

THE ROLE OF POULTRY IN FOOD PRODUCTION

G. L. Faber

Rainbow Chicken Farms, Hammarsdale

When asked to deliver this paper I gladly accepted. However, it was the first time that I really had a critical look at "us", that is, all animal protein producers, who seem to be taking the very food for existence of the human race out of its mouth and feeding it to animals. Or are we?

Ten years ago, the world's food supply amounted to 90 days of reserve. To-day the reserve has dwindled to an estimated 26 days.

Whenever the world food supply reaches a precarious level, Malthusian enthusiasts always lobby against using grains to produce livestock and poultry. Those who apologise for the growing taste for meat in the "have" nations, and who would force all of us onto a cereal diet in the immediate future, overlook some important considerations.

Animals are not, as I am sure you will hear to-day, the grossly inefficient converters of grain to protein they are painted to be. Other positive considerations for feeding livestock include such by-products as skins, leather, wool, fats etc., without which not even the vegetarians could get along.

In any argument over feed efficiency, the poultry industry comes out in pretty good shape, the ratio of 1 kilogram of chicken to slightly more than two kilograms of feed is pretty good. However, let us discuss the factors which make me, as a poultry producer even more confident in the future of poultry. Actually, these factors could apply to other livestock too. We also have to remember that ever since our predecessor stopped walking on all fours and discovered fire, they had a taste for animal protein, some even for human protein. This taste, I am happy to say will be very difficult to change, if ever.

If one considers the history of the poultry industry one can clearly see why there was a great incentive for large-scale producers to come in, adopt new methods, employ good management, and establish a new industry.

Although chickens have been with man as long as the written word, it is only in the last century that a serious look has been taken at it from a production point of view. Even during the first half of this century, poultry was still very much a back yard producer. The farmers' wife usually was responsible for running a small flock of chickens. Sanitation practices were poor, nutrition was poor, the bird had to scrounge a precarious living in the farm yard competing with pigs and cows. Eggs were laid in barns or broken down cars and then only in Spring because the normal avian urge gave them no alternative. The so-called "Egg Money" kept in a jar

in the pantry provided cough syrup, school books and the occasional packet of sweets.

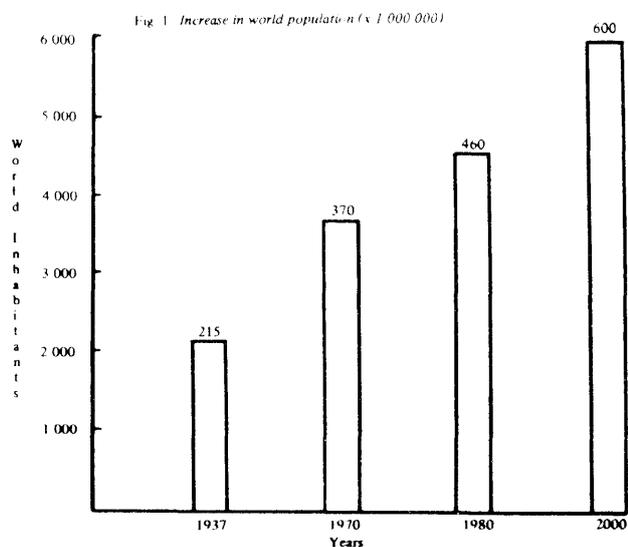
The U.S.A. can be considered the cradle of the poultry industry. It was here, in 1862 that the first primitive incubator was used. Artificial light to stimulate egg production was recorded by Dr. Waldorf in 1889. Broiler growing as a speciality began in New Jersey in 1890. However, it was not until 1933 when the National Poultry Improvement Plan was launched in U.S.A. that things really progressed in the poultry industry.

Poultry nutrition as we all know it today is a highly advanced, computerised facet of the industry. A far cry from a typical "scientific" ration of 55 years ago. "Chick Ration should consist of eggs boiled hard and chopped up, mixed with double its level of bread crumbs and slightly moistened with milk."

Up to now I have skirted the points of why I am so confident about the future. Let us now consider these one at a time.

