Prospects of Feed Crops in Nepal: the Role of CGPRT Crops

Bekha Lal Maharjan
**The CGPRT Centre**
The Regional Co-ordination Centre for Research and Development of Coarse Grains, Pulses, Roots and Tuber Crops in the Humid Tropics of Asia and the Pacific (CGPRT Centre) was established in 1981 as a subsidiary body of UN/ESCAP.

**Objectives**
In co-operation with ESCAP member countries, the Centre will initiate and promote research, training and dissemination of information on socio-economic and related aspects of CGPRT crops in Asia and the Pacific. In its activities, the Centre aims to serve the needs of institutions concerned with planning, research, extension and development in relation to CGPRT crop production, marketing and use.

**Programmes**
In pursuit of its objectives, the Centre has two interlinked programmes to be carried out in the spirit of technical cooperation among developing countries:

1. Research and development which entails the preparation and implementation of projects and studies covering production, utilization and trade of CGPRT crops in the countries of Asia and the South Pacific.
2. Human resource development and collection, processing and dissemination of relevant information for use by researchers, policy makers and extension workers.

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Regional Co-ordination Centre for Research and Development of Coarse Grains, Pulses, Roots and Tuber Crops in the Humid Tropics of Asia and the Pacific
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## Abbreviations

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<tr>
<td>AGDP</td>
<td>Agricultural Gross Domestic Product</td>
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<tr>
<td>APO</td>
<td>Asian Productivity Organization</td>
</tr>
<tr>
<td>APP</td>
<td>Agricultural Perspective Plan</td>
</tr>
<tr>
<td>APROSC</td>
<td>Agricultural Projects Services Centre</td>
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<td>CGPRT Centre</td>
<td>Centre for Research and Development of Coarse Grains Pulses Roots and Tuber Crops</td>
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<tr>
<td>FAO</td>
<td>Food and Agriculture Organization of the United Nations</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>HMGN</td>
<td>His Majesty’s Government of Nepal</td>
</tr>
<tr>
<td>IFPRI</td>
<td>International Food Policy Research Institute</td>
</tr>
<tr>
<td>JICA</td>
<td>Japan International Cooperation Agency</td>
</tr>
<tr>
<td>mt</td>
<td>metric ton</td>
</tr>
<tr>
<td>masl</td>
<td>meters above sea level</td>
</tr>
<tr>
<td>MoA</td>
<td>Ministry of Agriculture</td>
</tr>
<tr>
<td>NARC</td>
<td>Nepal Agricultural Research Council</td>
</tr>
<tr>
<td>NPC</td>
<td>National Planning Commission</td>
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<tr>
<td>SAARC</td>
<td>South Asian Association for Regional Cooperation</td>
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<tr>
<td>SAPTA</td>
<td>South Asian Preferential Trade Agreement</td>
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<tr>
<td>SPSM</td>
<td>Sanitary and Phytosanitary Measures</td>
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<tr>
<td>SWOT</td>
<td>Strengths, Weaknesses, Opportunities and Threats</td>
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<tr>
<td>TDN</td>
<td>Total Digestible Nutrients</td>
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Foreword

Coarse grains, pulses, root and tuber (CGPRT) crops are a very important component of the farming system in Asia and the Pacific region, particularly in the marginal areas where economically, ecologically and socially less favorable conditions prevail, and many farmers’ activities and lives rely on CGPRT crops. Therefore, it is crucial to promote the sustainable production of CGPRT crops and to expand the income generation opportunities through expanding market opportunities of CGPRT crops.

CGPRT crops are versatile crops and they can provide an extraordinary range of end uses, not only as foods for direct human consumption but also as materials for a diverse range of end products, including industrial uses. Feed is one of the alternative end products of CGPRT crops.

In developing countries, there has been a dramatic rise in the consumption of animal origin food products. It was a result of demand changes caused by changes in the diets of billions of people in the region, through population growth, urbanization, and income growth in these countries.

As animal-product demand increases, feed grain utilization also increases. Animal feeds are dominated by coarse grains, pulses, root and tuber crops or the products of these CGPRT crops. Therefore, this provides an expansion of market opportunity for CGPRT crops.

The development of animal husbandry and demands for feed vary greatly from country to country. Therefore, we need to analyze them comparing among countries within the region. Responding to this need, the CGPRT Centre has implemented a research project, “Prospects of Feed Crops in South Asia”, in collaboration with partners from four countries: India, Nepal, Pakistan and Sri Lanka.

It is my pleasure to publish Prospects of Feed Crops in Nepal: the Role of CGPRT Crops as one of the results of the project. This volume covers topics such as historical overviews of animal industry, agricultural policies, trading policies and prospects of feed demand and supply in Nepal.

I thank Mr. Bakha Lal Maharjan for his earnest and fruitful work. This study could only be accomplished with the continuous support from the Nepal Agricultural Research Council (NARC). Mr. S.S.E Ranawana, professor of Wayamba University, Sri Lanka, and Mr. Budiman Hutabarat provided useful comments and guidance at various stages of the study as the regional advisor and the project leader, respectively. I also thank Mr. Matthew Burrows for his editing services throughout the publication of the report. Finally, I would like to express my sincere appreciation to the Government of Japan for its support in funding the project.

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Director
CGPRT Centre
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Executive Summary

Introduction

The present study on “Prospects of Feed Crops in Nepal: the Role of CGPRT Crops” was undertaken under the technical collaboration of the CGPRT Centre, Bogor, Indonesia and NARC, Kathmandu, Nepal.

Problem statement

Livestock are a key element in the agricultural production system of Nepal. Livestock farming is largely found on small mixed farms with varying interaction between crop, livestock, fisheries and forestry. At farm level, the role of livestock is often multipurpose. Livestock is a source of nutritive products (milk, meat, eggs) and is an income and employment generating activity. Animals supply draught power without requiring fossil fuels and farmers depend on animals for transport in many rural areas. Draught animals are used for processing crops and for irrigation. Animal manure is used as fertilizer, fuel or as feed in fishponds. The multipurpose function of livestock is contributing about 15 per cent to the overall gross domestic product and 31 per cent to the agricultural gross domestic product (AGDP) of the country. The contribution of livestock is expected to grow to 45 per cent of AGDP by 2015, as envisaged in the long-term Agricultural Perspective Plan (APP) of the country.

Increasing evidence shows that a demand driven livestock revolution is underway in developing countries with profound implications for agriculture, the environment and poverty.

The term livestock revolution is used to describe the massive increase in demand for foods of animal origin fueled by population growth, urbanization and income growth in developing countries over the next 20 years (IFPRI, 1999).

The livestock revolution encompasses the following distinct trends:

1. Rapid increase in consumption and production of livestock products.
2. A change in production base from local, mixed farms to market oriented, vertically integrated types.
3. Increased substitution of meat and milk for grains in the human diet.
4. Rapid rise in the use of cereal based feeds.
5. Growth of more intensive production systems closer to cities.
6. Emergence of technological changes in livestock production and processing along the industrial systems.

Lack of policy action to adjust to emerging issues will not stop the livestock revolution but it will ensure that the form it takes is less favourable for growth, poverty alleviation and sustainable agricultural development in the country.

In the period between 1982-2000, FAO estimated an average annual growth rate in demand for meat, milk and eggs in developing countries of 3.7, 3.1 and 4.3 per cent respectively (FAO, 1987). Population growth, urbanization and income growth determine the changes in demand for livestock production. An IFPRI report estimated the income elasticity of demand for meat, milk and eggs at 0.97, 0.52 and 1.07 for Asia, indicating a high elasticity of demand for meat and eggs. The FAO / IFPRI predictions to year 2020 are that meat and milk consumption will grow at 2.8 and 3.3 per cent per annum in developing countries. The demand for livestock products, particularly meat and eggs is elastic with respect to income changes.
indicating there would be an increase in demand if there were changes in the income of the customer.

**Feed resources**

Inadequate feed resources, both qualitatively and quantitatively, are serious constraints to increased animal production. Perspectives for the future must be sought in expanding and improving the feed base.

Feed resources can be divided into:

1. Low quality roughages (natural pasture, crop residues)
2. High quality roughages (fodder crops, legumes, trees)
3. Agro-industrial by-products (oil meal, cakes and others)
4. Concentrates (compound feed of grains and agro-industrial products)
5. Supplements (vitamins, minerals and others)

In the conventional feeding regime, most of the feed energy supply for ruminants originates from rangeland, pastures and crop residues. Livestock feeding was based largely on extensive grazing on natural pastures, and to some extent on forests, crop residues and fodder crops.

About 35 per cent of animal productivity is estimated to have been lost due to the poor feeding system. The supply of total digestible nutrients (TDN) from crop by-products, forests and grazing lands, and others are estimated at 45 per cent, 30 per cent and 25 per cent respectively. Total production of digestible nutrients was 6,133 thousand mt against the requirement of 8,643 thousand mt in 2000. This indicates a deficit of TDN by 29 per cent in the country.

Reduced grazing resources due to land occupation and land degradation makes livestock increasingly dependent on crop residues. Fodder and forage production on crop land is competing with food production for human beings.

Grain feed used in developing countries increased by 3 per cent per annum due to increased demand for livestock products of milk, meat and eggs.

Demand for feed crops is a derived demand which depends on the size of the livestock population and the quantity of feed fed to animals.

**Objectives**

The objective of the study was to analyse the trends of demand and supply for animal feeds including the factors that determine production and consumption of feed crops. Other objectives are:

- To evaluate potentials and constraints for expanding feed crop farming.
- To formulate recommendations for policy options to promote the sustainable development of feed crop farming.

**Method of study**

The method of study involved the collection of data through rapid rural appraisal and group discussions with stakeholders, including livestock farmers, scientists and feed manufacturers. Interaction was made with policy makers and planners relating to feed crop production, feed prices and production of livestock products. Secondary data on population, income, prices, consumption and production of feeds was also reviewed during the study period.
A log-linear regression model was developed and analysis of data was carried out using eview software (Shamsudin et al., 1993) for evaluating the co-efficient of feed crop demand and supply.

Livestock population and production patterns

Major livestock populations in Nepal include cattle, goat, buffalo and poultry.

1. Cattle are the major livestock raised in all ecological regions of the country. It is estimated that 50 per cent of the cattle population is concentrated in the mid-hills and 38 per cent in the Tarai. The percentage of improved breeds in cattle is 8.25 per cent that are spread along the periphery of major highways and Tarai urban centers. Many dairy cattle are raised under intensive systems in the milk grid areas. Total population of cattle in 2001 was 6.98 million.

2. Goats are also raised in all ecological regions, with 55 per cent of goats concentrated in mid-hills. About 13.71 per cent of goats are estimated to be of improved breeds. There were 6.5 million goats in 2001.

3. Buffalo are important livestock animals in the farming system. About 50 per cent of the total buffalo population is reported to be raised in the mid-hills. Improved breeds consist of 21.14 per cent in the case of buffalo. The buffalo population was reported at 3.6 million in 2001.

4. Poultry is a fast growing enterprise. Commercial production of poultry meat and eggs is spreading over the major urban and highway areas. In the rural areas, poultry is raised under scavenging conditions, whereas in highway areas with accessibility to urban areas, poultry birds are raised under intensive production systems with the use of commercial feeds. About 50 per cent of the poultry is estimated to be of improved breeds. The fowl population was 20 million in 2001.

