Opening Address

SOME TRENDS IN GRASSLAND FARMING IN EUROPE

R. W. BROUGHAM
Grasslands Division, DSIR, Palmerston North

INTRODUCTION

IN an assessment such as this, one could cover a wide range of topics fairly shallowly or a lesser number in a bit more depth. I have opted for the latter. The topics discussed will embrace some trends in dairying, beef farming, sheep farming, hill country farming, and land use generally, species and variety usage in grassland farming, use of crude protein produced from pasture, and some implications of energy usage.

DAIRYING

It is difficult to talk about trends in dairy farming in Europe without first making the distinction between dairying in EEC countries and non-member countries. Pricing structures in EEC countries are having a major impact on trends in these countries and because of this are having different effects on non-member states in Europe.

EEC COUNTRIES

The ratios presented in Table 1 indicate that collectively the nine member states of the Market in 1974 were virtually self-sufficient in dairy products. Of significance is the fact that this was achieved by about 5¾ million dairy farmers with an average size holding of about 15 ha supporting on average about 10 milking cows (Tables 2 and 3). In comparison with the New Zealand dairy farmer, this means that the average herd size is about one-eleventh of an average New Zealand herd, and farm size is about one-third to one-quarter of the New Zealand dairy farm.

Production levels such as those shown in the first three tables when associated with self-sufficiency in dairy products and particularly pricing structures when assessed by farmers, researchers, economists, and advisers alike indicate a number of likely trends.

TABLE 1: SELF-SUFFICIENCY RATIOS IN SOME AGRICULTURAL PRODUCTS IN EEC COUNTRIES (1974)

Total meat	98
Beef and veal	100
Sheep meats	67
Whole milk	100
Butter	93
Cheese	107
Skimmed milk powder	133
Total cereals	95

TABLE 2: AVERAGE FARM SIZES (HA) IN EEC COUNTRIES (1974)

	Number of Holdings ('000)			*Average Size*
	Total	*% < 5 ha*	*% > 50 ha*	*of Holding*
West Germany	929	35	3	13
France	1261	21	11	23
Italy	2 173	68	2	7
Holland	146	25	2	14
Belgium	110	30	3	13
Denmark	132	12	7	22
Eire	270	18	7	17
U.K.	277	15	30	64
Average EEC	5 705	43	5	15

TABLE 3: AVERAGE HERD SIZES IN EEC COUNTRIES ON DAIRY FARMS (1974)

	Total Dairy Herds ('000)	*% Herds over 40 cows*	*Average Herd Size*
West Germany	630	4	a.7
France	697	12	11.0
Italy	607	9	5.0
Holland	100	11	22.6
Belgium	90	1	11.9
Denmark	72	4	15.1
Eirc	144	5	9.6
U.K.	92	33	38.2
Total and averages	2 432	3.4	10.5

(1) First, farm and operation size in EEC countries is likely to increase provided land prices allow this to occur. With time they are likely to look much more like the farm and herd sizes of counties in England, such as Cheshire. A summary of statistics of 40 such farms in the equivalent of a New Zealand Dairy Board discussion group is shown in Table 4. These statistics indicate markedly different farm structures from those applying to

TABLE 4: AVERAGE PRODUCTION STATISTICS OF 40 HERDS IN CHESHIRE (1976-7)

Average herd size	131
Average size of farm (ha)	236
Cows per hectare	1.825
Yield per cow (kg)	4 405
Concentrates fed per cow (kg)	1 1.35
Cost of concentrates ($)	166
Gross margin/cow ($)	347
Net margin/cow ($)	266
Gross margin/hectare ($)	632

most of the 534 million dairy farmers in EEC countries. They are certainly more realistically viable farm operations, offering the operators a much higher standard of living than generally pertains in dairying in many of the nine member countries of the Market.

(2) If this occurs, dairy farming in EEC countries will become centralized in the better grass growing areas of the Market or in regions where by-products of the productive arable farming activities of member countries are more easily accessible. The need for fresh liquid milk in population centres will restrict total centralization unless reconstituted milk is accepted.

(3) There will be an immediate aim for self-sufficiency in dairy products in each member country in spite of directives to the contrary from Brussels. Most member countries certainly have the capacity to produce more dairy products and most farmers within member countries certainly believe they have prior rights to markets within their own country. Once this is achieved a further aim will be to export to non-self-sufficient countries outside the EEC.