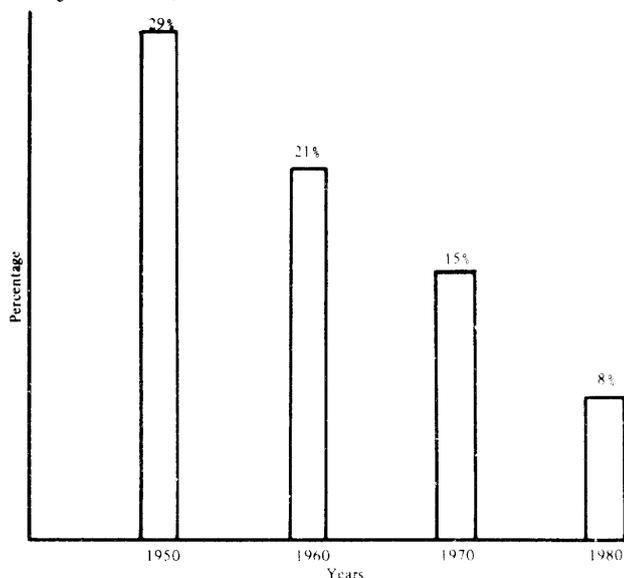
World population versus agriculturalists

If one looks at a breakdown of world population growth for a period of say 1937 through 2000 in Figure 1, it is clear that if not a population explosion at least a substantial growth is envisaged for the future. The key factor of course, is that these people have to eat. To feed the anticipated 6 billion humans by the turn of the century compared to the 4 billion to-day, the world food supply must increase by at least 50% over current levels or at an annual rate of about 3%.



To satisfy the increasing demand for grain and livestock, the agriculture industry will have to play a key role in the race against world food shortages. What is happening to the Agricultural Population world wide? Examining Figure 2 based on E.E.C. figures for the period 1950 through to 1980 clearly shows a steady decrease in this sector that should supply the worlds food needs.

Fig. 2 Percentage of total world population active in agricultural production

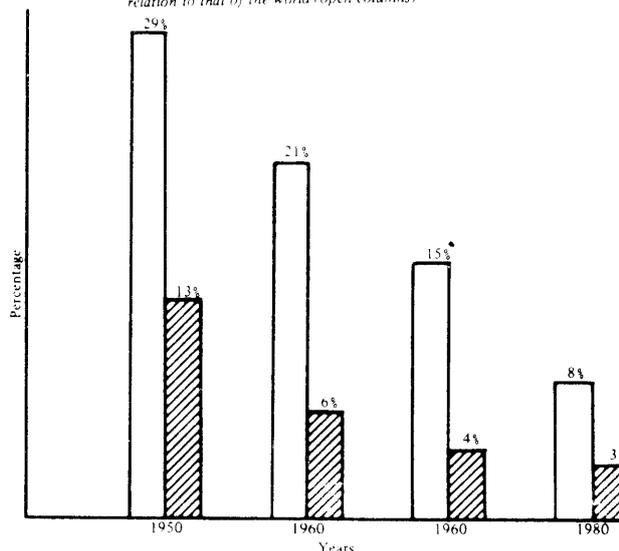


The question now is, can we with a decreasing agricultural population achieve our objective of feeding a hungry world? The answer is yes, for the following reasons:

- (a) The world is far from reaching its limit in agricultural production. The 1.6 billion hectares of land with adequate rainfall and easy reach of main population areas currently cultivated, are less than half of the 3.6 billion hectares available for this (U.S.D.A. figures).
- (b) Animal production efficiency in developing countries and even in developed countries can be substantially increased. Many areas also have poor disease control and animal husbandry practices, low animal genetic qualities as well as religious/cultural prejudices that severely limit animal productivity.

If one looks at the active agricultural population in the U.S.A. in relation to that of the world (Figure 3) and one remembers that through improved production technology in all sectors of the agricultural industry, evolution in animal production through intensification in this country has resulted in preventing starvation of one person in every four on our planet in 1970. Consequently one can appreciate my optimistic outlook on matters.

Fig. 3 Active agricultural population in the U.S.A. (shaded columns) in relation to that of the world (open columns)



Some agriculturalists predict that without food produced from livestock, the world population will use up all the grain supplies that can be produced by 1985, if it is forced to consume the grain directly. In effect, livestock provide a longer period of grace for the human race to balance its population and food demands.

Plant protein versus poultry meat protein

All animal products used for human consumption have a superior protein quality when compared with plant protein sources. The fact is, that animal protein is more available to humans for body maintenance and growth.

