THE FERTILISER ASSOCIATION OF IRELAND

FERTILISING FOR QUALITY PRODUCE
T.F. Gately

QUALITY PRODUCTION AT FARM LEVEL
Anthony Byrne

MARKETS FOR QUALITY BEEF
Michael Deely

WINTER MEETING – NOVEMBER 21st, 1986

Price £1

Publication No. 27

PRESIDENTS OF THE FERTILISER ASSOCIATION OF IRELAND

Name	Year	Name	Year
Dr T Walsh	1968	Mr G Cussen	1978
Mr W J C Milne	1969	Mr W E Murphy	1979
Mr G Foley	1970	Mr P McEnroe	1980
Dr J N Greene	1971	Mr T Fingleton	1981
Mr E J Sheehy	1972	Mr J Leonard	1982
Mr J C Brogan	1973	Mr P Duffy	1983
Mr T James	1974	Dr M Ryan	1984
Prof D M McAleese	1975	Mr P Keane	1985
Mr S McCann	1976	Dr J F Collins	1986
Mr M Roche	1977	Mr M Stanley	1987

COUNCIL OF THE FERTILISER ASSOCIATION OF IRELAND

Mr M Stanley, Fontstown Manor, Athy
Mr T King, IAWS
Mr L Stafford, NET
Dr T F Gately, An Foras Taluntais
Dr J F Collins, UCD
Mr D O'Neill, Albatros Fertilizers Ltd
Mr G Leonard, Grassland Fertilisers Ltd
Mr W O Brien, ICI Ireland Ltd
Dr D Collins, An Foras Taluntais
Mr T James, Ballyellin Limestone Flour Works
Mr R Walsh, ACOT (Ret'd)
Mr J Dardis, Irish Farmers Journal
Mr S Ward, Department of Agriculture

THE FERTILISER ASSOCIATION OF IRELAND

FERTILISING FOR QUALITY PRODUCE
T.F. Gately

QUALITY PRODUCTION AT FARM LEVEL
Anthony Byrne

MARKETS FOR QUALITY BEEF
Michael Deely

ROLE OF FERTILISERS IN PRODUCING QUALITY CROPS

T F Gately
An Foras Taluntais
Johnstown Castle Research Centre
Wexford

INTRODUCTION

The world has a finite amount of arable land and about 27% of the earth's land surface is used for agriculture. Of this, 10% is used for raising crops and 17% for grazing livestock.

Basically, food production must be increased three to fourfold if we are to accommodate both a doubling of population, from 4,000 million to 8,000 million over the next 30 to 40 years and an increased demand brought about by a higher standard of living. Although in a few of the developed countries, such as The Netherlands and Denmark, fertiliser use may decrease and in others its use will have to match more closely crop demands to protect the environment and prevent excessive nitrate levels in ground water, worldwide fertiliser use must continue to increase to meet the food requirements of an expanding population.

Fertilisers are plant foods. They supply some of the essential nutrients that are necessary for plant growth. These are the same nutrients that are already present in varying amounts in soils under natural conditions. It should be emphasised that fertilisers contain nothing that is not already present in productive soils. They are used widely because most soils just do not have a sufficient native supply of all the essential nutrients necessary for acceptable crop yields.

ESSENTIAL NUTRIENTS

Although plants will take up, in varying amounts, almost all the ions that are present around their roots, there are really only 16 elements that are essential, i.e. a deficiency of the element makes it impossible for the plant to complete its life cycle. These 16 are shown in Table 1. At least seven more, Na, Co, Se, Cr, Fl, I and Si, taken up by plants are necessary for animals. Three of the plant essential elements (C, H, O) come from air and water and are not intentionally included in fertilisers. Calcium is added in limestone to control soil pH and Mg may be added in magnesian limestone during liming or as $Mg\ SO_4$ for potatoes or sugar beet where the soil level is less than 25 mg kg^{-1}.

The fertiliser compounds used to supply the other major nutrients N, P, K and S are not very complicated; the principal nutrients they contain are N, P and K with Ca, Cl and S as accompanying ions (Table 2). Cations in fertilisers are mainly $NH4^+$, K^+ and Ca^{++} and anions are NO_3^-, $H_2PO_4^-$, HPO_4^{--}, SO_4^{--} and Cl^- (Table 3).

ORGANIC VERSUS CHEMICAL FERTILISERS

It should be emphasised that regardless of the forms in which the nutrients are supplied to soils the plant roots will absorb them as very specific cations or anions. This important characteristic of plant roots is very often ignored in discussion on the merits of organic versus chemical fertilisers. Table 4 shows the ionic forms in which the essential nutrients are taken up by plant roots irrespective of whether they are applied to the soil in the organic form or as chemical fertilisers. This root ion selectivity ensures that organic manures, no matter what their source, cannot confer a crop quality advantage when supplying the same amount of nutrients as chemical fertilisers. They may, however, improve the water holding capacity of soils and render cultivations easier.

When discussing the effect of fertilisers on crop quality it is important to be aware that they have played a key role in increasing food production worldwide. This increased production is essential to feed an expanding world population of which over 600 million do not get enough to eat at present.

CROP QUALITY

The quality of a crop is much more difficult to measure than yield and quality standards depend very much on the purpose for which the crop is used. For example, malting barley should have a low protein content whereas feed barley should have a high protein content. Indeed many quality factors, such as taste or flavour, are very subjective so that the absolute assessment of quality is extremely difficult. Nevertheless, there are some basic relationships between nutrition and quality in crops and these will be considered in the following sections.

Forage crops:

The quality of forage crops such as grass, clover, silage and hay depends very much on their digestibility which decreases with maturity. However, in practice the differences in voluntary intake may be a more important factor than digestibility in production potential. Experiments by Hight et al (1968) showed no effect on voluntary intake in sheep from widely different levels of N fertilisation of grass. An exception to this is where the crude protein is very low, probably less than 6%, when level of intake is limited by lack of N substrate for the rumen microorganisms. Table 5 from the data of Goswami and Willcox (1969) demonstrates the effect of increasing the rate of N on the various nitrogenous fractions in ryegrass. High N rates enhanced the protein content considerably. Whether this is beneficial or not depends on the proportion of true protein synthesized, the nitrogen requirement of rumen bacteria and the protein requirement of the animal. An increase in the nitrogen component requires a compensatory depression in others. Usually the depression occurs in soluble carbohydrates and in plant cell wall. However, the lignin content normally increases. The depression in soluble carbohydrates is a negative effect. Reduction in cell wall and fibre is positive while lignification is negative. Overall fertiliser N has only a small influence on digestibility but it may depress it slightly (van Soest, 1982).

In a grass/clover sward the use of N may reduce the contribution of the more digestible clover complement where P and K will increase it. On the other hand, fertiliser N will increase the proportion of highly digestible new growth in a grazed sward. Overall as N fertilising does not generally affect either the digestibility or the intake its effect on the amount of production per unit area is directly proportional to the increase in production of dry matter.

In addition to supplying energy and protein forage crops also supply animals with essential minerals. The mineral content of forage is very important to the animal in Ireland because of low supplementary feeding by concentrates. Plants containing enough N, K and S for their requirements more than adequately supply animal needs; conversely Ca and Zn concentrations just adequate for plants will be inadequate for animals. Nutrients such as Se, I, Na and Co are more important for the animal than for the plant.

Mineral content varies markedly between different parts of plants of the same species, leaves being higher on Ca, Mg, S and Fe than stems and older tissues – this is important because of the selective nature of grazing. Clovers tend to be higher in nutrients than grasses unless where the supply is very low when grasses may forage better for available supplies. There is also an animal effect. Sheep require herbage of lower P content than cattle – this may be because their feed intake is 1.5 to 2 times that of cattle.