(4) There will be an aim for greater efficiency. Already there is a trend for high-producing farmers to aim for lower costs of production and hence greater efficiency. This is being led actively by some of the best farmers. It will probably mean less dependence on concentrates for livestock feeding, on sophisticated mechanical aids such as self-feed silage set-ups, elaborate harvesters, muck spreaders, irrigation equipment, grass drying set-ups, etc. Two illustrations follow:

(a) Taking the United Kingdom as an example, it has been calculated that 36% of all ruminant production comes from feed grains. Put another way, this means that cereal consumption per head of population is about 350 kg, of which only about

70 kg is consumed directly, the other 280 kg having been fed to livestock first. This applies in dairying as well as in other livestock production endeavours. The data in Table 5 illustrate well the dependence of U.K. dairy farming on concentrate feeding. A large area of land is certainly required to produce these concentrates, a fact that is common throughout most of Europe. Annual feed rations per dairy cow on many farms approach 40% silage, 40% concentrates, and 20% grazed pasture. Interestingly, quite a fair percentage of concentrate feeding is soya bean products or the like, much of which comes from the U.S.A. One is surprised, therefore, at the fairly high dependence of the European livestock industries on the production of soya bean arid other similar products in the U.S.A.

TABLE 5: RELATIONSHIP OF FORAGE USAGE TO CONCENTRATES IN U.K. DAIRY FARMING

Animal Performance (yield/cow) (*litres*)	*Concentrates Fed* (*kg*)	*Hectares required for*			*Milk* (*litres/ha*)
		Concentrates	*Forage*	*Total*	
4090	914	0.27	0.49	0.76	5382
4546	1371	0.40	0.51	0.91	4996
5228	2032	0.61	0.48	1.09	4796

(b) Silage production and feeding are very significant in European dairy farming and some very elaborate set-ups are being marketed. Because of this, there is a strong emphasis in pasture management towards silage production with up to four cuts per year being obtained from pastures. Common pasture production yields and seasonal distributions are around 10 000 to 12,000 kg/ha/yr with GO to 75% being obtained between February 1 and end of June, with 300 to 350 kg N/ha/yr being applied. Some of the better farmers and researchers are concerned at these developments, especially in terms of costs to production. Because of this, there could be a trend towards much simpler self-feed silage operations, less silage, and more pasture actually eaten by the grazing animal in *situ*. This could alter the seasonal distribution of feed produced because of changes in species usage and. it would certainly result in cheaper production.

One very good farmer in the U.K. I spent time with summed up mechanized feeding of silage and other farming operations in the following statement: "I have yet to see the farmer who, through the use of forage boxes, self-loading trailers, mixer.

wagons, machines to dig the silage out, feeding troughs and additional concrete, additional labour, and a second machine to feed the stuff out in case the first one breaks down, can feed out as accurately as 1 can 5 tonnes of silage to 150 cows in 30 seconds work time." He added that after 7 years he was still writing off his original investment in a length of wire, a hammer, and 1 kg of staples!

TABLE 6: ESTIMATES OF NITROGEN USAGE IN DAIRYING IN SOME EUROPEAN COUNTRIES
(kg/ha/yr)

East Germany	400
Holland	350
Belgium: Flanders	300
Wallonia	150
Poland	200
England	180
Eire	150

(5) We are all aware that European livestock farming is very dependent on fertilizer nitrogen. Just how dependent is shown in Table 6. These figures may not be fully accurate as they were obtained from many people in the different countries, all of whom seemed to have variable figures. However, they will be approximations of real usage. They indicate a massive energy input, one that could certainly not be sustained in this country. Price for product in Common Market countries enables this level of usage. Milk price in Ireland, for instance, is around 76 cents per gallon compared with 23 to 24 cents in New Zealand, whereas nitrogen costs the same as in New Zealand.

It is difficult to predict trends in fertilizer nitrogen usage, especially when some farmers in Holland, for instance, use quantities as high as 1 000 kg/ha/yr. However, some of the pricing arrangements for the supply of energy to manufacture nitrogen will be up for renegotiation within the next few years, and this could markedly affect price and hence usage. The surprising fact to a visitor to European agriculture is the lack of concern shown for the "energy crisis". One hears little talk of it, which is in marked contrast to present thinking in the U.S.A., for instance. Any control of energy inputs into European agriculture will have dramatic effects. What one can be sure of is that, if nitrogen fertilizer rates of application continue at present levels or increase as the trends suggest, then techniques and systems of soil amelioration will become increasingly important.