If one measures the net protein utilisation (NPU) value, which is a combination of digestibility and biological value (percent of absorbed amino acids retained for maintenance and growth) of a broiler with that of maize/soya protein, the former is far superior at 80% compared to 56% for the latter. This means that 80% of the broiler meat protein is available for use when consumed whilst only 56% of maize protein is available.

We must remember that plant protein is not as available as animal protein because some of the tough, starchy membranes that enclose the food substance of plants are not broken down by the digestive process. Thus on an availability basis, animal products compare more favourably with grains and oilseeds as far as human utilisation is concerned.

If one considers the fact that 35% of the total protein and 9% of the total energy intake of the world human population is provided by food from animal sources, it is obvious that animals do play an important part in feeding the world. This is coupled with the fact that the amino acid balance of broiler proteins is better uti-

lised by humans than is plant protein. It only takes 45 grams of broiler meat protein per day compared to 65 grams of plant source protein to meet the adult protein allowance per day.

Poultry meat versus Red meat today and tomorrow

Poultry in any shape or form in South Africa and virtually all other countries is still very much the "Cinderella" of the meat industry. Why? Well, I consider that deep down we all realise that as a comparatively new-comer to the animal protein market, our little feathered friends have made a substantial dent into the traditional red meat market. Even so, research and development of better production methods for this highly successful agricultural commodity is still virtually sponsored one hundred percent by private enterprise only. A quick glance at any South African University or Agricultural college will verify this.

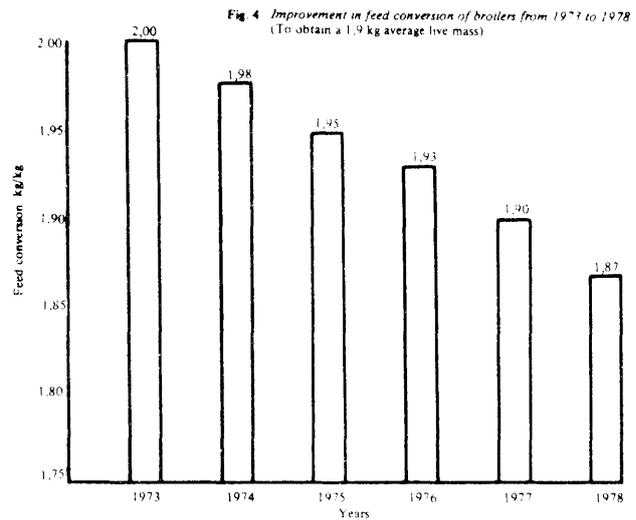
Please do not consider this as a plea for immense grants and additional courses for poultry specialists in South Africa, because even with this restraint the poultry sector of the Agricultural Industry in South Africa has made substantial gains during the past 15 years. One does wonder though, what it would have been like had we had the full backing of organised research and development behind us!

What are the factors that make poultry so suitable for agricultural farming and will secure it a bright future in agriculture?

- (1) The size of poultry, natural flocking instinct and advances made in intensified disease control and prevention, coupled with engineering breakthroughs in housing design, have all resulted in successful intensification of poultry farming. A modern poultry enterprise utilising the abovementioned advantages can produce 2.8 million kilograms of dressed mass on 20 hectares per annum.
- (2) The good feed conversion efficiency of broilers is a well established fact. Genetic selection for this criterion (which has a low heritability) as you can see from Figure 4 has resulted in an improvement over the past few years.

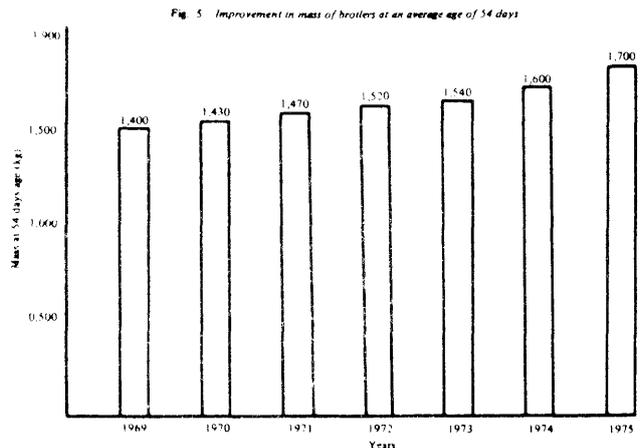
That means that the present day broiler can turn 1.93 kg of feed into 1 kg of good quality animal protein at 54 days of age. Presently modern large Breeding Companies are not only looking at improved feed conversion in the final product (broiler) but include their parent stock in this. The present day parent stock mother will consume 19.1% less feed to produce one broiler chicken than her counterpart of 5 years ago. The total feed required, including that of to-days broiler mother, to produce 1 kg of meat is 2.5 kg.