5. One of the fast growing livestock species is piggery, which is concentrated in certain areas of east Nepal. About 40.77 per cent of pigs are reported to be of improved breeds. The pig population was 0.912 million in the country in 2001.

The population of milk cows and milk buffalo has grown by 2.15 per cent and 2.25 per cent respectively.

Review of production and consumption of livestock products

Meat

From 1990 to 2001, a consistent growth in livestock products of meat, milk and eggs was reported. The annual growth rate of meat (including meat from buffalo (66 per cent), goat (25 per cent), poultry and pigs (9 per cent)) increased by 2.89 per cent. Poultry meat in particular, increased by 4.09 per cent during the period. Total production of meat was about 194,258 mt in 2000-2001.

Milk

Annual growth in milk production has been recorded at 2.83 per cent with 3.06 per cent growth in cow milk and 2.58 per cent growth in buffalo milk. Annual total milk production is 1,124,132 mt in the country.

Eggs
Egg production has increased by 3.39 per cent per annum. Total egg production was 507,323,000 units in 2000-2001.

Per capita consumption of milk, meat and eggs is estimated at 58 liters of milk, 10 kg of meat and 25 units of egg in the year 2000-2001.

To meet the increased requirement of livestock products, Nepal imported about 382,454 heads of buffalo, 465,506 heads of goat, 1,703,220 units of poultry birds, 929,276 liters of milk and 2,792,000 units of egg in 1998-1999. Similarly, exports from Nepal were 36,348 heads of buffalo, 47,266 heads of goat, 33,169 poultry birds, 149,986 liters of milk and 717,900 units of egg to India.

**Demand and supply of feed and feed crops in Nepal**

The demand for commercially manufactured concentrated animal feed is being affected by the fast growth of the livestock population, particularly in dairy animals and poultry birds. A significant growth in dairy cattle farms and commercial poultry firms can be seen in the country, particularly in urban areas of Tarai and accessible areas of the hills. Increasing numbers of dairy cattle, buffalo and poultry birds of improved breeds are replacing local livestock animals and birds. This has necessitated the use of blended and manufactured feeds under the intensive livestock raising systems. Many farmers in Kabhre, Chitwan, Pokhara and Bhairahawa said that they would sacrifice the personal expenses on unnecessary items and would prefer to spend the limited income on good feeds and healthcare for their animals.

The feed conversion ratio to produce a kilo of meat, milk and egg output has been derived at 3.0, 2.5 and 2.5 kg of feed respectively. The ratio does not include the feed required for body maintenance of livestock animals (Department of Livestock and APROSC, 1995).

The number of improved cattle is also increasing and farmers treat them as important assets and feed them quality feeds. The population of improved poultry is also rising, which is estimated at 50 per cent of the total. Poultry birds are raised under intensive conditions by providing commercial feeds. The annual growth rate in demand for feed was 3.24 per cent during 1990-2000.

Due to the growth in demand for commercial feeds, the prices of feed crops have registered a significant rise. The price of maize and soybean, the major ingredients in poultry and cattle feed, have increased by an annual increment of 20 and 10 per cent respectively during the 1990-2000 period.

Prices of livestock products have increased per annum by 12.98 per cent in the case of milk and 10 to 17 per cent in case of chicken and mutton. Similarly, the annual increment was 9.43 per cent in the case of poultry eggs.

Due to the scarcity of livestock products, Nepal tends to import a large amount of eggs, meat and milk to meet the rising demand.

The demand for animal feed in the coming decade will accelerate as the demand for livestock products increases from the rising population, growing income levels and a marked shift to consume quality animal foods against grains. It is projected that a huge gap between the requirement and supply of feeds will appear in the country. The total requirement of feed in 2010 is estimated at 874,000 mt of feed against the current availability of 410,000 mt in 2000. The annual growth rate of demand for feed will be 3.38 per cent per annum for 2001 to 2010.

**Supply of feeds**

The number of feed processing industries in 2000 was 154, producing about 410,000 mt of feed. Most of the feed industries in Nepal are small and are not operating at full capacity utilization. The reason for the lower utilization of processing capacity was the non-availability of raw materials and lack of proper maintenance. There is one government feed manufacturing
A plant in Hetauda with a production capacity of 2 mt per hour, which is only operating at 50 per cent capacity.

Larger processing mills operated by the private sector receive their feed grain supplies either from the local traders or from India. Major ingredients for feed production are maize and soybean with 42 and 11 per cent of the total ingredients.

Many processing industries reported that it is not cost effective to procure maize and soybean from small producers who do not supply large quantities and raw materials are also of poor quality containing heavy moisture in grains.

It is imperative that there should be a supply contract for maize and soybean between farmers and processing industries to guarantee the supply of quality raw materials. Appropriate institutional and policy arrangements should be worked and implemented for the betterment of both farmers and processors.

The feed crops maize and soybean, are often grown by small-scale farmers on the poorer lands. Efforts should be made to provide benefits to these small-scale farmers.

Nepal’s feed industry will have to face tough competition from other countries after its accession to the WTO. Nepal has to improve quality and cost competitiveness in its production. As the feed ingredients are of a bulky nature, Nepal will have to face the problem of increased storage and marketing costs.

Major ingredients, such as maize and soybean, are mainly produced on the hill-farms and grown as subsistence crops by small farmers under non-irrigated conditions. The amount of maize required for feed production was about 210,000 mt in 1999. This is estimated to increase to 342,000 by 2010. This increased volume of production has to be made available either through local production or imports from abroad.

It was reported that in 1999, the feed processing industries were importing about 40 per cent of total maize ingredient, or 84,000 mt, to fulfill the raw material requirement for feed production.

**Findings of analytical exercises**

1. The estimation of coefficients from the data under the area of maize feed crop in 1980-1999 shows that the cropped area under maize is not dependent on the relative prices of the (maize to rice) crop as the value of coefficients is quite low and negative. This result seems to be consistent under a subsistence economy where maize is being cultivated independent of prices.
2. The yield of maize is stagnant over the comparison period which is shown by the small and negative coefficient of trend variable. However, yield is found to be responsive to price of urea, indicating greater use of urea fertilizer over a decrease in relative prices of urea to maize.
3. The price response to demand of maize for food is, as expected, negative (-0.07). However, an increase in income of one per cent would lead to an increase in maize demand for food by 0.26 per cent.
4. Considering maize demand for feed, a one per cent increase in milk production would create a corresponding 1.25 per cent increase in maize demand for feed. However, in the case of eggs, a one per cent increase in egg production would lead to a 0.02 per cent decrease in maize demand for feed at the household level. This is due to the fact that processing industries may require more maize for feeds and farmers have to sell their maize with a corresponding decline in maize availability of feed at the household level. The results indicate that maize demand for feed does not decline with an increase in prices. This is because the processors do not maintain their stocks and have to buy even at increased prices.
5. Coefficients relating to demand of maize for other uses indicate that a one per cent increase in maize demand for food and feed purposes would lead to a 0.89 per cent increase in demand of maize for other uses.

6. Production of soybean is also found to be not dependent on price. This is as expected in a subsistence economy under which soybean is produced.

7. Coefficients show that a one per cent increase in the income of the people would result in a 0.46 per cent increase in soybean demand. The price response to demand for soybean is as expected, negative, indicating a decline in demand with an increase in prices.

These parameters have been used to project feed crop demand of maize and soybean upto the year 2020.

The open border market with India provides potentials as well as threats to Nepalese agriculture and product development. India provides a huge potential market for Nepalese products if they are cost competitive. On the other hand, Nepal products have to compete with Indian products that are produced on a large scale and also with greater technological know-how and competitive prices in the market.

In terms of price efficiency, Indian products are comparatively cheaper than the Nepalese goods (an example of dumping cheap paddy in the local markets). Nepal has to follow the price trends set by Indian markets for many agricultural commodities.

Hence, it is recommended that Nepal should monitor the developments of technology, products and prices so that it can benefit from Indian market trend arrivals and prices. Nepal can not have its own independent price policies but must adjust the internal prices in Indian border markets.
**SWOT framework**

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<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Increasing demand for livestock products.</td>
<td>1. Policy planning not oriented to feed crop and feed development.</td>
</tr>
<tr>
<td>2. No interference on (ingredients) input and output prices (livestock products).</td>
<td>2. Technology for feed processing weak.</td>
</tr>
<tr>
<td>3. Huge open border market for Nepalese feed crops and feeds.</td>
<td>3. Raw material availability to processing industries not adequate.</td>
</tr>
<tr>
<td>4. Increased demand for feed likely to continue.</td>
<td>4. Indian market prices dominate.</td>
</tr>
<tr>
<td>5. Dairy and poultry sector developing and expanding under the private sector.</td>
<td>5. Cost competitiveness is weak for local feed products.</td>
</tr>
<tr>
<td>6. Promotion of oilseed crop in the hills – a potential which can be used as a feed crop.</td>
<td>6. Market is fragmented and small.</td>
</tr>
<tr>
<td>7. Policy planning not oriented to feed crop and feed development.</td>
<td>7. Cost of transport and collection is prohibitive.</td>
</tr>
<tr>
<td>8. Technology for feed processing weak.</td>
<td>8. Government facilitation on research and market development is not available.</td>
</tr>
<tr>
<td>9. Raw material availability to processing industries not adequate.</td>
<td>9. About 40 per cent of the total maize used for feed is reported as imported.</td>
</tr>
<tr>
<td>10. Indian market prices dominate.</td>
<td>10. Quality of feed crops is poor.</td>
</tr>
<tr>
<td>11. Market is fragmented and small.</td>
<td>11. Industries not operating at full capacity.</td>
</tr>
<tr>
<td>12. Government facilitation on research and market development is not available.</td>
<td>12. Nepal Feed Association not able to play coordinating role in price, quality and other areas.</td>
</tr>
<tr>
<td>13. Cost competitiveness is weak for local feed products.</td>
<td>13. Import duties on ingredients very high.</td>
</tr>
<tr>
<td>15. Cost of transport and collection is prohibitive.</td>
<td>15. Tax policy is not conducive for feed development.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Domestic markets can be expanded with improvements in road access for livestock products and feed crops.</td>
<td>1. Due to the open border, Indian prices dominate the local market prices.</td>
</tr>
<tr>
<td>2. Export of livestock products such as ‘yak’ cheese can be promoted.</td>
<td>2. Local prices are higher for livestock feeds and products than in India.</td>
</tr>
<tr>
<td>3. Private sector participation in livestock and feed development forthcoming.</td>
<td>3. Productivity improvements are constrained by the non-availability of blended feeds for animals.</td>
</tr>
<tr>
<td>5. Potential for winter maize expansion in Tarai.</td>
<td></td>
</tr>
<tr>
<td>6. Cost reduction for livestock products an opportunity.</td>
<td></td>
</tr>
</tbody>
</table>

**Implications of SWOT analysis**

On the basis of the SWOT framework, it is found that there is a strong potential for feed crop development, which is supported by the increasing demand for livestock products (2.89 per cent in meat, 2.83 per cent in milk and 3.39 per cent per annum in eggs).

