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THE CASE FOR INCREASED ANIMAL PRODUCTION IN IRAN TO IMPROVE HUMAN DIETS AND INCREASE RURAL EMPLOYMENT

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Invitational Paper

Many countries today have in their plans for agricultural and industrial development given attention to the needs for improvement of the protein nutrition of their people. Although animal products are recognized as superior sources of protein, animal production is often relegated to an inferior position because of the widely held view that animal production is "inefficient" and that animal husbandry systems are peculiarly traditional and change only slowly and with difficulty. An analysis of the potential for animal production is appropriate for Iran as a rapidly developing country concerned with increasing the protein component of their diet and obtaining greater productivity from their large numbers of animals.

The decade of the 70's promises improved nutrition for the masses of people throughout the world. Improved cereal production and particularly the miracle varieties of wheat and rice have lifted for a time at least the specter of mass starvation and has allowed emphasis to be placed upon correction of widespread protein malnutrition. Improvements in agricultural production, industrial production and rising per capita incomes all contribute to interest in more and better quality protein in the national diet.

Iran has an enviable record of development during the past two decades. The per capita income has shown a compound annual growth rate of 3.5% for period 1950-1968 and the rate has been even higher since 1965. Per capita income is now probably about $300. per year which is low by European standards where the averages are mostly $1000-$2000., but the income is high by the standards of many African and Southeast Asian countries where the average is below $100. Agricultural production has increased at rate of 2.7% and population at a rate of 2.9% during the same period. About one-half of Iran's population is engaged in agriculture which is a low percentage as compared to many countries which exceed 75% and some approach 90%.

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The average diet for Iran in 1960-62 contained about 60g of protein per day, while the requirement in terms of the local diet was estimated to be 70g. The average protein intake consisted of 22% animal protein and 65% from wheat.

The importance of improving livestock production in developing countries and some of the difficulties are to be found in indicative World Plan for Agricultural Development (IWP) which has been prepared by FAO as a basis for the appraisal of food and development prospects for the next 15 years. (2) Closing the protein gap is accorded high prioirty in the plan and in this regard the following recommendation is made:

> Simultaneously with the propagation of new varieties of grains, priority should be given to increase the production of animal products where very quick progress is possible. Essentially this means poultry, meat, eggs and (where acceptable) pork. Increasing production of milk, beef, veal and other meat is urged, but is inevitably slow because the biological cycle of cattle and other ruminants is so long.

Some 1200 participants at the Second World Food Congress held in June 1970 at The Hague considered questions of food supplies and the commission concerned with "Higher Living Standards and Improved Diets" summarized the recommendations regarding the importance of animal protein supplies as follows:

> In the livestock sector, the importance of the ruminant animal as a means of converting grass and other roughages into human food was highlighted. In many areas of the world ruminant husbandry was the most logical and in some cases the only feasible form of land use. Although it was recognized that an integrated programme involving better nutrition, breeding, verterinary services, improved management and education, was essential to raise production, the key to achieving faster growth rates of ruminant livestock lay first and foremost in improved nutrition. While range and pasture management was of particular importance, substantial increases in production appeared possible even where cattle were kept in association with arable farming, through better use of by-products.

Additional recommendations of interest in this context were that (1) "The aim should be to develop labor-intensive farming techniques appropriate to small-scale enterprises. (2) Food-aid programmes should give particular emphasis to protein foods and be planned to ensure continuity of supply.

There are other possibilities for improving the national protein diet and planners frequently emphasize these almost to the exclusion of animal products because animal

production is often considered too "inefficient". Other solutions to the protein problem include fortification of staple foods with amino acids, cereals with genetically improved protein composition, increases fish consumption, leaf protein, mircrobial protein and detoxification of seed proteins. Animal products, however offer the advantage of familiarity under local conditions, minor requirements for processing and transporation but above all it must be recognized that animal products are in great demand, and whenever income allows, people will give high priority to satisfying their demands for animal products. It is understood that animal protein is not essential to correct a protein deficiency, but rather that animal proteins will be the method of choice when a population has a choice. The demand for animal protein would probably remain the same even if the need for protein could be satisfied by high quality plant proteins or by synthetic amino acids.

The history of animal agriculture in Iran is typical of the arid and semi-arid regions of the world located between the humid temperate zone and the tropics. Iran like other ancient civilizations was dependent upon irrigation and cereal production. Intensive animal agriculture was never a feature of these past cultures; production of meat and milk for the masses was impossible. Nomads who were outside the agricultural areas organized a culture based entirely upon animal agriculture. Each type of agriculturist over a period of centruies exploited to maximum the potentials of each ecological system.

The current demand for animal products in countries undergoing rapid agricultural and industrial development raises the question of how to approach rapid and large scale increases in animal production. The Nomadic herdsmen are natural livestock men, but the potential for increased production within their management system seems to be meager. Recent improvements of such control of animal diseases have increased the pressure on grazing lands often to a disastrous level. Agricultural expansion tends to encroach upon their best pastures; those in river valleys or near rivers which can provide irrigation. The peasant on his irrigated farm on the other hand is not generally acquainted with animal production and unaccustomed and formerly unable to use his valuable land to produce feed for animals.