Referring to Figure 4 one can see that genetic selection at pure line level projects an even better feed conversion in the pipeline at broiler bird level in the near future.



- (3) Coupled with improvements in feed conversion, mass for age (which has a high heritability) has made rather rapid strides.

From Figure 5 one can see that a 23% improvement in mass has been achieved over the past 7 years. Geneticists are confident that the end is not yet in sight.



A practical example of this improvement in mass for age can be seen in our own organisation. Comparing mass for age in December, 1968 with that achieved in December, 1975 shows an improvement of 23%. A gain of 3.3% per annum. Admittedly, better management and feed have also played a role in this, but without genetic improvements this would not have been possible.

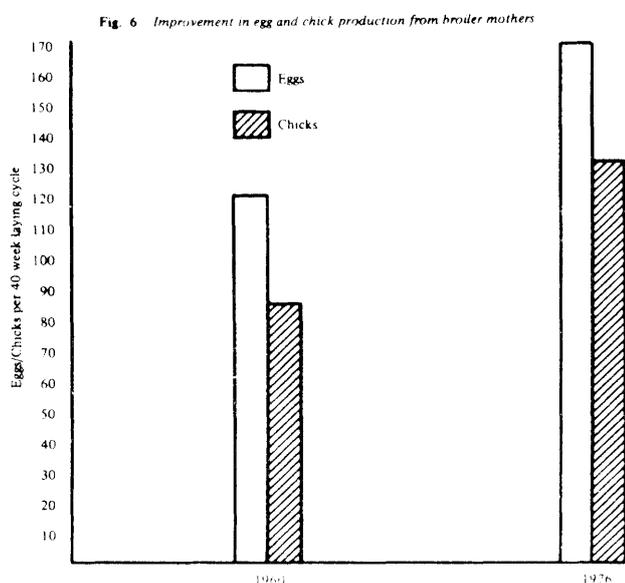
Based on our current capacity in Natal, this improvement in mass for age has resulted in producing an additional 11 million tonnes of dressed poultry meat per annum from a given number of birds.

- (4) Dressed yield (meat to bone ratio) is one of the selection criteria extensively used in genetic selection. Improvement in conformation of broiler breeds has resulted in an increase of dressed yield percentage from 65% to 80% since the early 1950's.

Poultry geneticists predict an improvement of 0.16% in dressed yield per generation as realistic which again worked back to dressed mass will mean an extra 2.2 grams of poultry meat per generation.

- (5) Genetic improvements at parent bird level have also not stood still. Hatchability and fertility figures of to-days parent stock mother is approximately 34% better than that of a pre-second world war mother. Which, in effect, means that less broiler mothers are required to produce a given number of broiler chicks. Hence a saving in housing and feed cost. Better incubator techniques have also played a role in this but current work on selection for fertility and hatchability indicate an expected annual improvement of 0,3%.
- (6) Egg production of broiler mothers has also increased dramatically. The broiler mother imported into South Africa in 1960, that was the first major importation of modern meat type birds into South Africa, produced 120 eggs during a 40-week laying cycle. The average number of broiler chicks hatched off these eggs were 85 based on the fertility and hatchability at that point in time.

The 1976-model broiler mother will produce 170 eggs or 130 broiler chicks during a 40-week laying cycle. This, as was mentioned earlier, will be achieved whilst consuming 19.1% less feed. (See Figure 6).



- (7) In comparing the efficiency of meat producing animals to convert feed nutrients to edible products, expressed as a percentage, the broiler comes out very well. (See Table 1).

Table 1

Percentages of feed nutrients converted to edible products

Animal Product	Conversion To Energy %	Conversion To Protein %	Gross Edible Product output as % of Feed intake
BEEF	8	15	10
LAMB	6	10	7
PORK	15	20	30
BROILER	10	25	45

Source: Hodgson R.E. 1970. J. Dairy Sci., 54, 442

- (8) If we have a closer look at the nutrition of the chicken, we will see that because of the economic importance a lot of effort has been expended to determine its critical nutritional needs. Being an experimental animal for fundamental nutrition studies, it has been used by scores of laboratories engaged in basic studies on nutritional requirements. This combination of circumstances has produced more information concerning the nutrition of chickens than of any other species, and has placed feed formulation on a sound scientific basis.