Lime and fertilisers have a major influence on the mineral content of herbage *per se* and on the animal. The natural ranges of major and trace nutrients in herbage are shown in Tables 6 and 7 respectively. Low Ca can cause calving problems. Phosphorus can be too low, for plants and animals, in mature herbage where adequate levels of fertiliser P are not applied. Low Cu levels in herbage occur in coarse textured sandy and organic soils and this can cause ill-thrift in animals. Cobalt is low in granite, peats and pure limestones and of course available Co is low if Mn is high (400 ppm). Our herbages appear to be low in iodine (I) but we need more research on this nutrient. Selenium deficiency in grazing animals occurs mainly in pure limestones and in peats.

Table 8 shows that Mg nutrition of milch cows can be a problem, particularly in spring when animals are grazing young herbage which is low in Mg and its availability is also low (Kemp, 1971). Generally only 20% of the Mg in herbage is re-sorbed from young grass. Magnesium content of herbage can be reduced by K fertilisation.

Fertiliser N increases the nitrate N content of herbage. In Ireland, much higher levels of nitrate were found under grazing by O'Donovan and Conway (1968) than were obtained by Gately and Ryan (1972) under cutting. It appears, however, from work in the Netherlands that nitrate toxicity is unlikely under grazing due to slow rate of intake. At Johnstown Castle, Sherwood and Murphy (1982) showed that where fertiliser N is applied two to five days before grazing there is a risk that the herbage may contain excessively high levels of nitrate N. They recommend that the fertiliser N be applied post grazing.

Sulphur increases the Vitamin A content, the protein content and the protein quality by increasing the cystine and methionine content and the digestibility by increasing the microbial gas production.

In summary, where high levels of fertiliser were applied, research carried out in the Netherlands (De Groot, Keuning, and Padmos, 1973) showed no problems with the health and production of high-yielding dairy cows (Table 9). In some instances additional fertilising with Mg, Na, Cu and Co could be beneficial.

Grain crops

Nitrogen is a key factor in grain quality because of its affect on protein content and protein quality. There is a strong negative relationship between grain protein content and yield (Riggs, 1984). The major effect of fertiliser N on cereal growth is to increase the total amount of radiation intercepted by the crop and not the efficiency with which it is converted to dry matter – this is achieved by increasing the area of individual leaves and the number of ear-bearing stems via tillering (Willington and Briscoe, 1984).

(a) Wheat: Our climate is suitable for the production of exceptionally high yields of biscuit and feed wheats by world standards but is not ideal for the growing of bread-making wheats. To be acceptable for milling in Ireland, wheat must contain 10.5% protein (at 15% moisture) as millers require a grist protein of about 11.5%. This is obtained by mixing imported Canadian hard wheat of about 13% protein with European (mainly French or English) wheat and native grain. As protein content of native wheat increases the amount of European and to a lesser extent Canadian wheat decreases.

In An Foras Taluntais a considerable amount of work has been done on wheat quality. Tables 10 and 11 show the effect of fertiliser N on the protein content of winter wheat grain grown in long-term tillage sites and directly following grass respectively. The protein content is much greater where the wheat is sown soon after grass in the rotation (Gately 1983-1985). Table 12 shows that increasing rates of N increased the grain protein and the gluten content (Dwyer and Thomas, 1983). The most important constituent determining the baking quality of wheat is gluten – this consists predominantly of the grain protein glutelin which is found in the endosperm. Nitrogen applied at flowering increases the protein content and the glutelin content and hence improves the baking quality. However, late N usually does not improve yields so that growers will not use it unless the premiums offered are worthwhile.

The feeding quality of wheat is mainly determined by the content of crude protein and its proportion of essential amino acids. These are amino acids that must be supplied as constituents of the mammalian diet as they cannot be synthesised by humans or animals (Table 13). Grains of wheat (and barley) are low in lysine and late N may decrease the lysine content as it increases lysine poor storage proteins such as gliadins (Hojjati and Maleki, 1972). However, evidence suggests that conventional cultivars nearly always contain enough lysine and other amino acids to meet human requirements provided sufficient cereal is consumed to meet energy and total protein needs (Periera et al, 1973). Furthermore, it is now possible to synthesise lysine (and methionine) which will reduce the need for ruminants in the nutrition of humans and other non-ruminants.

A close relationship exists between the protein content of cereal grain and the content of vitamins of the B group (thiamine, riboflavin, nicotinic acid). Nitrogen, especially late N enhances the vitamin B content of grain and thus improves their nutritional value (Schuphan, et al, 1968).

Experiments at Rothamsted, England and at CSIRO, Australia have shown that if there is insufficient S relative to N available to the plant, grain yield is depressed and the S amino acid content of the grain protein is decreased resulting in poor disulphide bonding and breadmaking (Byers, 1985). Poor disulphide bonding leads to poor dough formation.

(b) Barley: Apart from grass, barley for animal feeding is the most widely grown crop in Ireland. The main contribution of barley in feeds is to provide digestible energy. Its crude protein content also makes a valuable contribution but the energy portion is economically more significant. Hanrahan (1981) found only small variation in the digestible energy content of feed barleys. In Ireland, grain protein content is mainly influenced by the previous cropping history, the weather during the growing season and the amount and stage of growth of fertiliser N application (Gately, 1975). The effects of fertiliser N on feeding barley grain protein content are shown in Figure 1 and in Tables 14 and 15. The grain protein content will continue to increase with applied fertiliser N, even after there is no yield response. This is also true for wheat (Batey and Reynish, 1976). Thus excess fertiliser or soil N will lower the digestible energy content of barley grain.

Malting barley is a varietal characteristic. The malster requires specified varieties with low protein (ideally less than 10% protein in DM). The malting process involves germinating grain under controlled conditions so that the starch in the endosperm is released from the cells and partially degraded to polysaccharides which can later be further degraded to fermentable sugars and extracted in hot water. In Ireland, there has been a gradual increase in the grain protein contents of malting barley over the past twenty-five years. Since the amount of grass in the rotations has declined during this period the increase in grain protein must be due to the large increase in fertiliser N used on malting barley over this interval.

In order to produce quality malting barley somewhat less fertiliser N than is optimum for yield should be applied. The barley should be grown away from grass, peas and beans in the rotation and animal manures should not have been applied. All the fertiliser N must be applied not later than the 3-leaf stage (Feekes 2). For the growers to keep to these recommendations the malting barley premiums must give the required incentive. An adequate level of P decreases fungus infection. Weak straw in cereals due to K deficiency is the result of low carbohydrate levels. Grain size will also be small where there is K deficiency.

Sugar beet

The quality depends primarily on sugar content, but is also affected by the content of soluble amino compounds and by the content of minerals in particular K^+ and Na^+. The presence of soluble amino compounds and minerals disturbs crystallisation during sugar refining and thus affects the sugar output. Increasing the K nutrition to an adequate level generally leads to an increase in the sugar content and a decrease in the contents of soluble amino compounds (Draycott et al, 1970). Herlihy (1984) reported that P had little effect on quality and the main effect of K was to increase the sugar content (Table 16). The slight decrease in harmful amino nitrogen (H.A.N.) values shown in Table 16 is consistent with the increase in sugar content since they are inversely related. The small but consistent reduction of extractability due to K was caused by an increase in the K content of the juice.