The increased demand is likely to continue in the future with a 2.5 per cent annual growth in population and 2 per cent growth in personal income.

The fast growing poultry and dairy cattle sector will definitely push the demand for animal feeds and will bring a livestock revolution to the country.

Per capita consumption of meat and eggs is, at present, low which needs to be promoted by making the supply of feeds available to poultry and dairy enterprises. These enterprises are fast growing in the private sector which is a good sign of competitive business and cost effectiveness.
There are weaknesses and threats as well in the development of feed industries in Nepal. The government policy towards feed industries is not transparent and conducive for the fuller utilization of installed capacities. Feed industries are facing uncertainties about the delivery of raw materials, such as maize and soybean, in the required amount and of appropriate quality. They have to resort to imports from abroad. It deprives the small hill farmers benefits, who lack market outlets for their products.

Conclusions

To close the widening gap between demand and supply of feed crops, it is recommended that the government should facilitate the production of maize by promoting contract procurement of maize and soybean by feed processing industries which, will help to augment appropriate research and infrastructures such as storage, marketing and other logistics.

The second alternative is whether Nepal can import the feed required for the livestock population. This involves hard currency and other priority investment problems.

The third alternative is to grow winter maize and soybean in Tarai, often at the expense of other food crops such as lentil and other legumes, which have ready export market abroad.

The fourth alternative is to grow feed crops such as oilseed, millet and other crops on marginal terraced and small farms. This requires increased collaborative efforts from the government and the CGPRC Centre to increase feed crop production, employment and living status of marginal and poor farmers. This will help diversify farm production in the poorer lands and alleviate poverty.
1. Introduction

1.1 Background and justification

Livestock are a key element in the agricultural production system of Nepal as they provide nutritive products, employment and income to the growing population. Livestock animals are the main source of draught power and transport and also a source of farmyard manure to sustain the soil fertility needed for crop production. Livestock production contributes about 15 per cent to the Gross Domestic Product (GDP) and 31 per cent to the Agricultural Gross Domestic Product (AGDP). The contribution of livestock is expected to be 45 per cent in AGDP by the end of 2015.\(^1\)

The livestock sector is a fast growing sub-sector accounting for a significant share of economic growth. At present, growing evidence indicates that demand for livestock products is growing fast. Meat and milk consumption is estimated to grow at 2.8 per cent and 3.3 per cent per annum in less developed countries (Pinstrup-Andersen, Per and Others, 1999).

A recent food policy report by the International Food Policy Research Institute indicates that meat demand will double between 1995 and 2020 due to continued population growth, urbanization, income growth and changes in lifestyles and food preferences in developing countries. Demand for poultry meat is expected to increase faster, at an average annual rate of 3.6 per cent. Thus, a demand driven livestock revolution is taking place with profound implications for derived demand for feed crops to meet increasing demand for livestock products. It is envisaged by FAO that the value of livestock products in AGDP will equal or exceed those from crops in the coming years. In the demand for cereals, the demand for maize and other coarse grains for livestock feed will grow at a faster rate. The income elasticity for meat ranges from 0.2 to 0.9, indicating a higher elasticity than for cereal crops (maize, rice) (Rosegrant, 1995). The demand for livestock products is highly elastic with respect to per capita income changes. The Agricultural Perspective Plan of Nepal (National Planning Commission, 1995) also states that as income growth accelerates, there will be an explosive growth in the demand for livestock products. Under the perspective plan, the livestock sector is envisaged to increase its growth rate from 2.9 per cent per annum at present, to 6.1 per cent in 2015.

As a consequence, the demand for maize and soybean for feeding livestock will more than double in developing countries. The change in livestock production will occur as a result of rapid increases in demand for livestock products. Changes in livestock raising will occur in the following ways:

i. Change from small-scale subsistence farming to commercial farming.

ii. A gradual shift from conventional fodder systems to the use of cereal based blended feeds and a greater stress on intensive and stall-feeding systems. This gradual shift from livestock feeding based on extensive grazing/scavenging dependant on natural pastures and grazing grounds to feeding systems based on high nutrient density manufactured feeds is already taking place in the commercial livestock production sector in developing countries.

iii. Change in meat demand from ruminant to monogastric.

Deficiency in a balanced and nutritive feed supply has been blamed for the sub-optimum performances in improved livestock breeds in Nepal. About 35 per cent of productivity is estimated to have been constrained by the poor feeding system of the livestock (Rajbhandary

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\(^1\) The AGDP was estimated at Rs 33,000 million in 2000. The rate was US$ 1 equivalent to Rs 75.00.
Chapter 1

and Shah, 1981). In the conventional feeding system, livestock are raised under extensive pasture and grazing systems supported by a few nutritive grain supplements, particularly for dairy and meat animals. Feed for livestock is mainly obtained from forests, grazing lands and crop lands. Of the total animal feed base, crop residues accounted for 47 per cent and forest leaves accounted for 30 per cent of the feed. The rest is from non-cultivated shrub lands and grazing land.

Table 1.1 Total Annual Digestible Nutrients (TDN) supply from different sources (1,000 mt) in Nepal, 2000

<table>
<thead>
<tr>
<th>Sources</th>
<th>Mountain</th>
<th>Mid Hill</th>
<th>Tarai</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop by-product</td>
<td>106</td>
<td>981</td>
<td>1,783</td>
<td>2,870 (47)</td>
</tr>
<tr>
<td>Forest</td>
<td>404</td>
<td>753</td>
<td>674</td>
<td>1,831 (30)</td>
</tr>
<tr>
<td>Non-cultivated inclusion</td>
<td>104</td>
<td>466</td>
<td>127</td>
<td>697 (11)</td>
</tr>
<tr>
<td>Shrub land</td>
<td>88</td>
<td>308</td>
<td>27</td>
<td>423 (7)</td>
</tr>
<tr>
<td>Grazing land</td>
<td>208</td>
<td>72</td>
<td>2,580</td>
<td>312 (5)</td>
</tr>
<tr>
<td>Total</td>
<td>910</td>
<td>2,580</td>
<td>2,643</td>
<td>6,133 (100)</td>
</tr>
</tbody>
</table>

Source: Nepal Agricultural Research Council.

Table 1.2 Total Annual Digestible Nutrients (TDN) availability and requirement (1,000 mt)

<table>
<thead>
<tr>
<th>Sources</th>
<th>Mountain</th>
<th>Mid Hill</th>
<th>Tarai</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirement</td>
<td>1,071</td>
<td>4,316</td>
<td>3,255</td>
<td>8,643 (100)</td>
</tr>
<tr>
<td>Available</td>
<td>910</td>
<td>2,580</td>
<td>2,643</td>
<td>6,133 (71)</td>
</tr>
<tr>
<td>Balance</td>
<td>-161</td>
<td>-1,736</td>
<td>-612</td>
<td>2,510 (29)</td>
</tr>
<tr>
<td>Per cent</td>
<td>(15)</td>
<td>(40)</td>
<td>(19)</td>
<td>(29)</td>
</tr>
</tbody>
</table>


The available feed is about 71 per cent of the requirement, indicating a deficit of 29 per cent or 2,510 thousand metric tons of TDN supply. The deficit situation is acute in the mid hills where the livestock population is concentrated (Pariyar, Sedhain and Banskota, 1995). Details are given in Table 1.1 and 1.2.

It can be seen that livestock ruminant production is mainly forage based. Grain feeding and blended concentrates are used only in commercial poultry production and dairy livestock production areas, which are mainly concentrated around the urban areas and major highway areas such as Morang, Sunsari, Hetauda, Bharatpur, Kabhre, Pokhara, Bhairahawa and Nepalgunj. The major feed base of ruminant production is roughage. Sources, quantity and quality of these forages differ from one geographical ecological region to another.

Nepal is ecologically divided into three regions Mountains, Mid-hills and Tarai areas. In the mountains (>2,500 masl), which occupies a total area of 6,310 thousand hectares, a large portion of land is occupied by forest (28 per cent), grassland (22 per cent) and others (40 per cent). Cattle (yaks and chaurs), goats and sheep are the major livestock of this region. The major feed base is from forest lands (44 per cent), grazing land (23 per cent) and crop by-products (12 per cent). An annual feed deficit of 15 per cent of the total requirement is found in this region.

The mid-hill region (500-2,500 masl) covers 4,442 thousand hectares with forest area (41 per cent), cultivated land (27 per cent) and non-cultivated inclusions (15 per cent). Buffalo, goats, cattle and sheep are the major livestock populations. The major feed resources come from crop by-products (38 per cent), forest land (29 per cent) and non-cultivated inclusions (18 per cent). An annual feed deficit of 40 per cent is found in the mid-hill region.

The Tarai region (<500 masl) covers about 3,996 thousand hectares with forests covering 48 per cent, cultivated land (30 per cent) and others covered with grass land and other lands. Cattle, buffalo, goats and sheep are the major livestock populations. Major feed resources are crop by-products (67 per cent) and forest land (25 per cent). An annual deficit of 19 per cent of TDN requirement is found in this region.
Thus, it is observed that a substantial shortage of appropriate feed in quantity and quality is found in all ecological regions of the country. The overall deficit is 29 per cent at the national level. The feed deficit is more acute in the Hills followed by Tarai and Mountain Regions.

1.2 Growth of the livestock population

Livestock are kept by farmers for various purposes. Cattle are kept for draught power and farmyard manure for crop cultivation. Milk, meat and eggs for earning cash are also major reasons for raising cattle and other livestock by the farm households. Cattle are kept mainly for milk and cannot be slaughtered due to religious reasons. Therefore, farmers have to maintain and feed even unproductive old cattle at the cost of productive cattle. It is estimated that about 30 per cent of the adult cows and 10 per cent of bullocks are too old for milk production and draught purposes respectively.

Since livestock are not in balance with the feed resources available, there is a tremendous pressure on land, particularly on the forest areas and grazing lands. At present, the livestock population consists of 6.98 million cattle, 3.62 million buffalo, 0.56 million sheep and 6.47 million goats. Similarly, pig and fowl among non-ruminants, consists of 0.9 million pigs and 19.79 million birds. There are 0.8 million milk cows, 0.9 million buffalo, 5.9 million egg laying hens and 0.21 million egg laying ducks. Details are given in Table 1.3.

The growth rate of the livestock population was 1.05 per cent for cattle and 1.73 per cent for buffalo during the period from 1990-91 to 2000-2001. A higher growth rate of 4.93 per cent for pigs and 4.17 per cent for fowls were observed during this period. The milk animal growth rates for cow and buffalo were 2.15 and 2.25 per cent respectively. The growth rate of egg laying poultry birds was higher at 3.87 per cent per annum.

1.3 Production patterns of important livestock animals

1. Cattle are the major livestock and are raised in all ecological belts of the country. It is estimated that about 50 per cent of cattle production is concentrated in the mid-hills, followed by 38 per cent in the Tarai and 12 per cent in the mountains. Improved cattle breeds (cross breeds between the local cattle and Jersy or Holstein Friesians) consist of about 8.25 per cent (Asian Development Bank and HMG/Nepal, 2001). Improved breeds of cattle are found along the periphery of the major highways near the urban centers like Kabhre, Pokhara, Biratnagar, Bhairahawa, Chitwan etc. The annual growth rate of cattle was 1.05 per cent during the period of 1990 to 2001. Details are given in Table 1.3.