The basic findings derived from nutritional research with chickens have been used for discoveries of many vitamins and essential inorganic elements, inter-relationship studies between dietary Metabolizable Energy (ME) and protein in humans and many other discoveries. The knowledge of which has led to better nutrition and health of the human populations throughout the world.

It is, therefore, not surprising that with this background on nutrition, poultry rations have already successfully been formulated, making use of raw ingredients and by-products that have little direct nutritional advantages for human consumption. This way direct competition with human nutritional sources can be minimised. This factor, coupled with the possible improvement of existing crops, the breeding of new plants, or development of new products, or from the transformation of material which at present merely pollutes the environment should give poultry meat an extended if not inde-

finite lease of life in a hungry world. It goes without saying though, that these substances should not leave any residues in poultry meat which are a danger to human health.

Let us quickly have a look at a few product which have successfully been used in the poultry industry. This is by no means a complete list but only serves as an example of what has been achieved.

- (a) Recently, varieties of naked barley have been developed in which most of the glumes are removed during harvesting, and which yield almost as well as barley. It will be noted that naked barley has a composition closely resembling that of wheat, and as a poultry feed it can be expected to be about 8% better than normal barley (See Table 2).
- (b) Triticale, the new species of grain produced by combining chromosomes of durum wheat and common rye is another example of how plant breeders can develop improved varieties of plants for the feeding of humans and animals. With a protein of 16% triticale can replace up to 66% of the maize in a broiler ration (See Table 2).

Table 2

Composition of normal barley and wheat, naked barley, triticale and dried potatoes

	Normal Barley	Wheat	Naked Barley	Triticale	Dried Potatoes
Moisture %	10,0	10,0	10,0	10,0	10,0
Crude Protein %	10,2	10,5	11,8	14,1	8,6
M F (MJ/kg)	11,5	12,84	12,76	12,93	12,13

- (c) Potatoes grown for human consumption produce just over twice as much dry matter per hectare as cereal crops. Varieties of potatoes also exist which for reasons of shape, flesh, colour or the absence of flouriness are not acceptable to humans. Yet their yields may average nearly four times as much dry matter per hectare as cereals. Furthermore, if they were grown specifically for poultry feeding, the farmer would not have the expense of sorting them into different quality and size grades.

The composition of dried potatoes is given in Table 2. They contain less protein than wheat or barley, but are about mid-way between them in energy content. The maximum inclusion for broiler starter ration is 10% and for finisher 20%. In layers they have been used successfully up to 42.5%.

- (d) Microbial proteins grown on by-products of the petro-chemical industry are already being used in limited amounts in commercial production. There are two main products : one grown on n-paraffins that have been purified before use as a feedstock, the other grown on a feedstock containing n-paraffins and olefins. The latter product has to have the olefins extracted before use.

The amino acid composition of yeast protein is similar to those of soyabean and fish meals, except that it is richer in the sulphur amino acids, methionine and cystine than soyabean meal, but poorer than fish meal. The yeast also has a high content of nucleic acids which in vertebrates are anabolished to uric acid, so the food is better suited to poultry than to animals. For comparison with fish and soya see Table 3.

Dried yeast can be used satisfactorily in broiler starter rations up to 10% and in finisher rations up to 20%.

- (e) In broiler processing, the offal produced consists of blood, feathers and intestines. Equipment (Cookers) can be installed to convert this material into a good quality meal to be fed back to broilers. Levels of up to 12% can be used without any adverse effect on broiler growth.

The composition of the meal as set out in Table 3 is comparable with that of fish meal in protein content (slightly lower) but richer than fish meal as an energy source due to its high fat content.

Table 3

Comparison of soyabean meal, fish meal, BP yeast and poultry by-product meal

	Soyabean Meal	Fish Meal	BP Yeast	Offal Meal
Moisture %	10,0	10,0	10,0	10,0
Crude Protein %	45,4	63	60,2	58,0
Ether Extract %	1,2	6,8	7,8	21,8
M E (MJ/kg)	9,29	11,92	11,72	12,13

These are but a few of the products that can be used for the feeding of poultry. By-products from distilleries and other grain dependent factories are equally well suited for utilisation in poultry rations. In fact, complete poultry rations can be formulated to-day without using any feedstuffs commonly shared by man and animal.