Figure 2 shows the effect of fertiliser N on a range of yield and quality characteristics in sugar beet (Herlihy, 1985). This shows that there is a positive root yield response to N which will decline with increasing N input. Yield of total sugar (sucrose) and extractable sugar are very sensitive to the use of excess N because of its negative effect on sugar content and extractability. Nitrogen increases the concentration of amides and amino acids that are antagonistic to sugar synthesis in roots and that also reduce extractability by the processor. These harmful amino nitrogen sources (HAN) are also sensitive indicators of excessive N supply. Herlihy's work, at Johnstown Castle, has shown an overall average requirement of 100 kg N ha^{-1} for sugar beet, which ranges from 55 to 130 kg ha^{-1} when related to our index system of soil N availability.

Potatoes

The presence of an adequate supply of K promotes CO_2 assimilation and the translocation of carbohydrates from the leaves to the tubers of potatoes. Thus the starch content of tubers which is closely correlated with dry matter is high in potatoes well supplied with K. Muriate of potash (KC1) generally gives lower starch content than sulphate of potash (K_2SO_4) as shown in Table 17. This difference is probably due to the fact that chloride has a detrimental influence on the translocation of carbohydrates in the potato plant (Haeder, 1975). Herlihy and Carroll (1969) found that K, increased the proportion of large tubers and decreased the dry matter content when applied as KC1 (Table 18). Phosphorus tended to increase the dry matter content and improve the starch quality. Varis (1974) showed that high rates of N, K reduce the mealiness of tubers and N without K gives a very poor flavour. The after-cooking darkening of potatoes was increased by N but reduced by K.

In general, N causes a more vigorous vegetative growth and thus a delayed physiological ripening of tubers. In studies in Finland, Varis (1974) noted that high rates of N clearly reduced both dry matter and starch content. Potassium acted similarly though its effect was smaller. The effect of P, on the contrary, was to maintain and even increase the dry matter and starch content. Nitrogen increased the protein content of tubers but reduced its quality. Nitrogen increased the susceptibility of potatoes to skinning whereas P reduced it. In The Netherlands, Padmos (1986) said that the lower dry matter that is often found with higher levels of N can simply be a result of not letting the crop ripen sufficiently. The content of reducing sugars, glucose and fructose, is of interest in the industrial processing of potatoes. At high temperatures during cooking they react with amino acids to form dark compounds, which discolour crisps and other heat processed potato products (Voogd, 1963). Levels of reducing sugars above 0.2% give rise to undesirable discoloration (Cormack, 1982). As the tuber ripens, sugar content decreases and the starch content rises. More fertiliser N retards ripening but no effect of N, other than due to ripening, could be demonstrated on the content of reducing sugars. Swedish investigations (Johansson and Jonsson, 1971) suggest that cooking quality decreases with increasing N rates.

In a survey of potatoes selling at retail outlets incorrect size grading caused 58% of samples to fail and mechanical damage accounted for two-thirds of the reject potatoes (Kehoe and Sherington, 1984). Hence there is a major publicity campaign required to improve grading and prevent mechanical damage.

SUMMARY

1. Fertiliser use is essential for optimum crop production. On a worldwide basis more rather than less fertiliser must be used to feed the growing world population.

2. There is really not any conflict between the use of chemical fertilisers and organic crop production since nutrient elements are taken up by plant roots in the same form regardless of whether they are applied in chemical fertilisers, animal manures or crop residues.

3. Fertilisers, when applied at recommended rates and at the correct growth stages, will usually enhance the quality of all crops including grass, cereals, sugar beet, potatoes and vegetables. This improvement is mainly through an increase in protein content.

4. The major concern from the over-use of fertilisers and or animal manures is not their effect on crop quality but their role in the eutrophication of waterways and in increasing the nitrate levels in ground water. We must continue to marry as precisely as possible the use of fertilisers and animal manures to crop needs. If this is done there is no need to worry about the effects of fertilisers on crop quality whether for human or animal consumption.

REFERENCES

Batey, T. and Reynish, D.J., (1976). J. Sci. Fd. Agric. 27 983–990.
Byers, M. (1985). J. Sci. Fd. Agric. 36, 1968.
Cormack, W.F. Arable Farming, August, 1982.
Draycott, A.P., Marsh, J.A.P. and Tinker, P.B.H. (1970). J. Agric. Sci. 74, 567.
Dwyer, E. and Thomas, T. Food Science and Technology Res. Report. An Foras Taluntais, Dublin, 1983.
Gately, T.F. and Ryan, M. (1972). Ir. J. Agric. Res. 11: No. 1.
Gately, T.F., (1975). Ph.D. Thesis. National University of Ireland Dublin.
Gately, T.F. Soils Research Report. An Foras Taluntais, Dublin, 1983, 1984, 1985.
Goswami, A.K. and Willcox, J.S. (1969). J. Sci. Fd. Agric. 20. 592-595.
Grott, T.H. de, Keunng, J.A. and Padmos, L., Stikstof July, 1973. No. 16.
Haeder, Landw, Forsch 32/1 SH, 121-131, 1975.
Hanrahan, T. Farm and Food Research, December 1981, An Foras Taluntais, Dublin.
Herlihy, M. (1984). Annual Report on Sugar Beet Research (Tripartite Committee AFT/BVA/CSET, An Foras Taluntais, Dublin.
Herlihy, M. Farm and Food Research. December 1985. An Foras Taluntais, Dublin.
Herlihy M. and Carroll P.J. (1969). J. Sc. Fd. Agric. 20
Hight, G.K., Sinclair, D.P., and Lancaster, R.J. 1968. New Zealand, J. Agr. Res. 11 286-302.
Hojjati, S.M. and Maleki, M. Agron. J. 64, 46-48, 1972.
Johansson, O. and Jonsson, L. (1971). Lantbrukshobskolans, Meddelanden 146, pp 32.
Kehoe, H. and Sherington, J. Farm and Food Research, December 1984, An Foras Taluntais, Dublin.
Kemp, A. (1971). The Potassium Institute Ltd., 1971, Proc. 1st Colloq, p 1-14.
O'Donovan, P.B., and Conway, A. (1968). J. Br. Grassld. Soc. 23: 228.
Padmos, L. Netherlands Fertiliser Technical Bulletin, No. 16 Feb 1986.
Pereira, S.M., Jones, Jesudian, G. and Begum, A. (1973). British Journal of Nutrition 30, pp 241-250.
Riggs, T.J. (1984). MAFF, Reference Book 385 p 5-18 HMSO, London.
Sherwood, M. and Murphy, W.E., 1982. Soils Res. Rep. An Foras Taluntais, Dublin, p. 19.
Schuphan, W., Kling, M. and Overbeck, G., (1968). Qualit. plant. materiae veg. (Den Haag) 15, 177-214.
Varis, E. EC/FAO Symposium, Geneva, July, 1974.
Van Soest, P.J. (1982). Nutritional Ecology of the Ruminant, O and B Books, Inc. Oregon, USA.
Voogd, C.D., Literatuuroverzicht, Pudoc, 1963.
Willington, V.B.A. and Briscoe, P.V., (1984). MAFF Reference Book 385, p 131-132, HMSO London.