2. Buffalo are an important livestock animal in the local farming system. Buffalo are mostly (50 per cent) found in the mid-hills and are of native type and crossbred between local and murrah types. Buffalo are fed on crop residues and also supplemented by grains and home made concentrates. Improved breeds of buffalo constitute about 21.14 per cent of the total. The annual growth rate was 1.73 per cent during 1990-2001.

3. Goats are important livestock raised in the hills, mountains and Tarai areas of the country. About 57 per cent of the goat population is raised in the mid-hills and the main goat breed is Khari goat. In the Tarai, crossbred goats (local goats with Indian breed of Jamuna Pari and Barberi) are raised. About 13.71 per cent of the total goat population is reported to be of improved breeds. Castrated male goats are commercially important and are a source of cash income for rural farmers. Goats are mainly fed on pasture, grazing lands and forest areas. Commercially important castrated goats are provided with grain and crop by-products. The goat population increased by 1.88 per cent per annum during 1990-2001.
4. Poultry is the fastest growing livestock enterprise in the country. It is found around urban areas and on the periphery of national highways. Commercial poultry production pockets are located in Kathmandu, Bharatpur, Pokhara and Biratnagar. There are about 10,000 to 15,000 commercial poultry producers, each maintaining 100 to 400 layers. However, there are large-scale poultry production centers as well, which deal in broilers and layers. Hybrid broilers and layer chicks are supplied by local hatcheries, which also supply concentrated feeds, veterinary services and extension and marketing services. In rural areas, poultry birds are raised under scavenging conditions, whereas poultry birds on commercial farms are mostly fed with blended and processed feeds under intensive poultry raising conditions. About 50.35 per cent of the poultry population is of improved breeds. The annual growth rate was 4.17 per cent for poultry during 1990-2001.

5. Pigs are raised mostly in eastern Nepal and are important animals for certain ethnic groups in the country. Pigs are not accepted by certain castes such as Brahmins, Chetteris and Muslims on the basis of their religion and social traditions. The pig population has increased in recent years and demand for exotic breeds has particularly increased. Pigs, being monogastric animals, require feeds containing low fiber. Local pigs are raised under scavenging conditions and cross breeds are given mixed diets containing rice-bran, maize flour, and other crop by-products. About 40.77 per cent of the pig population is estimated to be of improved breeds. The annual growth rate of the pig population during 1990-2001 was 4.23 per cent. Other livestock animals such as yak, chauri, sheep, rabbit, and duck are raised by specific communities in location-specific areas, having a low commercial importance in terms of meat and milk products.

1.4 Review of production and consumption of livestock products

During the period 1990-91 to 2000-2001, there was a consistent and rapid growth in the production of livestock products, such as milk, meat and eggs. The increase in demand for livestock products has been associated with the rapid increase in the urban population and the rise in income levels. The growth rate of meat, milk and eggs was 2.89 per cent, 2.83 per cent and 3.39 per cent per annum respectively for the period of 1990 to 2001. Details are given in Table 1.4.

1.4.1 Milk production and consumption

Milk and milk products are the major source of animal protein in the Nepalese diet. Per capita consumption of milk in 1999-2000 was estimated at 58 liters. Total milk production was 1,124 thousand metric tons in the country, of which buffalo milk accounted for 70 per cent and cow milk accounted for 30 per cent. About 80 per cent of milk production is estimated to have been consumed at home itself and only 20 per cent is supplied to the market through dairy processing units and formal market channels (Nepal Agricultural Sector Performance Review, 2001). Total milk production was 1,124,132 mt in 2000-2001.

The growth rate of milk production was 2.83 per cent for the period of 1990-91 to 2000-2001. The growth rate of buffalo milk was 2.58 per cent, whereas the growth rate of cow milk was 3.06 per cent per annum. Milk is supplied by dairy processing units in urban areas such as Kathmandu, Hetauda, Biratnagar, Pokhara and other urban areas. Milk cooperatives (about 1000 in number) collect and supply milk in about twenty-nine districts of the country.

Other dairy products including ghee (clarified butter), butter, cheese, yogurt and ice cream are also produced, both at the domestic level and at processing units. Ghee produced in western and mid-western Nepal is exported to nearby Indian towns of Lucknow and Kanpur, where the Nepal ghee is popular among local consumers.
Introduction

Demand for milk and other milk products are rapidly increasing as a result of population growth and a rise in income levels in the country. Total annual demand for processed milk and milk products is estimated to be 240 thousand tons of milk equivalent, which consists of urban household demand (45 per cent), institutional demand (30 per cent), export demand of 8 per cent (Ministry of Agriculture, 1991) and other demand (17 per cent).

Milk supply during the winter season (flush season) exceeds the demand and milk holidays are observed twice a week by the dairy processing units in the urban areas. In times of milk shortages, the demand is met through imports. Imported dairy products are butter, cheese, tea-whitener, baby foods and small quantities of skim-milk powder (SMP). Demand for milk and milk products is expected to increase due to a rise in urban centers and an increase in the influx of tourists to the country. There is the possibility of exporting yak cheese to neighbouring countries. A higher level of milk production is estimated to be required to meet the increasing demand for milk and milk products in the coming decade (Nepal Dairy Development Board, 2001). This will require substantial improvements in milk productivity per lactating animal, which is possible through the better management of nutritive feeds to the productive cattle. Milk is becoming more and more expensive because of the low productivity of milking animals, expensive feeding practices and a lack of improved breeds. Milk yield per lactation is 370 liters in local cattle whereas for the crossbreeds (Nepali Jersey, Brown Swiss and Holstein) the milk yield is more than 1400 liters per lactation, that is 378 per cent higher than the productivity of local cattle.

1.4.2 Meat production and consumption

Demand for meat is mostly met from buffalo, goat and castrated goats, poultry and pigs. About two thirds of the total meat comes from buffalo. Demand for buffalo meat is particularly strong among the Newar community in Kathmandu Valley, Hetauda, Pokhara, Narayanghat and other hill towns. Large numbers of buffalo are imported from India (about 100 to 115 thousand buffalo per year). Buffalo meat accounts for 65 per cent of the total meat consumption (APO, 1997). Total meat production was 194,258 mt in the year 2000-2001.

After buffalo, goat and castrated goat are the second biggest source of meat, which constitute about 25 per cent of the meat supply in Nepal. Goat meat is equally popular irrespective of castes. Goats are imported on an increasing scale every year from India and China.

1.4.3 Egg production and consumption

Another source of meat and eggs is from poultry birds. A local breed of hen can lay about 67 to 112 eggs per annum compared to 200 and 250 eggs per year from crossbreeds and hybrids. The productivity of local birds is genetically inferior in egg and meat production compared to improved breeds. The live weight of local birds is 619 grams, whereas the live weight of crossbreeds ranges from 1,575 grams to 1,948 grams in the case of Austrohite and New Hampshire breeds.

Per capita consumption of milk, meat and eggs is estimated at 58 liters of milk, 10 kg of meat (with 65 per cent buffalo meat, 20 per cent goat meat and 7 per cent poultry meat), and 25 units of egg in 2000-2001.

To meet the growing requirement of animal products, Nepal imported about 382,454 heads of buffalo, 465,506 heads of goat, 1,703,220 units of poultry birds, 929,276 liters of milk and 2,792,000 eggs in 1998-99. Similarly, exports from Nepal consisted of 36,348 heads of buffalo, 47,266 heads of goat, 33,169 poultry birds, 141,986 liters of milk and 7,197,000 eggs to India (Department of Livestock Services, 2000 and Central Bureau of Statistics, 1999).

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2 The dairy processing units do not collect milk for a few days a week due to over-supply. Milk holiday refers to a day when the Dairy Development Corporation and its collection centers are closed for collecting milk from the milk-producers.
Growth rates of the livestock population for 1990-2000 are presented in Table 1.3.

### Table 1.3 Livestock population of Nepal

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</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>6,255</td>
<td>6,246</td>
<td>6,237</td>
<td>6,546</td>
<td>6,838</td>
<td>7,008</td>
<td>7,025</td>
<td>7,049</td>
<td>7,031</td>
<td>7,023</td>
<td>6,982</td>
<td>1.05</td>
</tr>
<tr>
<td>Sheep</td>
<td>906</td>
<td>912</td>
<td>911</td>
<td>914</td>
<td>859</td>
<td>869</td>
<td>869</td>
<td>855</td>
<td>851</td>
<td>850</td>
<td>-0.56</td>
<td></td>
</tr>
<tr>
<td>Goat</td>
<td>5,367</td>
<td>5,406</td>
<td>5,452</td>
<td>5,524</td>
<td>5,649</td>
<td>5,783</td>
<td>5,922</td>
<td>6,080</td>
<td>6,204</td>
<td>6,325</td>
<td>6,478</td>
<td>1.88</td>
</tr>
<tr>
<td>Pigs</td>
<td>591</td>
<td>599</td>
<td>605</td>
<td>612</td>
<td>636</td>
<td>670</td>
<td>723</td>
<td>766</td>
<td>825</td>
<td>877</td>
<td>912</td>
<td>4.93</td>
</tr>
<tr>
<td>Fowl</td>
<td>13,559</td>
<td>13,496</td>
<td>13,600</td>
<td>13,854</td>
<td>14,063</td>
<td>14,521</td>
<td>15,576</td>
<td>16,664</td>
<td>17,797</td>
<td>18,620</td>
<td>19,790</td>
<td>4.17</td>
</tr>
<tr>
<td>Duck</td>
<td>391</td>
<td>389</td>
<td>392</td>
<td>394</td>
<td>404</td>
<td>416</td>
<td>415</td>
<td>417</td>
<td>421</td>
<td>425</td>
<td>411</td>
<td>0.46</td>
</tr>
<tr>
<td>Milking Cow</td>
<td>689</td>
<td>695</td>
<td>699</td>
<td>739</td>
<td>766</td>
<td>785</td>
<td>816</td>
<td>826</td>
<td>828</td>
<td>840</td>
<td>852</td>
<td>2.15</td>
</tr>
<tr>
<td>Milking Buffalo</td>
<td>750</td>
<td>752</td>
<td>756</td>
<td>786</td>
<td>811</td>
<td>821</td>
<td>857</td>
<td>882</td>
<td>896</td>
<td>910</td>
<td>936</td>
<td>2.25</td>
</tr>
<tr>
<td>Laying Hen</td>
<td>4,206</td>
<td>4,187</td>
<td>4,217</td>
<td>4,295</td>
<td>4,405</td>
<td>4,548</td>
<td>4,887</td>
<td>5,182</td>
<td>5,421</td>
<td>5,668</td>
<td>5,998</td>
<td>3.87</td>
</tr>
<tr>
<td>Laying Duck</td>
<td>202</td>
<td>202</td>
<td>205</td>
<td>207</td>
<td>212</td>
<td>218</td>
<td>218</td>
<td>219</td>
<td>220</td>
<td>222</td>
<td>215</td>
<td>0.58</td>
</tr>
</tbody>
</table>

