth.
- Crimped grain treated with an effective mould-inhibiting additive supported a better animal performance response than did urea-treated whole grain.
- Ongoing research will provide further independent, objective information.

** The research reported in this short summary was led by P. Stacey and P. O'Kiely at Teagasc Grange, B. Rice and R. Hackett at Teagasc, Oak Park and F. O'Mara at Faculty of Agriculture, UCD.*

THE ECONOMICS OF ALTERNATIVE FEEDING PROGRAMMES

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Alternative forages are worthy of consideration on many farms. However, it is important to remember that their function is to improve farm profits and not simply to increase intake or levels of animal production. Thus, the role for these alternative forages needs to be considered in terms of relative total costs of production, relative revenues from the sale of meat / milk, relative payments of eligible EU funds and ultimately farm profits. This paper will present the cost / benefit analysis of using alternative feeding programme in both milk and beef production scenarios.

Milk Production

In the spring milk production system, the benefits accruing from utilizing an alternative forage – maize silage or fermented whole crop wheat (WCW) or processed WCW - were minimal. However, there may be a role for alternative forages in some spring milk herds, for example where land is fragmented. Only the costings for winter milk production are presented here.

In the winter milk production system, maize silage (MS) and fermented whole wheat silage (FWCW) were compared with the 'conventional' two-cut grass silage (GS) system. The production unit was 112,000 gallon, 120 acre dairy farm carrying 80 cows (60% spring, 40% autumn) and 20 replacement heifer units. A total of 31.5 ha were cut for grass silage in the conventional system (20 ha first cut) while 5 ha of good quality alternative forages partially replace the grass silage area conserved in the two other systems. The following assumptions were made:

- Milk production (and output) was held constant by adjusting energy allowances across the three winter forage systems. Based on current Teagasc data, a concentrate saving of 2kg and 1kg / head per day was assumed for MS and FWCW respectively, compared to good quality GS.
- The comparative variable costs of production per tonne of dry matter were 90, 78, 93 for GS, MS and FWCW respectively (excluding area aid). Storage, feeding, land charge and working capital charges have not been included in the costs per tonne of DM for forages.

- The yields of utilised silage obtained were 5.4 tonnes DM/ha for first cut grass silage, 3.5 tonnes DM/ha second cut grass silage, 11.9 tonnes DM/ha for MS and 12.4 t DM/ha for FWC respectively.
- It was assumed that MS was 28% DM and 25% starch and FWCW was 40% DM and 25%.
- Average concentrate input for GS, MS and FWCW was 880kg (200/t), 685kg (230/t) and 780kg (230/t) / cow / annum, respectively. Concentrate input for replacement heifers was 350kg (170/t) / animal.
- Supplementary feed was purchased to fill the deficit in grass supply at the shoulders of the year in the alternative forage systems. This accrued to 3.2 t / annum.
- Miscellaneous and fixed costs were included.
- The land growing the alternative forages was eligible and area aid was obtained (157/ha and   383/ha for maize and whole crop respectively).
- Improvements in body condition and animal health have not been factored into the system. Other issues including fragmentation, flexibility and reduced risk need to be considered.

The change in net profit from using alternative forages, compared to 70 DMD or 65 DMD grass silage is presented in Table 1.

Table 1. The change in net profit per gallon in winter milk production from using alternative forages, compared to 70 DMD or 65 DMD grass silage

	70 DMD Grass Silage	65 DMD Grass Silage
2 cut grass silage	-	-
Maize silage – 43% aid (157/ha)	+2.1 c/gal	+4.3 c/gal
Fermented WCW – 100% aid	+0.2 c/gal	+2.4 c/ gal

Based on the assumptions above, the following conclusions were drawn from the data.

- Alternative forages are not viable without area aid
- Maize silage gave the highest improvement in net profit, compared to either good or poor quality grass silage
- Based on current research data, fermented whole crop cereal silage has a significant role to play where grass silage quality is poor.

Beef Production

A critical test of finishing efficiency is the cost per kilo of carcass gained. This is a more relevant measure than feed cost per day, which is often used but is meaningless in the absence of performance data. The exercise presented here examined the cost of carcass gain to a grass silage, maize silage, fermented WC high concentrate (crimped cereal) and high concentrate (rolled cereal) based system. In looking at figures like these some other facts need to be considered:

1. Premia. In some situations very high performance may not be desirable, if cattle will finish before retention dates are reached, or possibly, before an expected market change takes place.
2. Other costs. Generally, earlier finish (higher performance) carries extra rewards through reduced non-feed costs such as interest, machinery, slurry spreading etc.
3. High concentrate diets require some additional husbandry skills if digestive upsets are to be avoided.