-,---One- final.---comment -on -nitrogen fertilizer usage in Western European countries. Most technologists see a trend towards N fertilizer use only on the most productive cropping lands. When the bubble bursts around EEC pricing structures for agricultural products, and some give this 5 to 10 years to happen, then systems of livestock farming based around grass/legume associations and outdoor grazing systems for most of the year will be developed. The technologists and better farmers are convinced this can be achieved. This, of course, will mean the end of the small farmers (fewer than 30 cows on present levels). Whether this happens will depend on the viability of the nitrogen manufacturing organizations in the world and their capacity to advertise, promote, and influence trends.

(6) If the assumption above is right and EEC countries move into an era of lower relative milk prices, then there will be no option but for the development of simple, low capital cost systems with definite economic limits on concentrate inputs. This will lead to a much greater dependence on grass and systems of paddock grazing. As pointed out by one very good farmer in Cheshire, if this occurs "there will be dire warnings from feed firms, animal nutritionists, and many others about the consequences of underfeeding if such systems develop". He added that "in spite of this, it will be discovered that cows can and will produce milk, will breed and remain healthy; they just won't be so fat".

I believe that EEC dairy farmers and especially those in Eire, the U.K., Holland, Denmark, and parts of France, West Germany, and Belgium could and probably will develop technologies around grassland husbandry that will emulate the efficiencies of arable farmers in Western Europe and their technologies in cereal, potato, and maize production. Such a technology would be very much dependent on grass and simple conservation arid self-feeding set-ups, and would result in relatively lowered costs of production. Undoubtedly, there is a tremendous potential for better utilization of pasture in these countries and, importantly for us, developments on higher producing dairy farms and research stations are demonstrating this. Some of this work is well ahead of our own.

(7) On the other hand, if present pricing structures in dairying in EEC countries are maintained, surplus production is inevitable because of protected financial survival of small herd farmers. Associated with this will be an even stronger shift to per-cow pro-

duction and systems of grazing very similar to what we call "set stocking". These systems, commonly called "open grazing" in the U.K., are being strongly promoted by organizations such as ICI and its pros and cons are being researched at government and private research stations. The system certainly provides more leisure for farmers with good farm structures.

OTHER EUROPEAN COUNTRIES

It is not possible in this paper to describe trends in other European countries separately. Instead they will be described collectively. Again they are as I observed them.

What is frequently not appreciated by people outside continental Europe is that much of the flat and rolling country is confined to arable farming. Except for some small regions and in countries such as Eire, U.K., Holland and Belgium, a high proportion of livestock farming is confined to the more difficult, hilly, and often poorly drained regions, or in "cut and carry" enterprises on flat land. Paddock grazing of herds of cows and mobs of cattle or sheep are very infrequently seen on flat or easy rolling country. In the dairying regions, operations range from 1 or 2 cow "strip farming" enterprises through to 5 000 or more cows/herd as typified by Eastern European co-operatives. For example, the average size of private (mostly "strip") farms in Poland is 4.77 ha, and in Galicia, Spain, the average farm of 4.8 ha is divided into 19 pieces (paddocks), each about 0.25 ha in area. At the other extreme are examples in East Germany detailed in Tables 7 and 8.

It is difficult to assess trends likely to occur in regions such as these and others seen, especially in Eastern Europe. However, there is no reason why trends in these countries should not be similar to those outlined for EEC countries.

(1) This will mean an increase in farm size, a trend that is already occurring and is illustrated by a privately owned hill farm visited in Poland (Table 9). This should be compared with the average farm size of 4.77 ha of privately owned farms in Poland. Even with such trends, these farms will still have their problems, some of which are outlined in the table.