Table 1.4 Production trend of livestock products (mt)

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk Production</td>
<td>864,831</td>
<td>871,234</td>
<td>876,594</td>
<td>918,609</td>
<td>961,560</td>
<td>1,012,163</td>
<td>1,048,040</td>
<td>1,072,945</td>
<td>1,097,023</td>
<td>1,124,132</td>
<td>1,124,132</td>
<td>2.83</td>
</tr>
<tr>
<td>Cow Milk</td>
<td>256,398</td>
<td>259,230</td>
<td>260,786</td>
<td>278,065</td>
<td>288,822</td>
<td>296,620</td>
<td>310,183</td>
<td>318,680</td>
<td>328,920</td>
<td>337,455</td>
<td>342,738</td>
<td>3.06</td>
</tr>
<tr>
<td>Buff Milk</td>
<td>608,433</td>
<td>612,004</td>
<td>615,808</td>
<td>640,544</td>
<td>682,551</td>
<td>664,940</td>
<td>701,980</td>
<td>729,360</td>
<td>744,025</td>
<td>759,568</td>
<td>781,394</td>
<td>2.58</td>
</tr>
<tr>
<td>Meat Production</td>
<td>147,347</td>
<td>148,695</td>
<td>149,893</td>
<td>154,343</td>
<td>158,748</td>
<td>161,520</td>
<td>174,268</td>
<td>180,675</td>
<td>185,034</td>
<td>189,160</td>
<td>194,258</td>
<td>2.89</td>
</tr>
<tr>
<td>Buffalo</td>
<td>95,312</td>
<td>96,013</td>
<td>96,574</td>
<td>100,383</td>
<td>104,070</td>
<td>104,830</td>
<td>113,482</td>
<td>117,350</td>
<td>119,562</td>
<td>121,769</td>
<td>124,848</td>
<td>2.82</td>
</tr>
<tr>
<td>Mutton</td>
<td>3,029</td>
<td>3,044</td>
<td>3,055</td>
<td>3,067</td>
<td>2,860</td>
<td>2,900</td>
<td>2,903</td>
<td>2,873</td>
<td>2,860</td>
<td>2,856</td>
<td>0.49</td>
<td></td>
</tr>
<tr>
<td>Goat</td>
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<td>29,844</td>
<td>30,377</td>
<td>30,702</td>
<td>30,908</td>
<td>32,040</td>
<td>34,550</td>
<td>35,640</td>
<td>36,235</td>
<td>36,930</td>
<td>37,769</td>
<td>2.60</td>
</tr>
<tr>
<td>Pig</td>
<td>10,242</td>
<td>10,407</td>
<td>10,447</td>
<td>10,642</td>
<td>11,027</td>
<td>11,800</td>
<td>12,374</td>
<td>13,090</td>
<td>13,924</td>
<td>14,646</td>
<td>15,239</td>
<td>4.43</td>
</tr>
<tr>
<td>Chicken</td>
<td>9,138</td>
<td>9,119</td>
<td>9,195</td>
<td>9,291</td>
<td>9,396</td>
<td>9,700</td>
<td>10,671</td>
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<td>12,146</td>
<td>12,659</td>
<td>13,259</td>
<td>4.09</td>
</tr>
<tr>
<td>Duck</td>
<td>254</td>
<td>268</td>
<td>268</td>
<td>270</td>
<td>280</td>
<td>290</td>
<td>291</td>
<td>292</td>
<td>294</td>
<td>296</td>
<td>287</td>
<td>1.04</td>
</tr>
<tr>
<td>Egg Production</td>
<td>369,519</td>
<td>368,164</td>
<td>370,928</td>
<td>378,079</td>
<td>383,122</td>
<td>396,400</td>
<td>421,460</td>
<td>440,910</td>
<td>460,625</td>
<td>480,800</td>
<td>507,323</td>
<td>3.39</td>
</tr>
<tr>
<td>Hen egg</td>
<td>354,296</td>
<td>352,983</td>
<td>355,539</td>
<td>362,589</td>
<td>367,378</td>
<td>380,400</td>
<td>405,462</td>
<td>424,910</td>
<td>444,500</td>
<td>464,530</td>
<td>491,566</td>
<td>3.52</td>
</tr>
<tr>
<td>Duck egg</td>
<td>15,223</td>
<td>15,181</td>
<td>15,389</td>
<td>15,490</td>
<td>15,744</td>
<td>16,000</td>
<td>15,998</td>
<td>16,000</td>
<td>16,125</td>
<td>16,270</td>
<td>15,757</td>
<td>0.31</td>
</tr>
<tr>
<td>Wool Production</td>
<td>767</td>
<td>620</td>
<td>620</td>
<td>621</td>
<td>625</td>
<td>618</td>
<td>623</td>
<td>623</td>
<td>615</td>
<td>615</td>
<td>613</td>
<td>1.82</td>
</tr>
<tr>
<td>Fish Production</td>
<td>8,713</td>
<td>9,125</td>
<td>8,609</td>
<td>8,828</td>
<td>9,542</td>
<td>10,031</td>
<td>11,727</td>
<td>12,373</td>
<td>14,000</td>
<td>14,000</td>
<td>15,320</td>
<td>6.89</td>
</tr>
</tbody>
</table>

2. Objectives

The general objectives of the project are to elucidate and analyze potentials, weaknesses, opportunities, constraints and policy options for the development of feed crop farming in Nepal, in balance with the rapid development of livestock and fisheries in the country. More specifically the objectives are as follows:

1. To analyze historical dynamics and future trends of demand and supply for feed crop products. This includes the analysis of factors determining the production and consumption of feed crops.
2. To evaluate potentials, weaknesses, opportunities and constraints for expanding feed crop farming.
3. To propose possible cooperation schemes for the trade and development of feed crops/products. This involves the examination of feed crop imports and exports.
4. To formulate policy options to promote the sustainable development of feed crop farming in the country.

The fast increases in the consumption of livestock products caused by rapid population growth, coupled with increased per capita income, have resulted in more diversified consumption patterns with more and more livestock and horticultural products. Demand for feed crops has increased in association with increases in demand for livestock products. It is imperative to analyze the prospects of feed crops as raw materials for animal feed. The analysis of feed crops in relation to production, consumption and trade and their potentials and constraints are needed to produce appropriate policy options. It is expected that an increase in demand for feeds and feed ingredients will stimulate CGPRT crop growth, since the main ingredients are maize and soybean. Hence, there is a need to investigate the real conditions, opportunities and constraints for feed crop farming in the country and identify policy options.

2.1 Scope of study

Feed: Feed is the range of food or feeding stuffs available to an animal. Feeding stuffs are a range of potential feeds available to livestock. Among these are fresh forages and pastures, conserved forages such as hay and silages, concentrates and succulent feeds. Feed can also be classified as conventional feedstuffs and non-conventional feed stuffs. Conventional feedstuffs are feed stuffs that have been traditionally used for decades or even centuries. They are normally abundant and are purposely cultivated to support animal production. The examples are maize, rice, wheat, barley, soybean cake, oilseed cake, fish meal, etc. Non-conventional feed stuffs are those by-products derived from the industry due to processing of main products and those feeds which have not been traditionally used in animal feeding and are not normally used in commercially produced rations for livestock.

Concentrate: Concentrate is animal feeding stuffs which have a high feed value relative to their volume. It is a low fibre, high energy feed that is concentrated by a factory-blended source of nutrients needed to increase the nutritional adequacy of feed supplements.

2.1.1 Feed crops

Feed crops are the crops that are utilized as fresh or processed for feeding. For the present study purpose, maize and soybean that are mixed and blended in commercial feeds are taken into consideration. These crops are used in a higher proportion for processing feed. Maize and soybean are used at 40 per cent and soybean/groundnut cake at 15 per cent for producing poultry feed. Similarly, rice bran, mustard cake and maize are used at 30 per cent, 35 per cent
and 10 per cent respectively in cattle feed. In the past, the amount of poultry feed manufactured was higher, with maize and groundnut/soybean used at 40 per cent and 15 per cent respectively, which belong to the group of CGPRT crops. Other crops such as rice brans and mustard cakes are available locally within the country.

To make the study scope manageable and simplified, the conventional sources of feeding regimes including fodder, pasture, forage and grazing, although constituting a major source of feeding in traditional livestock systems, have not been taken into account.

Since the project objective is to evaluate the prospect of feed crop development, it is important to establish the impact of feed crop prices and alternative crop prices. Similarly, it is desired to consider the role of determinants such as technological factors, population and income in the production and consumption of feed crops.

The analytical framework involves total supply and total consumption of feed crops. Total supply of a commodity/feed crop is the summation of domestic production with some imports and carry-over stock from the previous year. Total supply, hence, is used for consumption, some for exports and some to be stocked at the end of the year. Total consumption or demand is made up from food use by humans, feed to livestock and fish and some other uses.

2.1.2 Expected project outputs

The outputs of the present study will essentially consist of the following:

i. To establish a formal model of supply and demand for feed crops and how it is relevant to current policy decisions.

ii. To identify differences and common needs for knowledge to expand trade and cooperation policies among neighbouring countries.

iii. To identify priority areas for policy prescription to improve feed crop production and processing development.

iv. To reinforce an understanding of key issues and policies by people responsible for feed production, market and trade policy formulation.

v. To encourage policy debate among the various decision making levels with an interest in the feed industry.

2.2 Organization of the study project

The project has been coordinated by the CGPRT Centre, which is assisted by one regional advisor and one national expert. The national expert was responsible for implementing the study project activities with the advisory services of the regional advisor. The national expert worked with the nationally designated institutions and collaborated with multi-disciplinary experts such as feed and fodder specialists, livestock production specialists, livestock extension agents, private sector traders and feed processing experts and statistical experts in the country.

The initial findings and recommendations were discussed in a professional workshop in July 2002.

The coordination centre held two meetings in Bogor, Indonesia for the national experts, one planning meeting in September 2001 to discuss project objectives and methodology and a second regional workshop meeting for discussing the findings of the country study in September 2002.
2.3 Approach and method of the study

The preparation of the study report is based upon the following approaches and methodology.

Data required for the study is generated through:

a Rapid rural appraisal and group discussions with the livestock raising farmers in relation to feeding practices, particularly for commercial livestock production of milk, meat and eggs.

b Group discussion with managers of feed processing industries and suppliers of feed ingredients, mainly maize and soybean.

c Interaction with feed and fodder research and extension specialists and private traders.

The collection of secondary and relevant data included data relating to livestock population, production, feed consumption, prices of feed ingredients and blended feeds and prices of livestock products.

The preparation of the study report is also based on the following sources of data:

1. Review of relevant documents on agricultural policy and livestock development master plans and strategies.

2. Review of government policies relating to trade, livestock research and commodity development programs.

3. Secondary data collection relating to population, income, prices, consumption of feed crops and production of livestock feeds in the country by the processing industries, both at the central and field levels.

4. Field enquiry by the national expert and other collaborative team members on feed production research, extension and development.

5. Processing and analysis of data was carried out using the e-view software program for model formulation and recommendations of feed demand and supply prospects.