Table 2 below takes principally Teagasc, Grange experimental results and applies them to finishing steers of 550 kg fed to gain 120 kg liveweight, which is assumed to add 80 kg carcass weight. The diets assumed are good quality grass silage supplemented with 5 kg of barley based concentrate, excellent quality maize or whole crop wheat supplemented with 5 kg of concentrate suitably balanced for protein and an ad lib barley based concentrate, either crimped or rolled.

Table 2. The costs per tonne of feed dry matter used (excl. area aid)

Grass silage 72 DMD	90	Protein balancer	255
Maize silage	78	Rolled barley	165
Whole crop wheat silage	93	Crimped barley	165

The figures suggest that in the absence of area aid for cereals there are relatively small differences in the cost of adding 80 kg of carcass to finishing steers. Taking the area aid payment as a subsidy on the feed cost obviously changes the situation drastically and all cereal-based options are considerably cheaper than grass silage diets. This conclusion cannot be taken on its own, the effect on cattle premium claims and on extensification must be considered.

The high concentrate diets, whether based on crimped or rolled grain produce feed costs per kilo of carcass gained similar to grass silage with supplement without area aid and considerably lower when area aid is included. This is, for good managers, a highly predictable finishing system, but is only operable at these performance levels for 80 to 100 days. It can be built into a stepped feeding pattern with animals spending the first half of the winter on silage only and the second half on concentrates, as illustrated by Gerry Keane in Grange.

Table 3. The feed costs for 80 kg carcass gain for a finishing bullock from 550 – 670 kg

Diet Type	GS + 5 kg	MS[1] + 5 kg	WCW[1] + 5 kg	Hi conc. Crimp	Hi conc. Rolled
DM fed / day, kg					
Forage	6	7	7	1	1
Barley	4	3.3	3.5	9.8	9.8
Protein supplement		0.9	0.6	0.4	0.4
Daily intake, kg DM	10	11	11	11.2	11.2
CP, g/kg	129	130	129	124	124
Cost / day,	1.25	1.32	1.37	1.67	1.86
Carcass gain/day	0.67	0.8	0.8	0.95	0.95
No. days	120	100	100	84	84
Total feed cost,	**150**	**132**	**137**	**148**	**156**
Less arable aid	**150**	**123***	**116**	**110**	**118**

*GS = grass silage, MS = maize silage, WCW = fermented whole crop wheat, Hi conc = high concentrate system, [1]Must be of excellent quality. Low starch (immature) maize or whole crop are inferior to good grass silage for feeding beef cattle, *Maize silage area aid = 157/ha*

Conclusions

- Alternative feeds can have a realistic and cost efficient role in cattle finishing systems in certain circumstances.
- Not all maize or whole crop will be of excellent quality. Where starch levels are low the feeding value is inferior to good grass silage, and feed costs per kilo gain will be higher.
- Maize and whole crop have lower protein content than grass silage, and protein supplementation is necessary. Specific mineral supplementation is also required.
- On all-grass farms the introduction of an extra enterprise will complicate management, and should not be undertaken lightly. Contractors and possibly contract growing could have a role here.

Costings for High Moisture Grains

The decision to purchase moist grains for treatment must be based on the cost effectiveness of feeding grains balanced for protein and minerals compared to purchasing a balanced concentrate. The comparison must be made on a dry matter (DM) basis because of the difference in moisture content (MC) of purchased concentrates and moist grains. Table 4 presents an example of calculating the cost of purchased concentrates compared to buying grain for crimping and balancing for protein and minerals. Based on the costs used, the purchased concentrates cost 192/t DM and the crimped grain balanced for protein and minerals cost 177/t DM.

Table 4.

Purchased concentrates	160/t		UFV (energy) = 1.11/kg DM
Storage losses	5.0		Crude protein = 16%/kg DM
	165/t fresh or 192/t DM		DM = 86%
Crimping grain			
Cost of grain	77/t @ 35% MC		Equivalent to 95/t @ 20% MC
Crimping process	10/t		
Additive	6/t		
Ensiling	5/t		
Storage losses	5/t		
Interest (8%)	4/t		
Total	107/t as fed		
Balancing crimped grain			
Crimped grain (107/t)	770 kg	82	UFV (energy) = 1.11/kg DM
Distillers grains (160/t)	210 kg	34	Crude protein = 16%/kg DM
Cattle minerals (400/t)	20 kg	8	DM = 70%
		124	
Total	**124/t fresh or 177t DM**		

Variables that may affect the economics include:

1. Storage and handling costs associated with high moisture grains.
2. You must be registered with the Department of Agriculture and Food, if minerals are being mixed.
3. The cost of additive, crimping, protein feeds, purchased concentrates, grain price and interest charges may vary.
4. Good pit management is essential with crimped grain, contamination with mould growth etc. may have a negative effect on feeding value and consequently monetary value.

Costings will need to be done on an individual farm basis because of variation in some of the factors mentioned above.