Table 1: Essential elements for plant growth

Structural		**Micro**	
C	Carbon	Mn	Manganese
H	Hydrogen	Fe	Iron
O	Oxygen	B	Boron
Primary		Zn	Zinc
N	Nitrogen	Cu	Copper
P	Phosphorus	Mo	Molybdenum
K	Potassium	Cl	Chlorine
Secondary			
Ca	Calcium		
Mg	Magnesium		
S	Sulphur		

Table 2: Fertiliser compounds

Ammonium nitrate	Ammonium phosphates
Ammonium sulphate	Superphosphate
Urea	Concentrated superphosphate
	Potassium chloride
	Potassium sulphate

Table 3: Forms of elements added in fertilisers

N	NH_3 NH_4^+ $CO(NH_2)_2$, NO_3^-
P	$H_2PO_4^-$, HPO_4^{--} PO_4^{---}
K	K +
Ca	Ca^{++}
S	SO_4^{--}
C1	$C1^-$

Table 4: Form in which essential nutrients are taken up by plant roots from soils

Major nutrient	*Ionic form taken up*	*Trace nutrient*	*Ionic form taken up*
N	NO_3^-	B	$H_2BO_3^-$
	NH_4^+		HBO_3^{--}
P	$H_2PO_4^-$	Mo	MoO_4^{--}
	HPO_4^{--}	Cl	Cl^-
		Fe	Fe^{++}
K	K^+		Fe^{+++}
S	SO_4^{--}	Mn	Mn^{++}
Ca	Ca^{++}		(Mn^{+++})
Mg	Mg^{++}	Zn	Zn^{++}
		Cu	Cu^{++}

Table 5: Effect of increasing nitrogen supply on the various nitrogenous fractions of ryegrass *(Goswami and Willcox, 1969)*

kg N ha–1	*Total N*	*Protein N*	*Free amino acid N*	*Nitrate and Nitrite N*
	% DM	*% DM*	*% of DM*	*% DM*
0	1.32	0.98	0.16	0.04
62	1.53	1.10	0.16	0.04
124	1.89	1.26	0.21	0.06
248	2.69	1.75	0.31	0.17
496	3.73	2.06	0.56	0.35
992	3.93	2.34	0.59	0.35

Table 6: Normal ranges of major elements in Irish pastures and recommended animal requirements

Element	*Symbol*	*Herbage Content %*	*Animal Requirement %*
Calcium	Ca	0.2–1.7	0.4–0.55
Chlorine	Cl	0.02–2	0.10–0.20
Magnesium	Mg	0.08–0.5	0.15–0.20
Nitrogen	N	1 – 5	2.0–3.0
Phosphorus	P	0.1–0.5	0.3–0.5
Potassium	K	0.8–4	0.3–0.5
Silicon	Si	1 – 2	–
Sodium	Na	0.01–0.6	0.15–0.20
Sulphur	S	0.15–0.35	0.15–0.25

A dash (–) indicates lack of data

Table 7: **Normal ranges of trace elements in Irish pastures and recommended animal requirements**

Element	*Symbol*	*Herbage Content (ug/g)*	*Animal Requirement (ug/g)*
Arsenic	As	0.05–0.3	–
Boron	B	1–20	nil
Cadmium	Cd	0.01–0.3	nil
Chromium	Cr	0.1–0.3	–
Cobalt	Co	0.03–0.2	0.1–0.2
Copper	Cu	2–15	10–20
Fluorine	F	0.5–10	–
Iodine	I	0.07–1.5	0.5–1.0
Iron	Fe	20–300	25–40
Manganese	Mn	20–300	40
Mercury	Hg	0.01–0.05	nil
Molybdenum	Mo	0.05–2	0.2–0.5
Nickel	Ni	0.5–3	–
Selenium	Se	0.03–0.2	0.1
Vanadium	V	0.05–0.5	–
Zinc	Zn	20–60	50

A dash (–) indicates lack of data

Table 8: **Mineral contents of herbage and the mineral requirements of dairy cows** ***(Kemp, 1971)***

	Average content	*Highest and lowest content*	*Requirement of lactating cows*
	% DM	*% DM*	
K	3.0	1.0–5.0	0.5
Na	0.2	0.01–2.0	0.10–0.15
Ca	0.6	0.3–2.0	0.40–0.55
Mg	0.2	0.1–0.5	0.15–0.40

Table 9: **High N – Low N on Experimental Farm in the Netherlands (1960-1968)**

Item	*High N*	*Low N*
Kg N ha^{-1} $year^{-1}$	550	150
Milk yield cow^{-1} (kg)	4133	4114
% Fat	3.73	3.81
% Protein	3.30	3.31
Total in calf %	95.9	93.4
Herbage Composition (%)		
DM	14.4	15.8
Crude protein	25.7	20.2
Crude fibre	22.6	23.6
Ash	10.1	10.1
Starch equivalent	64	62
NO_3	0.87	0.25
K	2.60	2.61
Na	0.60	0.43
Ca	0.71	0.62
Mg	0.22	0.22
P	0.43	0.44
S	0.34	0.33
C1	1.46	1.66

Table 10: Crude protein (DM) of winter wheat (cv. Norman), long-term tillage – 9 sites *(Gately, 1983–1985)*

kg N ha^{-1}	*% Protein N × 5.7*	*Grain Yields t ha^{-1}*
0	9.32	3.34
50	8.89	5.60
100	9.41	6.96
150	10.23	7.67
200	11.32	8.04
S.E.	0.053	0.0428

Table 11: Crude protein (DM) of winter wheat (cv. Norman), following grass – 8 sites *(Gately, 1983–1985)*

kg N ha^{-1}	*% Protein N × 5.7*	*Grain Yields t ha^{-1}*
0	10.98	6.36
30	11.29	7.01
60	11.75	7.19
90	12.28	7.32

Table 12: Effect of level and timing of nitrogen (N) application on winter wheat (cv. Armada) quality – main effects

N (kg/ha) at GS 5	*Protein wheat (%)*	*Dry gluten (%)*	*Sed. value (ml)*
50	9.5	10.5	23.5
100	10.1	12.4	27.0
150	11.1	14.4	26.0
200	11.7	15.8	26.0
N (kg/ha) at GS 9–10			
45	11.4	14.4	26.5
0	9.8	12.1	24.8

Table 13: Essential amino acids in human nutrition

Valine	*Threonine*	*Phenylalanine*
Leucine	*Methionine*	*Tryptophan*
Isoleucine	*Lysine*	

Table 14: Crude protein (DM) of barley grain *(Gately, 1975)*

Rotation	*N applied, kg ha–1*			
	0	*34*	*68*	*85*
1st crop (42 sites)	12.5	13.2	14.1	14.4
4th or later crop (42 sites)	10.0	10.5	11.5	11.8

Table 15: Crude protein (DM) of spring barley (cv. Triumph), long-term tillage – 3 sites *(Gately, 1983–1985)*

kg N ha^{-1}	*% Protein N × 6.25*	*Grain Yields t ha^{-1}*
0	10.87	3.09
50	11.20	4.51
100	12.58	5.50
150	13.67	5.82
200	14.51	5.90

Table 16: Effects of fertiliser K on sugar beet quality

Kg K ha–1	*Sugar content %*	*H.A.N. mg 100 g^{-1}*	*Extractability %*
0	17.91	136	93.8
120	17.93	132	93.5
240	18.03	130	93.4
360	18.22	123	93.2

Table 17: Effect of muriate of potash versus sulphate of potash on the starch content of potato tubers *(Terman, 1950)*

Treatment	*Starch %*
KC1	13.3
K_2SO_4	14.6
half KC1 + half K_2SO_4	13.8

Table 18: Effect of N P K on tuber size and dry matter

NPK	*Percentage tuber*		*50 mm*	*Dry Matter %*		
	N··	*P*	*K··*	*N···*	*P···*	*K···*
0	19.8	24.1	16.0	23.2	21.9	22.6
1	22.0	22.4	22.7	22.7	22.3	22.6
2	24.3	22.5	25.9	21.9	22.4	22.2
3	25.8	22.9	27.3	21.4	22.5	21.9