6. The secondary data, field survey data and other information were used in the analysis and projection, as required by the study. The report has been prepared using compiled information and data generated by the demand and supply analysis in the proposed models.

2.4 Analytical framework

2.4.1 An analytical exercise

Total supply of a commodity is the sum of domestic production and some imports, if any, and a carryover stock from the previous year. Annual production of maize is estimated as the product of its area and yield.

Total supply is used for consumption, some exports and some to be stocked at the end of the year. Total consumption of maize consists of food use by humans, feed to animals and other uses.
Domestic demand for feed crops is the sum of its demand for food, feed and other uses. Food demand is a function of the price of the commodity and the prices of other competing crops, per capita income and total population. Feed demand is a derived demand determined by the changes in livestock production, feed ratios and own and cross price effects of feed crops. The demand for other uses is a ratio of the previous years demand based on food and feed demand changes. Prices are taken as exogenous variables since Nepalese prices are basically influenced by the prices prevailing in the border markets.

2.4.2 Formulation of the model

The model consists of five basic components, which explains the behavior of producers and consumers in the national market. The behavioral equations in the model are acreage function, yield equation, maize demand for food, maize demand for feed, and maize demand for other uses. The model is completed by introducing a market clearing identity of maize supply to equal demand for maize for food, for feed, and for other uses. The assumptions are that net exports or net imports are insignificant, that domestic production (i.e. area x yield) reasonably represents the total supply of maize in the country, which is consumed in different uses. Prices of food crops in the country are very much determined by bordering Indian market prices, and therefore, the price variable is taken here as exogenous.

The model consists of six endogenous variables, two lagged endogenous variables and eight exogenous variables. The empirical model is specified as follows:
2.4.2.1 Model for maize

a) Acreage Function
\[ \ln \text{MAH}_t = A_0 + A_1 \ln \left( \frac{\text{MPP}_{t-1}}{\text{RPP}_{t-1}} \right) + A_2 \ln \text{MAH}_{t-1} \]

b) Yield Function
\[ \ln \text{MYD}_t = B_0 + B_1 \ln \left( \frac{\text{UPP}_{t-1}}{\text{MPP}_{t-1}} \right) + B_2 \ln \text{MYD}_{t-1} + B_3 \ln T \]

c) Maize Demand for Food
\[ \ln \text{MFOOD}_t = D_0 + D_1 \ln \left( \frac{\text{MPP}_t}{\text{RPP}_t} \right) + D_2 \ln \text{PCI}_t + D_3 \ln T \]

d) Maize Demand for Feed
\[ \ln \text{MFEED}_t = E_0 + E_1 \ln \left( \frac{\text{MPP}_t}{\text{RPP}_t} \right) + E_2 \ln \text{MPRD}_t + E_3 \ln \text{EPRD}_t + E_4 \ln \text{MFOOD}_t \]

e) Maize Demand for Other Uses
\[ \ln \text{MOTHER}_t = F_0 + F_1 \ln \left( \frac{\text{MFOOD}_t}{\text{MFEED}_t} \right) + F_2 \ln \text{MAH}_t \]

f) Market Clearing Identity (production of maize equals consumption)
\[ \text{MAH}_t \times \text{MYD}_t = \text{MFOOD}_t + \text{MFEED}_t + \text{MOTHER}_t \]

Definition of variables:
- MAH = Maize area in hectares.
- MYD = Maize yield in mt per hectare.
- MMPRD = Maize production in mt (MAH x MYD/1000).
- MPP/RPP = Relative price of maize to rice.
- UPP/MPP = Relative price of urea to maize.
- MPP = Maize retail price in Rs per mt.
- RPP = Paddy wholesale price in Rs per mt.
- UPP = Urea price in Rs per mt.
- T = Trend (1979 = 1).
- MFOOD = Maize demand for food in mt.
- MFEED = Maize demand for feed in mt.
- MOTHER = Maize demand for other uses in mt.
- EPRD = Egg Production (in ‘000).
- MPRD = Milk production (in ‘000 lt).
- PCI = Per capita real GDP.

2.4.2.2 Model for soybean

The model consists of two basic components which explain the behaviour of producers and consumers in the national market. The behavioral equations in the model are - supply function and demand function. The model is completed by introducing a market clearing identity of soybean supply to equal demand for soybean as a foodgrain. The assumptions are that net exports or net imports are insignificant, that domestic production (i.e. area x yield) reasonably represents the total supply of soybean in the country, which is consumed in different uses. Prices of food crops in the country are very much determined by bordering Indian market prices, and therefore, the price variable is taken here as exogenous. Due to data limitation, a sample size of only 12 years could be considered.

The model consists of three endogenous variables, one lagged endogenous variable and two exogenous variables. The empirical model is specified as follows:

a) Supply Function
\[ \ln \text{SPRD}_t = A_0 + A_1 \ln \left( \frac{\text{SPP}_{t-1}}{\text{CPI}_{t-1}} \right) + A_2 \ln \text{SPRD}_{t-1} \]
Chapter 2

b) Demand Function
   \[ \ln SCON_t = D_0 + D_1 \ln (PCI_t) + D_2 \ln (SPP_t / CPI_t) \]

c) Market Clearing Identity (production of maize equals consumption)
   \[ SPRD_t = SCON_t \]

Definition of variables:
SPRD = Soybean production in mt.
SPP/CPI = Soybean real price (deflated by consumer price index) in Rs per mt.
SCON = Soybean consumption in mt.
PCI = Per capita real GDP.
3. Review of Current Status

3.1 Development of the animal feed sector

It is a proven fact that there is an inherent desire for diverse dietary patterns among us. As income grows, dietary patterns become more diversified with better quality of food staples that is grains substituted by livestock and horticultural crops. In other words, demand for animal products increases while demand for grains as food decreases as per capita income grows. This is observed in the higher per capita growth rate of milk and meat by 2.4 and 4.9 per cent growth, compared to 0.8 per cent growth in cereals per annum in Asian countries. As a derived demand from the livestock population, the demand for feed crops has also been rising at 5 per cent per year in developing economies of Asia. There is a rising demand for grains, particularly maize for feed. The decreasing availability of grazing and pasture grounds has also led to changes in livestock raising systems, from extensive to intensive systems in which livestock are fed with manufactured feeds. Additionally, the demand for blended feeds has increased due to the adoption of modern bred livestock animals that demand manufactured feeds under the stall-feeding system.

Animal productivity in general, is constrained by the shortage of feed, which is estimated at 30 per cent of the total TDN requirement at present. Though the livestock section of the Department of Agriculture was established in 1953, very limited systematic research on animal feed and nutrition has been carried out so far. Some of the available livestock feeds and fodders have been tested for their nutritive value and feeding rations accordingly recommended. Hetauda Feed Mixing Plant, in the government sector, has introduced blended feeds on government livestock farms since 1970-71. Private sector initiatives for the establishment of feed processing have been taken since 1961 by the Ratna feed and hatchery industries in Kathmandu. Pasture and fodder research has been carried out by a number of government institutions since 1970-71. There has been a Pasture and Fodder Production Division under the Nepal Agricultural Research Council since 1983-84 to conduct various fodder and pasture related research activities. There is a pasture and Animal Nutrition Development Unit (1994) under the Department of Livestock Development to provide services to farmers in the different parts of the country. These divisions carry very few research and development works related to commercial manufactured feeds in the country.

The demand for commercially manufactured concentrated livestock feed is basically a derived demand and is influenced by the growth in population, particularly of poultry and dairy animals. There is a steady rise in the population of dairy cattle, especially of improved breeds, which are replacing local cattle. Increasing numbers of improved breeds of cattle are found in Chitwan, Rupendhehi, Kaski, Kabhre, Morang, Sunsari and Kathmandu Valley. At present, the demand for commercial feeds is estimated at 42 per cent from the poultry sector and 58 per cent from cattle and other animals.

The demand for milk, meat and eggs has been rising very fast due to an increase in population and income. This has led to the rapid rise in the demand for manufactured feeds. The demand for feed is based on the production trend of milk, meat, and eggs in the country. Feed conversion ratios of 3, 2.5 and 2.5 kg of feed for producing a kilogram of meat, milk, and egg output has been estimated.

The annual demand for manufactured feeds was estimated at about 632,000 mt in 2000. The existing feed mills are able to produce 410,316 mt of feed which indicates a deficit of 35 per cent of the total requirement. The gap is partly being met by feed available from cereals, legumes and crop by-products, though inadequate and unbalanced from a nutritional point of view.
Chapter 3

3.2 Feed crops and feed ingredients

Maize is the most commonly used cereal grain in poultry feed. It is rich in energy, vitamins, critically limiting amino acid methionine and low crude fiber. It is a highly palatable feed ingredient for livestock and poultry. Maize and other cereals are the by-products locally available in the country.

The other most commonly used legume by-product is groundnut/soybean cake. It is rich in protein, critically limiting amino acid lysine and is also highly palatable. Other locally available oilseed cakes, rice and wheat bran are also used to some extent as animal feed. For cattle feed, the grains used to a greater extent are mustard cake and rice brans.

Feed supplements including minerals, vitamins, amino acids and anti microbial agents are mostly imported from India.

Table 3.1 Animal feed composition (in per cent)*

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Layer</th>
<th>Broiler</th>
<th>Cattle/Buffalo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>40.0</td>
<td>40.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Rice polish</td>
<td>10.0</td>
<td>6.0</td>
<td>-</td>
</tr>
<tr>
<td>Wheat bran</td>
<td>4.0</td>
<td>4.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Rice bran</td>
<td>-</td>
<td>-</td>
<td>30.0</td>
</tr>
<tr>
<td>Roast mustard cake</td>
<td>10.0</td>
<td>5.0</td>
<td>-</td>
</tr>
<tr>
<td>Raw mustard cake</td>
<td>-</td>
<td>-</td>
<td>35.0</td>
</tr>
<tr>
<td>Sesame cake</td>
<td>3.5</td>
<td>5.5</td>
<td>-</td>
</tr>
<tr>
<td>Soya/groundnut cake</td>
<td>6.0</td>
<td>15.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Fish meal</td>
<td>10.0</td>
<td>10.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Meat meal</td>
<td>2.5</td>
<td>2.5</td>
<td>-</td>
</tr>
<tr>
<td>Bone meal</td>
<td>2.0</td>
<td>5.5</td>
<td>-</td>
</tr>
<tr>
<td>Molasses</td>
<td>3.0</td>
<td>3.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Common salt</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Limestone</td>
<td>8.5</td>
<td>2.0</td>
<td>-</td>
</tr>
<tr>
<td>Premix/vitamins</td>
<td>0.1</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Note: * The feed formula is only a typical example and it can vary between manufacturers depending upon the price and availability of feed grains.