(2) As the age structure of farmers increases (and it certainly is in most hill country regions of Europe) there could be wide spread depopulation of these regions. This is already happening in large tracts of land in countries such as Italy and Spain. Younger generations are not prepared to live at subsistence levels,

TABLE 7: DETAILS OF A CO-OPERATIVE FARM AT PFLUCKUFF, EAST GERMANY

Area:	2 500 ha
Stock:	4500 to 5000 cows 1500 to 2 000 young stock. Cows in units up to 1 200 and indoors throughout the year.
Lactation period:	300 days
No. of lactations:	4-6
Bull calves:	To weaning
Female calves:	To yearlings — half kept as replacements
Daily feeding:	To established energy and crude protein standards
Economic evaluation:	Not possible as State sets own prices

TABLE 8: OTHER DETAILS OF A CO-OPERATIVE FARM AT PFLUCKUFF, EAST GERMANY

Area:	2 500 ha
Soils:	Sandy to stony
Main operation:	
Westerwolds ryegrass	
Forage harvested (4-5 cuts per year)	
N fertilization: 360 units N/ha	
Irrigation: 30 mm after each cut	
Annual yield: 14 000 to 16 000 kg/ha	
All forage harvested for silage or haylage	
Harvesters (locally made) capable of cutting 1.6 ha/h	

TABLE 9: DETAILS OF PRIVATE HILL FARM IN POLAND

Area:	50 ha
No. of stock:	129 (18 milking cows) 70 in winter
Concentrate feeding:	5 kg/milking cow/day 8 tonnes per year
Money availability:	3% interest loans for concentrates, buildings, animals, etc. Up to 65% of all improvements.
Repayment:	Demanded at a certain production level — e.g., for 1 milking cow, pay back equiv. 3 000 litres/ year. Farm can be reclaimed if payments are not made.
Main problems:	4- to B-month growing season Poor utilization Lack of building materials Poor agricultural services No good machinery adapted to hill country farming Economic and political problems

especially with the "attractions" of city life. Some experts are convinced that "rural exodus is today an irreversible process in Western civilizations". There are certainly some trends under this heading that New Zealand could well afford to study, particularly with reference to our own hill country. What confounds this observation is that in the Galicia region of Spain where average farm sizes are only 4.8 ha, land prices can reach $NZ35 000 per hectare.

(3) In many European countries farming co-operatives, both private and State, will increase in number and size. It is also believed that this will result in increased productivity, and, for the privately owned co-operatives, increased profits. What is happening in Poland is a good example of this and is illustrated in Table 10.

(4) In Eastern European countries, there is a strong aim for self-sufficiency in agricultural products. There are large deficits. In Hungary, for instance, milk consumption per person per year is around 80 to 100 litres. They have a target of 150 to 200 litres per person and they are sure this will be achieved. This aim for self-sufficiency is strongly related to international trading problems and balance of payment difficulties with EEC countries. It is a trend that will continue unless agriculture endeavour in the much richer EEC countries becomes too menial to be undertaken. One asks the question "Could this occur?" It may with time.

TABLE 10: SOME AGRICULTURAL STATISTICS POLAND

Rural population	9.6 million (28.1%)
Employed in agriculture	6.0 million (37.7%)
State farms	17.4% of total area
Farming co-operatives	1.4% of total area
Farmers' circles	0.7% of total area
Privately owned	80.5% of total area
Arable lands	76.6%
Meadows	13.1%
Pastures	8.6%
Orchards	1.5%

Production from State farms as % of total production (1973):
- 31.7% of all cereals
- 44.9% of oleaginous seeds
- 31.1% of all beef
- 19.8% of all milk

Area (average) : 730 ha
Number: 4 005 organized in 1350 enterprises

TABLE 11: SYSTEMS OF BEEF FARMING

1. EXTENSIVE-OUTDOOR SYSTEMS				
2. AUTUMN SYSTEMS				
Sep.	*Apr.*	*Oct.-h'ov.*		*Mar.-May*
Calves purchased	Out to grass	Yarded		Finished
Conc.	No other feeds	Self-feed silage		
Dry grass		2½-4 lb cereals		
Hay				
3. TWO-YEAR SYSTEMS				
Feb.	*May*	*Oct.-Nov.*	*Apr.*	*Oct.-Nov.*
Calves purchased	Out to grass	Yarded	Out to grass	Yarded
Conc.	Some cereal	Low plane—	No conc.	Self-feed silage
Dry grass		Silage only if wt. gain		Up to 4½ lb cereals
Hay		of 0.5 lb/day		Sold fat Mar.-May
4. INDOOR SYSTEMS (3-14 months)	Daily fed for 10 to 11 months (see next table)			

BEEF FARMING

Europe has a large population of cattle. The Common Market countries, for instance, support more than 50 million beef cattle and are self-sufficient in beef and veal meats (see Table 1). In other European countries, however, beef consumption is not high and there is much scope for increased beef production and, if trade barriers permitted, scope for increased trade. However, as with dairy farming, the aim for self-sufficiency in beef production in most European countries is strong.