..; ... Sig at 1 and 0.1% respectively

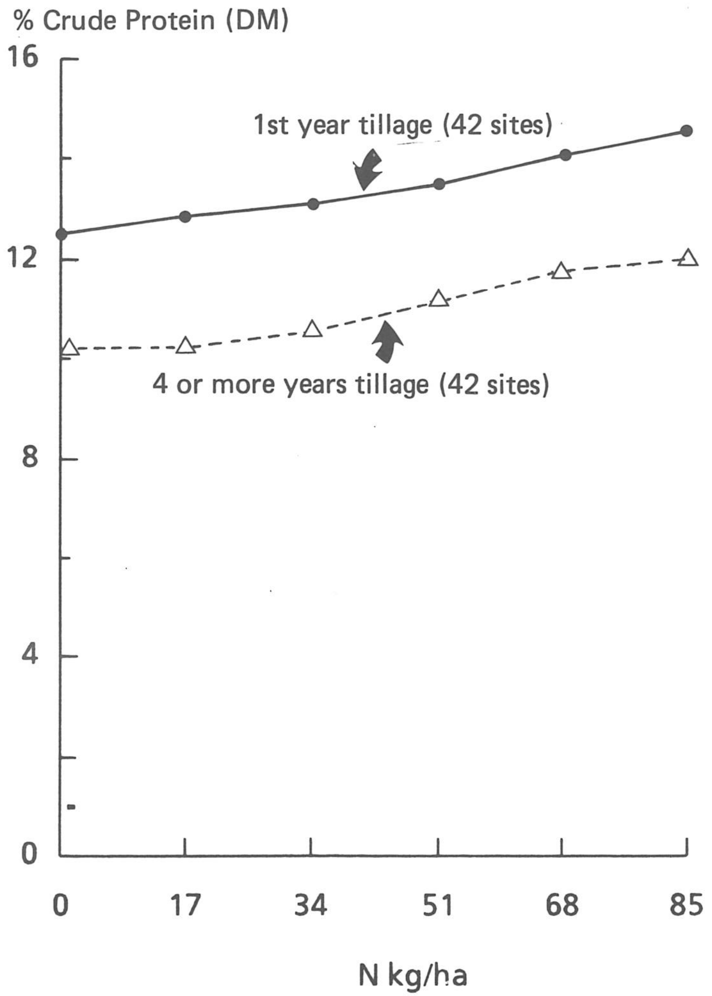

Fig 1: Effect of fertiliser N and number of years in tillage on the crude protein content of feeding barley.

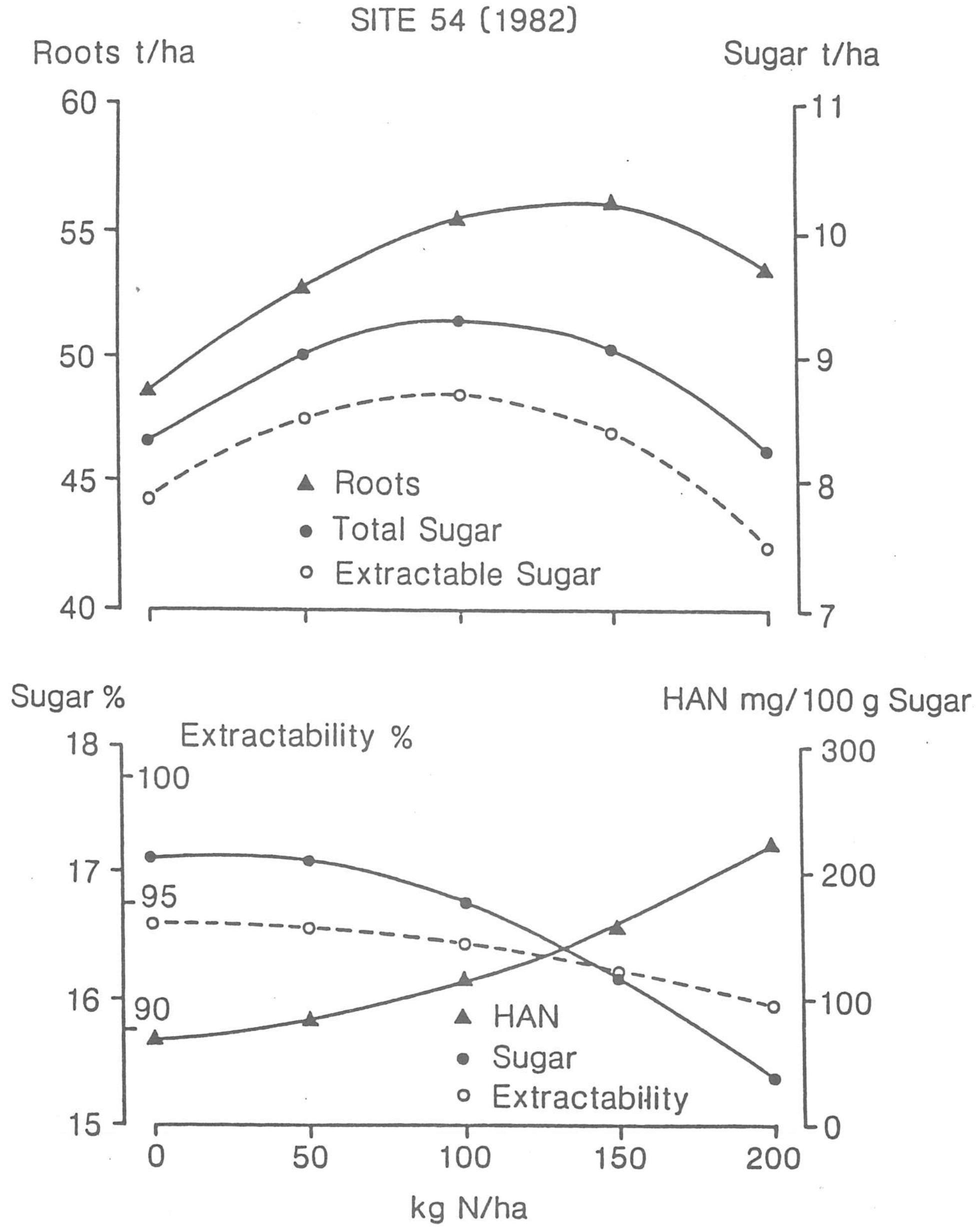

Fig. 2. Fertilizer N and sugar beet yield and quality

QUALITY PRODUCTION AT FARM LEVEL

Anthony Byrne
Longtown
Sallins, Co Kildare

I would like to thank the Fertiliser Association of Ireland for inviting me to speak at its Winter Conference today. I think the theme of quality food is very topical. With such large stocks of surplus food in so many areas of the developed world, it seems eminently sensible that we should strive to produce the quality food which is most attractive to the consumer.

As a farmer and a consumer, I have a twofold interest in the production of quality food. As a farmer, I want to produce the best crops and animals which I expect to make the top price. As a consumer, I look for the best food when I go shopping in my local supermarket.

Food is now of a higher quality than it has ever been. Farmers are producing better quality products and the major advances in the food processing industry ensure that these reach the consumer in a most attractive and nutritious form. Of course there is further scope for improvement and in these difficult times it is essential for the whole agricultural industry to pinpoint where a higher standard of quality might be attained. We should also examine why certain sectors of the industry have not kept pace with the general improvement.