According to the demand for feed ingredients for livestock, the processing industry consumes over 277 thousand mt of energy feed ingredients, which constitutes 67.5 per cent of the total. Maize constitutes about 42 per cent of the total energy ingredients. Protein source ingredients constitute about 27.5 per cent in which soybean contributes 10.7 per cent, and minerals and vitamins constitute about 5 per cent of the total feed ingredients.
Review of Current Status

Table 3.2 Use of feed ingredients and amount locally available

<table>
<thead>
<tr>
<th>Feed Ingredients</th>
<th>Local Source per cent</th>
<th>mt</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy source ingredients</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellow maize</td>
<td>72</td>
<td>276,736</td>
<td>67.5</td>
</tr>
<tr>
<td>Rice bran/polish</td>
<td>60</td>
<td>170,938</td>
<td>41.7</td>
</tr>
<tr>
<td>Deoiled rice bran/rice polish</td>
<td>100</td>
<td>41,020</td>
<td>10.0</td>
</tr>
<tr>
<td>Wheat</td>
<td>100</td>
<td>16,992</td>
<td>4.1</td>
</tr>
<tr>
<td>Wheat bran</td>
<td>100</td>
<td>12,270</td>
<td>3.0</td>
</tr>
<tr>
<td>Molasses</td>
<td>100</td>
<td>10,028</td>
<td>2.5</td>
</tr>
<tr>
<td>Protein source</td>
<td>10</td>
<td>112,850</td>
<td>27.5</td>
</tr>
<tr>
<td>Soybean oil meal</td>
<td>0</td>
<td>43,990</td>
<td>10.7</td>
</tr>
<tr>
<td>Til cake (sesame)</td>
<td>10</td>
<td>24,392</td>
<td>5.9</td>
</tr>
<tr>
<td>Sunflower cake</td>
<td>0</td>
<td>20,510</td>
<td>5.0</td>
</tr>
<tr>
<td>Mustard cake</td>
<td>75</td>
<td>12,198</td>
<td>3.0</td>
</tr>
<tr>
<td>Fish meat</td>
<td>0</td>
<td>11,760</td>
<td>2.9</td>
</tr>
<tr>
<td>Minerals/vitamins/additives</td>
<td>48</td>
<td>20,730</td>
<td>5.0</td>
</tr>
<tr>
<td>Bone meal</td>
<td>50</td>
<td>4,102</td>
<td>1.0</td>
</tr>
<tr>
<td>Oyster shell</td>
<td>0</td>
<td>4,284</td>
<td>1.0</td>
</tr>
<tr>
<td>Limestone</td>
<td>100</td>
<td>7,986</td>
<td>1.9</td>
</tr>
<tr>
<td>Feed additives/vitamins</td>
<td>0</td>
<td>4,358</td>
<td>1.1</td>
</tr>
<tr>
<td>Total</td>
<td>54</td>
<td>410,316</td>
<td>100</td>
</tr>
</tbody>
</table>


The number of feed processing industries in the country was 154 in 1999-2000, producing about 65 per cent of the total feed requirement. The local supply of energy source requirements provided about 72 per cent but the percentage of protein source ingredients locally available was only 10 per cent. Similarly, 52 per cent of minerals and vitamins were imported, mainly from India. Overall, the country has to depend on imports for 46 per cent of the total feed source ingredients.

Most feed industries are small processing units producing less than 300 mt a year. There are however, 20-25 processing industries which can produce annually more than 10,000 mt of feed. The capacity utilization is about 60 to 70 per cent mainly due to the unavailability of feed ingredients, lack of proper maintenance of operation plants and irregular supply of hydro power.

These feed processing units are vertically integrated and provide hatcheries, veterinary supplies, health services, livestock input and output marketing services and other support services.

To meet the rising demand for livestock products, it is estimated that a higher annual increment in feed production is required to meet the required feed supply in the future (FAO/RAPA, 1999). At present, the percentage of feed consumed by poultry is 42 per cent and 58 per cent by cattle.

The large commercial feed processing mills (numbering 20 to 25) are located mostly in Kathmandu Valley and other urban areas such as Chitwan, Pokhara, Biratnagar, which supply about 65 per cent of the feed requirement.

There was one government run animal feed manufacturing plant in Hetauda (1970-71) with a production capacity of 2 mt per day. This plant produces and supplies to government research farms and is currently operated at 50 per cent capacity.
Chapter 3

The quality of the feed manufactured in Nepal is monitored by the Department of Food Technology and Quality Control. The standards for feed composition are set under the Animal Feed Act of 1976. Nepal Feed Regulation Act 1984 prohibits unwanted adulteration and does not allow the reduction or removal of natural properties and utilities of any feed ingredients.

Larger processing mills receive their feed grain supplies directly from local feed ingredient suppliers and also imports from India. Local ingredient suppliers also supply ingredients to small processing units. The major feed manufacturers distribute their product through small dealers and about 5 per cent of the feed is directly supplied to commercial livestock and poultry enterprises. The dealers provide their clients with veterinary services, input and output marketing services and credit arrangements for livestock raising purposes. The manufacturers are the price setters for the feed and associated inputs and outputs.

Table 3.3 Number of major feed processing industries by district in 1999-2000

<table>
<thead>
<tr>
<th>S. No</th>
<th>District</th>
<th>Number of Industries</th>
<th>Annual Production in mt</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kathmandu</td>
<td>30</td>
<td>192,848</td>
<td>47</td>
</tr>
<tr>
<td>2</td>
<td>Lalitpur</td>
<td>4</td>
<td>12,309</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Bhaktapur</td>
<td>16</td>
<td>28,722</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>Kabhre</td>
<td>5</td>
<td>12,305</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Dhanding</td>
<td>1</td>
<td>8,206</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Chitawan</td>
<td>18</td>
<td>41,038</td>
<td>10</td>
</tr>
<tr>
<td>7</td>
<td>Makwanpur</td>
<td>8</td>
<td>16,412</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>Kaski</td>
<td>14</td>
<td>12,309</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>Tanahu</td>
<td>2</td>
<td>8,206</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>Parbat</td>
<td>1</td>
<td>4,103</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>Nawalparasi</td>
<td>1</td>
<td>4,103</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>Rupandehi</td>
<td>4</td>
<td>8,206</td>
<td>2</td>
</tr>
<tr>
<td>13</td>
<td>Siraha</td>
<td>1</td>
<td>12,309</td>
<td>3</td>
</tr>
<tr>
<td>14</td>
<td>Sunsari</td>
<td>1</td>
<td>16,412</td>
<td>4</td>
</tr>
<tr>
<td>15</td>
<td>Morang</td>
<td>1</td>
<td>8,206</td>
<td>2</td>
</tr>
<tr>
<td>16</td>
<td>Jhapa</td>
<td>1</td>
<td>4,103</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>Others</td>
<td>46</td>
<td>20,520</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>410,317</td>
<td>95</td>
</tr>
</tbody>
</table>


The production of feed is concentrated in Kathmandu Valley followed by Chitwan and annual production was estimated at 410,316 mt in 1999-2000.
4. Agricultural Policies

4.1 Production policies

The importance of the livestock sector is well recognized in the long term Agricultural Perspective Plan (APP) of 1995-2015 (National Planning Commission, HMG/N, 1995). Under the APP, the livestock sector is planned to grow from 2.9 per cent per annum in the initial years to 6.1 per cent in the last five-year period of APP. Thus, APP is the guiding document of the agricultural planning and policy framework in Nepal.

The Ninth Development Plan recognizes that the livestock sector can play a productive role only if there is expansion in crop production. Agricultural improvements create income growth and in turn generate expansion in the livestock sector by providing a better-feed base and supply of feed ingredients. The commercial development of livestock, which is the objective of APP, entails the buying of inputs, such as commercial blended feeds and the selling of livestock outputs.

To support the livestock growth envisaged under the APP, it is imperative to accelerate the production of quality animal feed along with the growth of traditional sources, such as natural grazing and crop by-products. This will require improved and focused research on livestock feed and nutrition (National Planning Commission, HMG/N, 1998).

It has been long recognized by government policy documents that the livestock sector is constrained by the lack of appropriate breeding, health, nutritive feed and management factors. Productivity of the livestock population is constrained by a lack of appropriate research on the above listed factors. The productivity of a pair of bullocks at the plough varies from 0.8 to 3.2 hectares of ploughing per day.

The milk yield of a female buffalo is reported to average about 2 litres/day or between 400-500 kg per lactation, of which 300 kg would be consumed by the suckling calf. The local cattle yield only 0.7 litres/day. Very few studies have been undertaken to determine the feed requirements of the productive cattle for their optimal performance and production. However, a blanket requirement of 5 kg of green fodder, 12.5 kg of dry fodder and 0.5 kg of oilseeds for the daily maintenance of cattle has been established.

Research on animal husbandry, pasture and fodder has only recently started to be undertaken and is seriously handicapped by the lack of resources, personnel and priority (World Bank, 1974).

Priority in livestock production during the early stages of livestock development was focused more on reducing the incidence of infections and parasitic diseases through veterinary services. Secondly, more emphasis was given to the introduction of improved/exotic breeds of livestock and new forages to improve local production sources. Research was carried out more on producing crossbred animals and forage seed and seedling distribution to small farms. Little monitoring has been undertaken on the impact of improved breed distribution and management (National Agricultural Research Centre and ADB, 1991).

Research in animal nutrition has been limited but recently, studies on oats and silage as supplementary feeds for dairy cattle were carried out.

A large proportion of livestock research has been of little relevance to farmers since insufficient attention has been paid to farmer’s problem in the design of research programs.

Government policy over the years has been to provide research and extension services to the livestock sector free of charge. Full or partial subsidies have been provided on livestock inputs such as animal breeding, fodder seeds, medicines and other inputs. Government programs and policies were more oriented to control prices and the free movement of food grains according to demand driven conditions. Excessive administrative procedures such as in the
processing of foreign exchange requests, overvalued exchange rate policies and the unofficial imposition of tariffs on animal products in trade/export/import has inhibited livestock development (HMG/N, 1993).

The main strategy of the Government’s livestock policy is to satisfy the minimum per capita calorie requirement in terms of milk, meat and eggs through improvements in livestock productivity. Shortage of feed has remained one of the most crucial constraints in the dairy development program. The policy objective has been to improve feed and fodder resources for livestock on a sustainable basis (HMG/N, MoA, 1991). However, these policy objectives have not been supported by priority programmes, resource allocation or availability of trained manpower on feed and fodder research and development activities. To reduce the pressure of the existing cattle population on feed and fodder resources, it is required that the excessive population of unproductive local cattle be reduced. The prohibition of service to inferior cows must be popularized to have the selective growth of improved breeds and reduce the pressure on the existing fodder and feed base. A program to reduce the bovine population by restricted breeding has not yet been implemented. Less productive livestock males need to be castrated and replaced by improved breeds and productive animals through artificial insemination programs. Unfortunately, these strategies have not been part of the government’s plans and programs (World Bank, 1994).

Government support programs to supply livestock feed ingredients (maize, soybean and other inputs) are not yet seen on a pronounced basis. Regulatory measures to control price and quality of feeds are sometimes implemented more as a policing activity than to facilitate the feed producing and consuming entities. Price and quality regulatory mechanisms for livestock products are occasionally implemented but are not effective in the livestock market.

4.2 Price policies

The range of price policies available for Nepal is limited because of the open border situation with neighbouring countries. The Indian market is so big that no change in the quantity exported to India can change the Indian price, nor does any change in the quantity imported from India. There is little Nepal can do to prevent trade with India due to the open border situation covering 500 miles. Trade with China is very much limited.