Besides this, the value of poultry manure as a fertiliser is well accepted. The rising cost of commercial fertilisers make it even more attractive. Dried poultry waste as a feed ingredient is widely used in South Africa with great success by quite a number of livestock farmers.

(g) Now that we have analysed various reasons for my confidence in the future of poultry production, let us look at the market positions in South Africa for the period 1960 to 1975. If I have not convinced

everyone yet of the value of poultry meat, I am sure these figures based on information obtained from the Department of Agricultural Economics and Marketing in Pretoria, will.

The data on volume and price are shown in Tables 4 and 5 and Figures 8 and 9. An index for each series was calculated, comparing each year against the base of the mean of the figures for the first three years, expressed as a percentage.

Table 4

Commercial slaughterings per annum (July to June)

YEAR	BEEF		MUTTON		PORK		CHICKEN	
	1 000 Tons	Index						
1960/61	292,9		91,2		41,0		42,0	
1961/62	328,7		102,3		42,8		42,6	
1962/63	328,6		96,1		44,1		44,0	
Mean	316,7	100	96,5	100	42,6	100	42,9	100
1963/64	340,4	107	96,3	100	42,7	100	47,3	110
1964/65	359,0	113	96,6	100	45,5	107	51,7	121
1965/66	348,1	110	113,2	117	53,3	125	61,6	144
1966/67	342,4	108	112,5	117	58,0	136	66,7	156
1967/68	297,3	94	123,0	127	54,9	129	77,8	181
1968/69	286,7	91	145,7	151	61,7	145	91,2	213
1969/70	311,6	98	160,7	166	72,8	171	101,0	236
1970/71	335,3	106	169,4	175	71,1	167	104,9	245
1971/72	368,7	116	147,8	153	68,9	162	115,8	270
1972/73	438,7	139	95,9	99	77,0	181	144,9	338
1973/74	504,7	159	140,7	146	97,6	229	193,0	450
1974/75	502,8	159	148,2	154	88,7	208	223,6	521

Source – Department of Agricultural Economics and Marketing.

Table 5

Weighted average retail prices

YEAR	BEEF		MUTTON		PORK		CHICKEN	
	c/kg	Index	c/kg	Index	c/kg	Index	c/kg	Index
1961	50,9		62,6		65,0		78,0	
1962	51,4		62,6		64,4		77,2	
1963	53,1		63,5		66,1		77,6	
Mean:	51,8	100	62,9	100	65,2	100	77,6	100
1964	56,0	108	67,0	106	70,3	108	77,4	100
1965	66,6	129	72,5	115	76,5	117	78,3	101
1966	69,0	133	73,9	117	76,5	117	74,3	96
1967	73,4	142	77,2	123	78,9	121	72,5	93
1968	77,6	150	78,0	124	82,0	126	69,9	90
1969	79,4	153	78,5	125	83,1	128	66,6	86
1970	**	—	**	—	**	—	**	—
1971	93,9	181	82,2	131	88,9	136	63,2	81
1972	103,7	200	105,4	168	101,1	155	65,5	84
1973	132,6	256	136,6	217	118,0	181	77,8	100
1974	148,8	287	147,4	234	125,7	193	81,4	105
1975	184,6	356	178,3	283	152,7	234	94,9	122

** Not available due to certain changes in the method of calculation.

Source — Department of Agricultural Economics and Marketing.

Comparing the performance of the various agricultural meat products in these last two tables it is obvious that poultry is here to stay.

Conclusion

As long as there are people who can afford meat, meat will be produced. In this paper we have also seen that animals are not the wasteful creatures they often are made out to be. We, the human race need them if we wish to survive with a full stomach.

It is well to remember that prices dictates a lot. An increase in price of animal products will result in a de-

crease demand. The section of livestock production that wishes to survive the longest will be the one that can produce economically and sell at the most reasonable price. The Poultry Industry, as we have seen, has developed along these lines rather successfully and is still on the forefront of new developments.

The long-term solution to world food supplies lies with the research and technology in both plant and animal production sectors of the agricultural industry, where I am convinced new and improved production methods and strains will develop. This, of course, will be of less value if the world population expansion is not curbed or at least reduced.