The quest for better quality food and a higher standard of nutrition is not a recent phenomenon. It is worth noting that one of the earliest pieces of legislation governing food quality was a British Act passed in 1266 which, among other safeguards, contained legislation to protect the public from the sale of "unsound meat". It does not seem to have met with any great success. Apparently there was an urgent need for such legislation as many of the foods used in those days were heavily adulterated with a variety of strange additives. Pepper had clove dust and even gravel added to it. In the 17th century coffee was unstretched by using lard, acorns and dried grass. As bread often contained grit from the millstone some unscrupulous millers of the time felt at liberty to add sand or ashes to the flour on occasions.

We have certainly come a long way since those days in improving the quality and standard of food. Today's ever more discerning consumer has a wide selection of quality foods from which to choose. A large measure of this achievement is due to relatively recent advances in the food processing industry which now provides a product which is not only more nutritious but looks better and keeps better as well. The farmer of course, has also had a part in raising the standard. Greater attention to hygiene and better management have improved the quality of our milk. Presentation and quality control in the potato and vegetable sectors have now reached a more satisfactory level. Our beef farmers are producing more quality lean cattle which the consumer increasingly prefers. Lamb producers are also more aware than ever of what the market wants and is prepared to pay for it. The cereal grower is warned that a better quality sample is needed to meet the tighter intervention standards. There is also a drive to persuade growers to drill a higher percentage of quality milling wheat. I will return to this topic later.

In these days of food surpluses it must eventually be the country of the individual farmer who produces to the highest quality standard that rises to the top of the pile. In some areas, we have been very successful in projecting Ireland as the land of green fields and good wholesome food. We must make the most of this as it is one of the few advantages we have over our partners in Europe. However, we must be careful that the products we grow and export are consistent with this image. This imposes an obligation on farmers and exporters to ensure that standards are never allowed slip. One consignment of inferior quality can do long lasting damage to our reputation. Everybody down the line from the exporter to the farmer will suffer the consequences.

On the farm growing better crops or producing higher quality meat and milk requires one essential component – great attention to detail. Doing anything better needs an extra effort and food production is no exception. This means a little more care and a higher level of farm management. So it is likely to be the better informed progressive farmer who is producing the better quality products.

In the dairy industry a constant supply of top quality milk is essential if the products manufactured from it are to command a premium price. With increasing intervention standards the pressure is all the greater to improve quality. Every effort must be made to ensure that all milk is free of antibiotics. Apart from its deleterious effect on cheese production and its residual contamination of skim milk, any hint of such contamination could have a disastrous effect on consumption. Liquid milk has got to be fresh. Any staleness or off-flavours are not acceptable. Constant vigilance particularly in the cleaning of tanks and milking equipment can avoid such problems.

We must find new markets for dairy products while at the same time safeguarding and expanding existing outlets. This can only be achieved if the producer and processor work together. We must ensure that a first class raw material is available for the production of a nutritious end product.

Today there is a much greater awareness of the need for producing only the best and many Co-ops and their suppliers have earned a reputation for high quality products. This will pay substantial dividends in the years ahead.

One area where the importance of quality has not been so noticeable is cereal production. In wheat growing it might be argued that there are higher quality feed wheats and lower quality feed wheats. I would reserve the title quality for milling varieties. I will examine the pros and cons of growing a high quality milling Winter wheat against a lower quality feed variety. In trials carried out by the Department of Agriculture between 1983 and 1986 the yield of the feed wheat Gawain averaged 8.55 tonnes per hectare whereas the leading milling variety Avalon had an average yield of 8.10 tonnes per hectare over the same period. This is a difference of almost 0.2 tonnes per acre. This translates into about £20 per acre if all wheat was making the same price.

To produce the milling wheat, it will probably be necessary to apply a late dressing of fertiliser to boost protein levels. The cost of this dressing is unlikely to be fully recovered in extra yield. In any event, this will necessitate one extra field operation. The net extra cost would, I suggest, be about £5.00 per acre. It is also likely that a crop earmarked for milling will need an extra fungicide spray. Again not all of this expense would be recouped in higher yields. Its primary purpose would be to improve the quality and appearance of the grain. As this will be a late spray, there may also be a loss due to shedding and a certain amount of damage due to passing through the crop at such a late stage. Unless a purpose built tractor is used, the loss could be considerable especially if difficult weather follows. All in all the total net cost of such a spray must be at least another £5.00 per acre. So we now have a total cost differential of about £30.00 per acre.

Suppose there is a bonus of £14.00 per tonne for milling wheat over feed wheat. If I have the very respectable yield of 3.20 tonnes per acre used above then I will get an extra £45.00 per acre from my milling variety. So I make an extra £15.00 per acre clear profit. However, this assumes that my milling wheat reaches the milling standards. If it fails to come up to these criteria, my attempt to grow a quality wheat has cost me £30.00 per acre.

The net effect is that I must be sure that my milling variety actually goes for milling in at least two years out of three. This is a fairly tall order when I examine my experiences over the last two years on my own farm. In 1984-85 about 90 acres was drilled to a milling variety all of which was rejected. This year I had 155 acres of potentially millable wheat. Only 35 acres of this managed to meet the required standard. I admit that the last two years have been particularly difficult but I would suggest that the results over a longer period would not be radically different.

This exercise also assumes that I get a bonus of £14.00 per tonne for ordinary milling wheat with an average protein content. By past experiences this is a fairly optimistic assumption. We are promised a bonus of £12.00 for the coming year which leaves me singularly unimpressed. It should also be noted that this bonus is for wheat with a protein content of 10.5. If the protein content is lower then the bonus is only £7.00. Over the years I have consistently found a greater demand for feed wheat at harvest time. Competition from merchants can often push the prices of feed wheat to a level very close to the milling price.

This was brought home to me when I examined how two loads of wheat, one of milling wheat and the other of feed, fared this year. Both had exactly the same moisture content. The milling sample had a specific gravity of 69 K.P.H. and the feed was 68 K.P.H. The protein in the milling sample was below 10.5 and the screenings were 12.9% I got £3.17 per tonne more for the milling variety. Year after year I find that what might seem a reasonable bonus for bread making wheat is eroded by deductions of one kind or another. In general these do not apply to feed wheat.

If substantial quantities of bread making quality wheats are to be grown in the future, there will have to be a sharing of the attendant risks and benefits between the grower and the miller. It seems at present that the farmer carries all the risks. He can sow, spray and fertilise his wheat and apply the best crop husbandry techniques. I can do this only to find that at the end of the day because of difficult weather or varietal changes, the crop does not pass the milling tests. I suggest that there should be some sharing of the losses in such circumstances. Perhaps a procedure could be adopted where a millable variety which fails to make the grade is priced at an intermediate level.

Of course I am assuming that a home-base and home-supplied milling industry is needed. It seems to me that there are those who would prefer to buy a guaranteed quality product from some foreign source rather than deal with thousands of Irish farmers producing a less consistent product even at a much lower price. I believe it is essential that the industry decides where it wants to go in the coming years.

Bread is supposed to be the staff of life and even if this is an overstatement it must surely be wise for any country to retain a home-based industry. Had Chernobyl been in the centre of Europe rather than in the Soviet Union we might, today, have a better appreciation of the importance of growing our own quality wheat. If it is vital for the nation to store a substantial stock of oil, might it not also be worthwhile to protect a home supplied milling industry?

One area of grain growing where the swing to quality has paid dividends for many farmers in recent years is the growing of malting barley. Apart from the home demand there has been a substantial export trade which has made the growing of Spring barley a more attractive proposition. This market can be uncertain as it depends on the general demand for malting barley in Europe. However, the malting varieties can now give yields equal to the best feeding barleys. Since there is no extra expense in their production, there is no risk of loss in opting for such varieties. If milling wheat varieties could be found with yields equal to the feed varieties, the economics of my earlier exercise would be significantly improved. I do not know if there is some property or characteristic of millable varieties which prevents them from figuring among the top yields. I suspect that no such obstacle exists and that if a renewed effort was put into developing higher yielding milling varieties, they might well be found.