Systems of beef farming in Europe are many and varied. They range from the use of dual-purpose animals (harness work, milk, and meat) used in "strip farming" operations in areas such as Spain, Poland, hill country regions of France, Hungary, Italy, and many others through to stall feed operations commonly called "cereal beef" or "zero-grazing" operations. Four of these systems are outlined in Table 11.

As for dairying, most of these systems, excluding particularly the "strip grazing" systems or extensive systems, are strongly dependent on concentrates, silage, and in many cases elaborate self-feed or indoor housing set-ups that mean high costs of pro-

TABLE 12: DETAILS OF CEREAL BEEF FATTENING FARMS NEAR MILAN, ITALY

9 farmer co-operative	
600 head of bull cattle	
Weight at buying (3 months):	50-150 kg
Killing weight (13-14 months) :	500-600 kg
Daily feed (at 10 months):	
Greenfeed maize	6 kg
Maize silage	6 kg
Nutrients (soya, etc.)	1 kg
Straw or hay	1 kg
Av. daily weight gain:	1½ kg

TABLE 13: RELATIONSHIP OF FORAGE USAGE TO CONCENTRATES IN U.K. BEEF PRODUCTION

Carcass Weight (kg)	*Concentrates Fed (kg)*	*Hectares required for*			*Meat/ Hectare (kg)*
		Concentrates	*Forage*	*Total*	
218	1880	0.57	—	0.57	155
		18-month system			
272	1168	0.35	0.31	0.66	152
		20-month system			
277	1016	0.30	0.40	0.70	158

duction. This is illustrated in Tables 12 and 13 for maize fed or cereal beef in Italy and the U.K., and 18- and 24-month systems in the U.K.

Again depending on price for products and, in the case of Eastern European countries, government directives and trade deficits, most of the trends outlined for dairying will also probably occur in beef farming. They will all be related to the interrelationships of level of feeding of pasture, silage and concentrates, stocking rate (per animal performance) and price for product.

Of interest to me in the U.K. was the way breed was put in perspective. Many mobs of cattle seen contained a wide range of breeds all happily grazing or loafing and obviously putting on weight. Travelling around the country, one wondered whether there was some sort of national competition to produce mobs containing the widest range and largest number of different breeds..

SHEEP FARMING

In all countries of Europe numbers of sheep supported are not high. There are many more cattle, cows, and pigs than there are sheep. As well, systems of sheep farming are quite variable, although they tend to be similar within countries or regions. One such system is shown for the Cheshire region of the U.K. (Table 14).

TABLE 14: SOME DETAILS OF A SHEEP FARMING SYSTEM IN CHESHIRE, ENGLAND

Tupping:	Mid-October
Indoors:	Late December Fed *ad lib.* silage Late January Conc. at ½-¾ lb
Lambing:	Mid-March Lambing shed for 24 h then outdoors to 4-paddock rotation
Lamb selling:	Late June-September
Weaning:	Late July
Carrying capacity:	Best — 11-12/ha Average — 7/ha
Breed:	Welsh halfbreed
Lambing percentage:	160-165
Lamb prices:	$40 at 40 kg LW Winter lambs up to $50/head

A similar system to this was observed in Hungary but with some variations. For instance, lambs were taken to weaning in stables and tupped ewes were taken inside much earlier than in Cheshire. There were also some interesting developments with electric fencing in sheep farming in that country.

As to trends in sheep farming in Europe, it is obvious that again there will be an aim for self-sufficiency because of the desire for fresh meats. This was highlighted in France. They certainly do not want our frozen meat, but readily go along with an arrangement that allows them to buy fresh, British mutton while the British eat our frozen sheep meats. And they have made sure that pricing arrangements make this lucrative to the British sheep farmer.

LAND USE

In most countries visited in Europe there were indications of depopulation of hill country regions. Already the quote has been used that "rural exodus is today an irreversible process in Western civilizations". And there is plenty of evidence to support this, as has already been demonstrated. This trend has implications for countries such as ours and could result in deficits in production within Europe, with consequent gains for less affluent primary producing countries. It depends totally on the incentives European governments offer to keep people in the rural regions and producing at good levels. In my view it will need some very large carrots. I am sure there are some lessons in this for New Zealand. These trends are occurring in this country and will only be halted by very good financial incentives to retain and build up rural populations.