EFFICIENCY OF PRODUCTION

The low efficiency of livestock production has been a deterrent to promotion of programs based upon animal protein production. The term efficiency usually is defined loosely to convey an undesirable comparison between animal and plant production. It is important that those secientists concerned with the promotion of animal production should use rigorous definitions of efficiency. The importance of efficiency has been considered in recent years by Byerly (1) Meyer and Garrett (3) and Ward (9)

For the simplest comparison, there is no question that if animals eat the same food as man (cereals) to produce meat or milk that efficiency of production is lower than if eaten directly by man. The protein quality, however, will be improved. If animals obtain their feed entirely from products that man can not or will not eat there is no basis for comparison of efficiencies; everything produced by the animal is a bonus.

Table 1 and 2 presents one method of comparing efficiency; the feed energy consumed, above maintenance, in relation to the energy contained in milk or meat. The calculations presented in these two tables illustrates the very important point that the more energy an animal consumes above its maintenance requirement the greater the efficiency of production. High milk production per cow results in a smaller feed cost for maintenance and a steer making large daily gains reaches market weight faster and thus there are fewer days for which maintenance costs have to be paid. For milk production 50% of the feed energy in the Netherlands is converted to milk while only about 20% of that consumed by cows in Turkey is used for milk or 80% goes for maintaining the cows. Table 2 compares the most intensive beef production method with the most extensive beef production system still found in many areas of the world where cattle reach a marketable weight at 6 to 8 years of age.

Another estimate of efficiency that can be provided by calculation is the amount of meat produced per head of cattle per year. Preston (6) has made such calculations for 22 Latin American countries and finds a range from 8 to 37 kg of meat per head as compared to 87 for the U.S.A. Although all the difference can not be attributed to differences in energy intake, Preston considers that feed energy is the major factor.

Ruminant animals generally have been given the role of scavengers in arid countries. They are fed those coarse fibrous feeds which cannot be utilized by man, pigs or chicken and graze land unsuitable for cultivation because of its topography or lack of water. Productivity under these conditions is low because the daily intake of digestible energy is low. However, vast expansion in animal production could be effected immediately in any country by feeding cereals or other high carbohydrate feeds if it were justified by the economic situation. This would mean essentially adopting the latest livestock production practices of the temperature zone countries. Because ruminants, as a species, occupy their ecological niche due to their ability to utilize fibrous feeds does not mean that they cannot use more digestible feeds. In fact, high productivity per animal requires feeding readily digestible feeds. The recent very large increases in productivity in the countries of the temperate zone have been achieved very largely by feeding cereals. The emphasis here is placed upon the importance of large intakes of digestible energy because this is the basic limiting factor in animal production. Certainly protein, vitamins

Table 1 Energetic Efficiency for Average Cows in Turkey and Netherlands[1]

Ave milk	Turkey	Netherlands
Production/yr (Kg)	900	4500
Weight of Cows (kg) (estimated)	400	600
Energy Requirements		
Maintenance (Mcal/day)	5.8	7.7
Maintenance (365 days)	2117	2810
Milk (Mcal/yr.)	558(900 kg)	2790(4500 kg)
5 cows x 2117 Mcal	10,585	
4500 kg milk	2,790	
Total for 4500 kg milk	13,375	5600
Energy Efficiency for milk	2790/13,375=21%milk	2790/5600=50%milk

[1]Energy requirements calculated from Morrison's Feeds and Feeding.

Table 2 Comparison of Energy Efficiency for two Systems of Beef Production

	Intensive Production (i.e. Barley-Beef)	7-year-old Streer
Slaughter wgt.	450 kg	450 kg
Brith wgt.	30 kg	30 kg
Gain	420	420
Age at Slaughter	1 yr.	7 yr.
Energy Requirements:[1]		
Body wgt. gain (MCal)	1,848	1,848
Maintenance	1,642	11,494
Total	3,490	13,342
Energy Efficiency for Gain	1,848/3490=53%	1,848/13,342=14%

[1]Energy requirements calculated from tables of Lofgreen and calculations are based upon an assumed average weight of 250 kg.

and minerals are important but only as supplements to energy, but bascially the production of a nation's livestock will depend upon the amount and quality of feed energy available.

Feed efficiency can be increased by feeding readily digestible feeds because the energy intake per animal can be increased greatly. This allows a greater percentage of the daily intake to be used for production and a smaller percentage for maintenance. This is true, of course, only if the available animals have the genetic potential for rapid growth or high milk production. Further we must assume freedom from disease and parasites.

Reid (Table 3) has calculated energy and protein efficiencies of farm livestock which include energy costs for the entire operation i.e, maintenance of dam, rearing, average death losses etc. (7). His calculations illustrate the relatively high efficiency or milk production, a factor which deserves more attention from those concerned with planning nutrutional programs for a nation or region. Probably the most useful energy calculation is protein production per Mcal of digestible energy.