It is worth noting that Spring wheats are generally of the highest quality but suffer from lower yields and late ripening. It now appears that it may be possible to overcome these disadvantages by drilling these varieties in the late Autumn. Yields under this system seem to be encouraging but further research is needed to determine optimum varieties and the level of Winter hardiness.

I realise that I have dwelt at some length on the problems associated with producing quality grain. This is not only because it is an area where I have direct experience but because I feel it is a good illustration of the difficulties facing those trying to produce quality food.

In the production of quality meat products the processor has at least an equal role to that of the farmer. Packaging, appearance and shelf life are major factors in the marketing of these products. Certainly, the farmer must provide the raw material which can be sold with the minimum of waste. But it is a long way from the farm gate to the supermarket or butcher's shop.

With the imminent proscribing of growth promoters, the production of quality lean beef carcasses is going to be a good deal more difficult. A sector which is already among the least profitable is going to find it even more difficult. A sector which is already among the least profitable is going to find it even more difficult to survive financially. Production of beef, especially in the off season, is a very risky business. Large sums of money are involved and recent high interest rates put extreme pressure on margins last year and seem to be following a similar trend this Winter. So it is opportune for all cattle farmers at every stage of the production cycle to breed and stock the highest quality cattle. Not only will these command a premium price but growth performance and conformation should be significantly better.

In the late seventies live exports of cattle were a ready outlet and in some cases quality was of secondary importance. Plain cattle had little difficulty finding buyers and as a result the quality of our cattle dropped appreciably. This has been reversed in recent years. It is noticeable at marts that there is much greater interest in the better quality lots. Plainer cattle are making very poor prices on occasions.

In the factory the return from a quality carcass may be over 5% above the average. It is important that at what is the end of the production cycle this extra yield is recognised and that payment is scaled accordingly. At present it is common enough for poor conformation to be penalised but with rare exceptions premiums for the top quality cattle are unusual. Greater use of the best continental breeds can provide larger numbers of quality cattle but before they breed these or pay higher prices for them as stores, farmers must be confident that they will receive higher prices when they are sold.

One area of agriculture that many see as synonymous with quality food production is organic farming. In recent years there has been a significant increase in interest in this area. In its earlier day it was regarded as a low-input and low-output system. Given the high fixed costs which exist on many farms such a system would have few attractions today. However, it may now be possible to tend towards a higher output operation while still using organic or semi-organic methods. In Britain, it is expected that such food will have a 1% share of the market over the next ten years. If this is so, true organic farming can only have a marginal effect on overall food production.

There may, however, be a greater role for the production of "conservation standard" food. This is half way between conventional and organic farming. In this system, fungicides and residual herbicides cannot be used and the types of pesticides and fertilisers used must be carefully chosen. For example sulphate of potash is permitted while muriate of potash is definitely out as it releases chlorine ions into the soil. Food produced under such a regime would have to command a substantial premium. Given the present state of the economy, not many consumers could be expected to meet the extra expense over a long period. I can see such food selling reasonably well in the fashionable stores of London and perhaps Dublin but I am not sure that a sufficiently large market exists here to make it viable. A small number of farmers are producing this specialised food at present and there may be others who could profitably change to the system. But in the overall quest for quality food, organic farming is unlikely to play a prominent part in the medium term.

Like most farmers, I have come to realise more clearly, that what I rear and grow must find a customer. In the seventies we often thought that being in the EEC we could produce even greater quantities of milk, meat and grain. Disposal would never be a problem. Quality was secondary as long as we could produce the quantity. For me and many others, it has been a slow and at times painful education to the changed scenario now prevailing. We now appreciate that everything produced must find a genuine buyer and that this will not be easy unless the product is top quality, expertly prepared and presented in an appealing format. But in recognising this, I must also ensure that pursuing this long term objective does not lead me into short term difficulties.

As a beef and tillage farmer, I have had two particularly difficult years and my plans for next year and the immediate years ahead must be based on hard reality. Each enterprise must return a reasonable profit in the season. If producing quality meat or grain leaves me as good a margin as an inferior product, then I will gladly opt for the former. But if the converse is true, then grandiose designs for the quality of food must remain academic. I cannot afford to go broke producing quality food.

The farmer has little or no control over how and where his products are marketed. Nor can he influence the price of the final product. In this respect he is totally dependent on the processor or buyer doing a good job. He must also depend on getting a fair price for producing a quality product. This is the crucial link in the production of quality food. It is incumbent on the buyer to pass on some of the extra financial benefits, which he receives through selling a quality product, back to the farmer. At the same time the farmer must ensure that he can supply a product of consistent quality for marketing.

Such a relationship is more noticeable in some sectors than others. Even within a sector, certain buyers and their suppliers work in closer harmony with a greater understanding of each others needs and problems. If such a mutually advantageous arrangement can be implemented in all areas of agriculture, it could go a long way to overcoming the problems which the industry is currently experiencing.

MARKETS FOR QUALITY BEEF

Michael Deely
CBF – Irish Livestock and Meat Board

The most essential condition for success in beef marketing is product quality. Quality needs to be established from the start and maintained throughout if we are to shift from commodity trading and intervention to consumer marketing. Quality is particularly important for Ireland since we export over 80% of our beef production.

Quality is defined by the profitable segment of each market. Quality means different things in different markets.

The main aspects of quality which are common to all markets are leanness, tenderness, flavour, fat colour and lean colour. Weight range is also important and also the carcass conformation.

The aspects most in the farmers' control are leanness and weight range. Breeding, feeding and management all affect the type of beef produced.

Since the demand from all markets nowadays is primarily for lean beef we must use all opportunities open to us to increase the production of lean beef. The use of implants has helped this to a great extent in recent years. Together with a reduction in fat, carcasses were also better shaped and were heavier by using implants. With the total ban on the use of growth promoters, we must turn to other means of producing beef of top quality for today's consumer.

The use of Continental bulls both in the dairy and suckler herds must increase to produce more leaf beef. Indeed, suckling itself must now be looked at seriously as a means of increasing calf numbers firstly and secondly as a means of improving the quality of store cattle available to finishers. By using a beef-dairy cross cow and a Continental bull, first class beef animals can be produced which will satisfy even the most discerning markets. The June Census of 1986 shows a 3% reduction in dairy cows and a slight increase in beef cows. This slight increase in the Beef herd is an encouraging trend and one which could be speeded up if more support was given to this sector. The support should be given on a quality basis to prevent an increase in numbers only rather than desirable quality.

With increased culling proposed in the dairy herd, dairy farmers should be encouraged to use a Continental Beef bull on more of their dairy cows. This would surely be preferable to increased slaughtering of such cows and it would not deplete the National Herd.

Great strides have been made in producing quality beef in recent times. Results for 1986 show that we have 2.2% of our steers in the overfat category while 64.5% grade 'R' or better in conformation. The maintenance of that level of quality, in the absence of growth promoters, is a major production target.

We will now look at the markets available for the quality beef produced. The main markets are as follows:

a) Domestic Market
b) the United Kingdom
c) Continental EEC
d) International Market

a) Domestic Market

The domestic market at present is worth £220 million to the industry annually. It consumes 17% of our beef. The consumption of beef in 1985 was estimated at 22 kgs. per head. The outlook for the next few years suggests no great change in consumption levels.

Lightweight heifers 400-450 kgs. live weight are the most popular beef animal on the domestic market. These yield carcasses from 190 kgs. to 240 kgs. and provide cuts and joints which prove most in demand by the Irish consumer.

b) the United KIngdom

The main outlets here are to Northern Ireland and Great Britain.