In some of the more densely populated countries of Western Europe, major conflicts are also developing between those interested or involved in primary production and conservationists and environmentalists. These developments could' mean that large tracts of land are planted to natural vegetation species and diverted to leisure use. Initially, the more difficult soil types would be put to this type of use. Some farming lobbies and groups of experts believe that one answer to this problem could be the encouragement of outdoor grazing systems sustained over most of the year based on sound management principles both in terms of productivity and of ecological balance, thus more closely approaching New Zealand systems.

There are certainly alternative demands for use of land, in some cases resulting in complete removal of farming livestock,

as in the grouse shooting regions of Scotland, or abandonment of good management principles for open grazing in highly productive regions, such as along river banks or where public walkways are involved. In some of these situations it is even more profitable to exclude the farm animals.

TRENDS IN SPECIES AND VARIETY USAGE IN GRASSLAND FARMING

If some of the trends outlined in this paper occur, especially those involving more sustained systems of grassland farming with better utilization of the feed produced by the grazing animal associated with lowered energy inputs, particularly fertilizer nitrogen, then greater use will be made of more permanent pasture varieties, including legumes that have a much better seasonal spread of production. In the European environment this will mean legume varieties that are resistant to diseases, viruses, and nematodes. Some leading farmers are already thinking this way, and leading researchers are predicting such trends, particularly first for hill country regions and later encroaching to easier country.

Variety production and usage in Europe to a New Zealander are a nonsense with far too many varieties listed for certified use that do not differ significantly in performance in official tests. Of even greater significance is the fact that acceptable listing to the trade really only means certification to sell varieties. It certainly does not mean availability of varieties. As outlined by one of Europe's leading breeders, "Of the 170 or so ryegrass varieties in the EEC Common Catalogue less than 10% (17) are frequently traded in Belgium". It is a question of demand, seed supply, advertising, and profit. And, importantly, each country is again aiming for self-sufficiency through its own breeding efforts.

This situation has a marked impact on availability of seed in other Europeari countries. In Galicia, Spain, for instance, the major limitation to development of pastoral agriculture was stated to be the availability and consistent supply of named cultivars at a reasonable price, the same variety being unavailable year to year.

There is an awful lot of "immediate opportunism" in variety development and seed trading because of the many interests involved and the competition occurring for survival for both commercial and government-sponsored plant breeding efforts. It was all summed up to me by the following statement from a recently retired head of a plant breeding organization in Europe: "There is

a need for solid research effort now to recoup the situation around variety usage and production and seed production when the bubble bursts." Because he was sure it would, especially when the use of perennial pasture types increases. The implications of this statement are obvious and of high significance to New Zealand agriculture.

USE OF CRUDE PROTEIN PRODUCED FROM PASTURE

In Western Europe there is a surplus of crude protein production from pasture. It has been calculated, for example, that this amounts to about 1 kg of crude protein per hectare per day in excess of cow requirements. This is attributable to high fertilizer N use, on average about 250 kg N/ha/yr. Of significance is the fact that luxury consumption of crude protein in Western Europe is twice as high as that imported in livestock foodstuffs from the U.S.A., foodstuffs such as soya bean concentrates. The annual bill is a massive one.

According to one leading researcher in Holland, the answer to this problem is to fractionate the protein in the grass and feed this at levels of around 16% crude protein to animals indoors. It is an interesting idea and one that will be well worth following, as its implementation could have implications for us.

IMPLICATIONS OF ENERGY CRISIS

As already stated, there appears to be much less concern in Europe for the impending energy crisis than there is in, say, the U.S.A. or in New Zealand. By our standards very high inputs of fertilizer nitrogen are in use, there is a much higher dependence on mechanization than in New Zealand, silage making inputs and feeding out machinery and set-ups are much more elaborate than ours, and very high amounts of concentrates are fed.

The implications of an energy crisis are therefore large and one cannot avoid thinking that there would need to be some major adjustments to farming patterns and farming systems, as are presently occurring in regions of the U.S.A. In that country irrigated agriculture, cattle feedlot operations, and corn production and drying in some regions of Texas and the American Midwest are hurting because of energy costs. The same could occur in Europe as present forms of energy become more costly and less readily available for farming. The implications of this for our own agriculture could be large and certainly require intensive study.