Table 3. Efficiency of Domesticated Animal Enterprises in the Production of Food Protein and Energy (Reid 1970)

	Protein production (gm)		Energy production as:	
Enterprise	Per kg feed	Per Mcal of DE	% of GE	% of DE
Pork	21.8	6.1	16	18
Eggs	36.0	10.1	11	12
Broiler	42.7	11.9	11	12
Milk	24.4	10.5	13	22
Beef	7.3	2.9	4	6

The economic efficiency of ruminants can be higher than non-ruminants in this important trait, because the ruminant can convert low quality protein or non-protein-nitrogen to high quality protein and they do not compete with man for limited sources of high quality protein (i.e. soybeans. fish meal).

Partly because of the greater efficiency of milk production it has been easier to satisfy the demand for milk than for meat. While milk surplus have plagued most

developing countires in recent years, beef as yet has never been considered a surplus product. The reason is that although feed efficiency can be improved by heavy feeding, the limiting factor in beef production soon becomes the supply of calves. A high proportion of the feed needed to produce beef (75-80% in U.S.) is accociated with maintaining a breeding herd. About 1.8 breeding animals must be supported in the U.S. to produce a beef carcass for the market (7). Breeding herds have normally been maintained under extensive conditions on the poorest and most inaccessible land where improved management is difficult to apply. Periodic and seasonal drought means semi-starvation which in turn aggravates disease problems. The age of puberty is lengthened and the reproductive efficiency is reduced. Heavier feeding can greatly reduce the age at which females produce calves. Under the most extensive conditions the first calf may be born at 5 years; this can easily be reduced to 2 years or less by adequate nutrition. Despite the inefficiency of feed conversion, beef proudction can be rationalized within the national economy of many countries. At certain stages of development the demand for meat increases rapidly and if the demand is staisfied by importation, it can contribute to the foreign exchange problems. Meat, and particularly beef, provides a valuable export item. Beef is probably the only agricultural product not available in surplus amounts on the world market today.

What are the possibilities for supplying the feed necessary to revolutionize livestock production. The feed must be produced largely on the best arable land. The objective should be to produce the greatest quantity of feed energy per unit of land by means of the best fertilization and cropping practices. Grops may include cereals, especially maize and maize silage, molasses and even sugar have been shown to be capable of supporting ruminant production when combined with urea to furnish a part of the nitrogen needed.

This discussion has considered cattle almost entirely because they are the principal source of milk and of the meat generally in greatest demand. Poultry production has not been considered because the industrial-type operation is already found in Iran and many other countries. The efficiency of sheep meat production can be higher than cattle because multiple births are common. Current methods of production are not particularly more efficient but the potential is good for a reduction in the breeding flock per carcass produced while nothing of sort is apparent for cattle. Ewes have produced six lambs per year (instead of one) in experimental flocks. If the technology can be adapted commercially, sheep meat could, perhaps, compete with broilers.

We have discussed above, questions of the efficiency of animal production and how these might be improved, but an equally important factor for a nation like Iran is the

relation between per capita income and the consumption of animal proudcts. The elasticity of demand for meat (the proportion of income increment that will be spent for meat) is very high and the manner in which demand changes with income has been well illustrated by a recent U.S.D.A. study (8) and by the paper of Perisse' *et al.* (4). Although demands are great relative to income, important and rapid changes in the nutritional status of the lower income people cannot be expected. Incomes may not be adequate to provide a rapidly expanding national market and an export market may be the only alternative to spur production of animal products.

Livestock proudction as a means of improving the national diet can have another great advantage if the emphasis is placed upon increased production by small farmers and peasants, because high value animal products can provide a desirable source of income to a large number of rural families. This possibility for rural employment should receive strong consideration in agricultural planning. Large scale livestock proudction can probably produce more efficiently according to the usual definition of efficiency. However many small scale family livestock units may be more efficient for the welfare of Iran at its present stage of development when about 50% of its people are engaged in agriculture. It is possible today by means of systems analysis methods and the national statistics available to make reasonable estimates of the effects of an animal production program in terms of improvement in the national diet, in terms of rural employement and agricultural income.

CONCULSION

An increase in the production of milk and meat can be expected to improve the quantity and quality of protein in the national diet and at the same time help to satisfy a strong demand for animal protein. It is probable that the improvement will not be great for the poorest people but this is a weakness of most programs for improved nutrition. Large increases in the production of ruminant animals probably can be expected only by intensive husbandry practies. The key feature of intensive production is a high intake per animal of readily digested feed energy. Such a feed supply can probably be obtained only by intensive cropping of the best lands.

If intensive livestock production can be developed by small farmers animal products may make an important contribution to agricultural income and rural employment as well as improving the protein quality of the diet. The "Green Revolution" has shown us what can be done with cereal production, now we need a comparable revolution in meat and milk production. Perhaps we can call this the "Red and White Revolution".

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