Northern Ireland

Northern Ireland is now the chief outlet for live cattle from the Republic. In 1986 over 63% of all live exports took place to Northern Ireland. In terms of beef and beef products it only accounted for about 3% of our total exports.

Great Britain

In contrast to Northern Ireland, beef and beef products are the main export items here. In 1986 Great Britain accounted for over 30% of our total beef exports and as such is the largest single market for our beef. Because of this we must pay particular attention to the demands of this market.

Traditionally, we exported live cattle to Great Britain for breeding, further feeding and direct slaughter. Now, because we have developed a very modern and efficient slaughtering and processing industry, the trade has turned right around. From a position in the early sixties of over 700,000 live cattle being exported each year, only approximately 28,.000 were exported live to Great Britain last year. Live exports this year are not expected to be significantly greater.

The main emphasis then will continue to be on beef and beef products. Self-sufficiency in the UK beef market has grown considerably in recent times – from 75% in 1970 to 87% in 1984 and approximately 91% early in 1986. This increase has been brought about both by a fall in consumption and increased production. Based on recent and proposed reductions in the breeding herd, UK production is forecast to fall in the next 2-3 years and this should maintain their beef import requirements even if beef consumption slips a little further. It is also worth remembering that Ireland's share of the UK import market is growing and higher percentage of this trade is being sold direct to retail outlets.

The increasing sales to retail outlets has led to an increasing demand for vacuum-packed beef. In 1985 there were over 10,000 tonnes of beef sold in vacuum packed form to Great Britain. This was almost as much as the total amount of vacuum packed beef sent to the EEC countries totally.

In 1986, exports of vacuum packed beef to Great Britain increased again to approximately 13,000 tonnes.

The increasing demand for vacuum packed cuts from Great Britain has led to a change in the type of animal most suited to this trade. There is now a demand for heavier carcases up to 340 kgs. These can be from steers or heifers. The conformation must be very good and with a light fat covering. When boned, these carcases will yield a high percentage of saleable meat which is the important criterion for this market.

Carcases of this quality are more likely to come from Continental Cross animals and this is particularly so for heifers. In fact, the vast majority of our heavy Continental heifers are now sold to the British market and prices paid to producers are very little less than those of steers, especially when beef is in short supply.

While vacuum packed beef exports are increasing, the largest amount is still sold in carcase form to the UK. The premium outlets for carcases are supermarkets and depots. These outlets are very demanding on quality, delivery and service all the year round. In recent years, Irish processors have forged closer links with retail outlets in Great Britain. They have supplied them continuously despite the fact that short-term gain could be had by supplying some other outlet. The availability of suitable cattle for these markets on a year round basis is a major headache for Irish factories. Schemes to improve the seasonality of premium quality cattle should be encouraged.

c) Continental EEC

Irish beef exports to Continental EEC markets fell in the period 1980-84. It recovered in 1985 as European production showed the first signs of falling in many years but unfortunately declined again in 1986. The greatest challenge facing Irish exporters over the coming years will be to sell our steer beef competitively to retail outlets in West Germany, France and other EEC countries.

France

Irish beef exports to France amounted to 36,000 tonnes in 1986 or slightly more than 30% of that sold to Great Britain. The type of steer beef normally imported into France is lean, heavy carcases with good to excellent conformation. Requirements are mainly for hindquarters, although in winter forequarter beef is used in greater quantities. No major increase in imports in expected in the medium-term but significant changes in the product mix are envisaged. In 1985, slaughterings in France showed the following breakdown:

Steers	15%
Bulls	19%
Females	66%

The outlets for meat sales in France have also changed dramatically and in 1985 it was shown that over 50% of meat sales took place through supermarkets. The majority of French supermarkets use mostly cows to supply their beef. Thus, the outlet for Irish steers in France is more in the local butcher trade. The high quality outlets there can use our top quality Continental steers. Those carcases would weigh over 400 kgs., be no more than grade 3 fat and of excellent conformation.

French production is expected to increase this year mainly as a result of increased cow and bull slaughtering. Despite some transfer of dairy cows into the suckler herd, the French breeding herd in 1986 was similar to 1985 levels. With consumption remaining static, this should increase imports. Ireland could be expected to increase its share of the French market particularly if our steer prices become more price competitive.

West Germany

The market position of beef in West Germany has altered considerably in the past 15 years. For most of the 1970's, West Germany was a net importer of beef, with a self-sufficiency ratio as low as 86%. However, steadily rising production and stagnant consumption pushed the ratio to 121% in 1984. Although self-sufficiency has increased dramatically, the share of imports in domestic consumption has remained stable at about 15%. In other words, the continuous increased in production has been parallelled by a comparable increase in exports rather than by a reduction in imports.

West German beef production deals predominantly with young bulls. These are produced very efficiently and enjoy many extra supports when compared to our steers. Thus they have largely ousted our steers from traditional European markets. Irish steer beef, largely as a result of CBF promotions there, enjoys a good reputation in Germany. They see Ireland as a producer of healthy animals using largely non-intensive systems which produces beef of natural and wholesome qualities.

There are signs now that the cycle of bull beef production is in decline in Germany. The aim then would be that our steers would become more competitive and we would regain our share of the German prime market.

International Markets

In 1986, international markets accounted for 48% of our beef exports. These markets have been vital in recent years in that they have proven a very profitable alternative to our traditional steer markets. With EEC aids such as Export Refunds and Aids to Private Storage, international markets have been increasingly important.

They have also been important for live cattle. In 1986 over 80,000 cattle were exported live to these markets, principally Egypt and Libya. In both live and slaughtered form they have proven ideal outlets for our lean Friesian steers. In the absence of growth promoters, it will be important to maintain these outlets since many of our poorer Friesian and Holstein crosses would not be suitable for other premium markets.

However, as welcome and indeed vital as these international markets are, the recent decline in oil prices has brought into focus the instability of such markets for the Irish meat and livestock trade.

Thus CBF has concluded that, in strategic terms, the long-term future for the Irish Meat Industry must lie in Europe.

Relative Prices

Beef prices during the 1960's and 1970's increased faster than the average of all products and consequently their ratio to pigmeat and poultry further disimproved. During the past 2-3 years, there has been some recovery in the price competitiveness of beef.

Health Issues

The impact of health issues are certainly less than those of price. It is our view that these issues probably reinforce and consolidate the on-going trends rather than being their major cause.

Fat is an issue of which the Irish meat industry is acutely aware. There are no customers now for fat beef. As pointed out earlier, Irish producers have responded by producing leaner cattle. It is also much more efficient to produce lean meat rather than fat.

Convenience

The trend towards convenience foods seems certain to continue and the implications for sales of meat and particularly those associated with traditional cooking methods are of considerable importance. A whole new focus will have to be placed on packaging and product innovation, especially in the area of the less popular cuts. The major problem is to make fresh meat more convenient and yet retain its good colour, tenderness and flavour. Current developments in this are in Ireland are hampered by the fact that because of our distanced from the market, shelf life of prepared fresh products becomes very important.

Summary

Down through the years, we have rightly prided ourselves on our animal health status and our approach to keeping the country free of disease. During 1986 Ireland was declared Officially Brucellosis Free and this has increased our status.

Our meat has had an excellent reputation throughout the world. It is vital that this country continues to achieve the highest international standards of quality and hygiene. Indeed, the growing consumer concern with dietary issues and healthy living offer Ireland a unique opportunity to capitalise on our positive image as a producer of prime quality natural beef.