Hence, Nepal cannot have any independent price policy of its own. The price policy must concentrate therefore, on costs and returns of alternative exchange rates and on the efficiency of marketing.

The three Indian states of Bihar, West Bengal and Uttar Pradesh provide a huge market for Nepal and Nepal is, in effect, a small part of that huge Indian market. Nepal’s prices for most agricultural commodities are largely determined by Indian market forces. Nepal can export as well as import any quantities to and from India without changing Indian prices. Nepal’s policy has been to capitalize on opportunities offered by Indian market potentials rather than establish a price policy of its own.

4.3 Exchange rate policies

In most countries, the foreign exchange rate is the single most important instrument of agricultural price policy. A realistic exchange rate facilitates export and import trade. Nepal has a free convertible exchange rate against the Indian rupee and follows rationing of foreign exchange. At present, the Nepalese rupee is overvalued by 20 to 30 per cent against Indian currency. In this situation, exporters from Nepal receive fewer rupees for their dollar earned and importers of goods receive more dollars for their rupee. Importers who obtain a license and foreign exchange can buy scarce resources and make high profits. If the Nepalese rupee is devalued by 10 to 20 per cent against the Indian rupee, exporters would be encouraged because
Agricultural Policies

they could receive 10 to 20 per cent more rupee for a ton of rice or wheat. In the long run, a more realistic exchange rate means a more competitive export sector and import substituting sector providing higher incomes to the country. The effect of overvalued currency is to damage local production and encourage consumption of imports.

The government’s effort to provide a minimum support price for grains, with an intention to provide higher prices to farmers has not been successful so far. Similarly, the distribution of subsidized food grain in the food-deficit districts with a view to stabilize prices in the past, has created more problems than price control.

4.4 Agro-processing policies

The Agricultural Perspective Plan (APP) anticipates that exports, particularly to India, will play a crucial role in the development of agricultural businesses and processing in Nepal. Export trade development will require robust agribusiness operations based on cost competitiveness. Agribusiness and processing in Nepal represents about 10 per cent of the Gross Domestic Product. Nepal’s industrial enterprises total about 2,387 of which 90 per cent are agri-based processing units and business enterprises. Nepal’s small farmers have had limited access to the commercial markets. Farmers have not yet developed agri-business skills and their relationship to market intermediaries is limited to village level traders and collectors.

Excess agricultural produce is generally sold in primary raw material form directly to consumers and traders without any processing by farmers.

Agricultural processing is needed to add value, to add time utilities and to extend the storage life of many perishable agricultural commodities such as livestock products of meat, milk and other products.

Agricultural processing units in Nepal are mostly based on agricultural commodities such as rice, wheat, maize, mustard, pulses and some horticultural products like tomato, vegetables, orange, mango, ginger and medicinal plants.

The Industrial Enterprises Act of 1992 has been revised to support a one-window tax system to eliminate numerous taxes and charges currently being encountered in export trade. However, the multi-barrier tax system and non-tariff barriers still discourage agri-business. The Industrial Policy is lop-sided in the sense that it has biased approaches and incentive systems for agro-based industries. Agro-based industry is a major industry in Nepal and its promotion is managed by the Industrial Promotion Board without input from the Ministry of Agriculture. The rate of interest charged on credit for agri-business is as high as for other commercial operations. Nepalese quality control measures do not carry prosecution to prevent misuse of trademarks, which may inhibit the development of agri-processing industries for export businesses.

In relation to livestock development, feed industries established to produce feed for livestock are not operating at full capacity due to a low supply of raw materials, mainly maize and soybean. The government doesn’t seem concerned to regulate the supply of raw materials to the feed processing industries. The quality of feed supply is sometimes poor due to moisture problems in maize and the non-availability of appropriate storage conditions. The raw materials of maize and soybean, though available inside the country, are widely dispersed in small amounts and are costly to assemble in large quantities. There is no organized market structure for collecting feed crops from small producers.

Maize production and yield have been almost stagnant in the mid hills for a number of years. There is demand for maize for food, feed and other purposes but the supply is becoming limited. There is an immediate need to improve the yield of maize on the marginal land in the hills which is rain-fed and suffers from a lack of fertility. This crop is grown by poor farmers on smallholdings.

The Government must facilitate to develop a supply contract for maize and soybean to feed processing industries, feed ingredient traders and farmers to guarantee and regulate the supply of quality maize to feed producers. Appropriate research, extension, credit and price
adjustment arrangements should be developed by the concerned stakeholders with assistance from the government.

Agricultural entrepreneurs recognize the need for better roads, a reliable supply of electricity and appropriate technology to develop cost competitive agri-businesses with Indian counterparts. Additionally, the processing units in Nepal are so small in capacity and numerous in number that they tend to have limited economies of scale and as a result, are driven out of the market on the condition of price, quality, volume and regularity of supply.

Significant policy changes are needed to foster agricultural processing units including stable and remunerative tax structures, transport rules and regulation and a commitment to improve quality and cost effectiveness. It is important that government incentives and investments do not distort the market and create disincentives for private sector investments as has so often happened in the past. Industrial policies though, have tried to give or make provisions for incentives to agri-processing units, however, the policies have not been implemented in action as per the spirit. There are deviations between concessions provided by the act and provisions made in the national budget. As a result, industries such as the textile mills in Simra, malt projects in Hetauda, sugar mills in Dhangadi, Nepalgunj, the oil mill in Nepalgunj, the Indreni soybean mill in Kathmandu and others were abandoned in the recent past. The existing oil mills in Banke, Nepalgunj are facing a shortage of raw material in the form of oilseeds and a soybean oil-processing factory in Simra is also importing most of its raw materials from other countries. In all of these cases, the reasons for the failure or closure of the industries have been the lack of raw materials, inadequate government support, excessive bureaucratic controls and deviation from policy in the implementation of activities for developing industries.

Agri-processing units using primary products as raw materials such as rice, oil and pulses were established mostly in the private sector and are widespread throughout Nepal. The second set of agricultural production support industries, such as livestock feed, seed processing, agricultural tools and milk processing were mostly established as both public and private sector enterprises. Thus, the agri-processing industries have concentrated in seeking opportunities through market penetration at the earlier stages, which include grain mills, sugar mills, fruit processing units and feed processing units. A second set of industries sprang up, which had growth potential to market development opportunities. Those are milk processing, tea processing and oil expelling industries.

A third set of processing units are at the development crossroads, which have export potential. These are high value products like honey, spices, mushrooms, animal feed pellets, instant noodles, sericulture, floriculture and herbal products.

The main agricultural processing industries related to the livestock sub sector are those involved with dairy, meat, leather, carpet, animal feeds and other livestock inputs such as vaccines. All of these processing units, except the manufacture of carpets, were initiated in the public sector and later diversified and were replicated in the private sector.

The performance of public sector agro-processing units such as the leather tanning industry and vaccine production units are poor by commercial standards and have gone out of operation or transferred to the private sector for effective management. The leader in the public sector is the Dairy Development Corporation, which has to compete with a large number of recently established, private dairy processing industries in urban areas.

There are 154 animal feed processing industries spread over 23 districts of Nepal, but there are only 10 to 15 feed processing industries that continue to operate on a commercial scale.

The most important commercially competitive, livestock related industry is the carpet industry, which has increased its export volume to 1,000,000 square meters in the 10 years ending 1990. The industry is rated as the top most foreign exchange earner, which is managed and owned largely by the private sector.
Agricultural Policies

Government assistance to agro-industry includes credit, training, incentives for foreign investors and export marketing support but the effectiveness of this support is very much limited due to a lack of clear cut government policy and bureaucratic tendencies in providing incentives.

The major constraints to agricultural processing development are the poor availability of raw materials, a limited domestic market, lack of cost competitiveness and economies of scale, inadequate government assistance and tax structures that encourage imports of Indian commodities (Nepal Feed Industry Association, 2001).

Export markets are competitive and demand quality products. Nepalese entrepreneurs are not adequately trained and have little exposure to international market conditions.

With liberalization of the economy and trade in the region, Nepal should extend its vision for a broader market and prepare an industrial base to produce quality products at a competitive price.
5. Trading Policies Likely to be Affected by WTO/International Agreements

Nepal, a landlocked country and ranked as one of the least developed countries, has no access to ports for trade with the outside world. Trade and transit treaties with India and China govern the trade regime of the country. In the past, there was little trade with China, which was also on a state-trading basis. Trade was largely with India, both on a state and private basis. Nepalese products have limited access in those markets due to protectionist and restrictive policies in the past. Nepali traders and manufacturers have limited markets within Nepal, which are dominated by low-income consumers and geographically scattered markets. There was little scope for realizing economies of scale and cost competitiveness and of benefiting from the larger markets of India and China.

With liberalization and the free trade regime popularized through the World Trade Organization (WTO), Nepal can access international markets without any hindrance of land and sea routes.

If Nepal attains WTO membership in the near future, Nepal can take advantage of using the WTO for arbitration and dispute settlement procedures for having the trade barriers solved in a situation of a landlocked country. Nepal has already least developed country status facilities but local production has to compete with imports at world market prices. Nepal, as an active member of South Asian Association for Regional Cooperation (SAARC), can also benefit from the SAARC Preferential Trading Arrangement (SAPTA) as a trading block with its members.

WTO membership implies that member countries are obliged to grant certain rights and access, freedom of transit, country status, dumping protection, reduction of protectionism and increased grain prices without subsidies. Nepal, being a landlocked country, will have complete transit rights via the shortest and most convenient routes to the sea. There will be a phased reduction of agricultural subsidies and export subsidies among the WTO member countries.

However, the provision of sanitary and phytosanitary measures (SPSM’s), a sort of backdoor protectionism, is sometimes treated as a disincentive measure for developing countries to have access to markets in developed countries (Winrock International, 1996). This may not act as protectionism if applied to protect human, animal or plant life or health in the importing countries. Freedom of transit is of very specific importance to Nepal. In the absence of WTO rights, Nepal’s access to the sea is governed by the Trade and Transit Treaty of 1960 with India, to use Calcutta port, which is one of the most congested and shallow ports and cannot handle large vessels for bulk transportation.

Nepal has suffered in the past from the dumping of subsidized goods from neighbouring countries. Most often, the subsidy-generated surpluses from abroad are dumped in the local market. Nepali products have to compete with not rival producers but with the national treasuries of richer countries. This will become minimized in the trading arrangements with WTO member countries in the future.

After accession to WTO membership, there will be no distinction on the basis of the flag of vessels, the place of origin, departure, entry, exit or destination or on any circumstances relating to the ownership of goods, of vessels or of other means of transport.

There will be no unnecessary delays or non-tariff restrictions to the traffic coming from or going to territory of the contracting parties. These shall be exempt from custom duties, transit duties and other charges in respect to transit. If Nepal attains WTO membership, it can have the legal right to transship goods through India using any convenient port of entry or exit.
Chapter 5

For Nepal, there are benefits to be realized of being a WTO member. Cereals are not the only crops which Nepal can export. There are high value crops, off season vegetables and fruits, medicinal plants and herbs, legumes and pulses that can be exported to other countries after the subsidy reduction of these commodities by importing countries.

Trade policies would be significantly affected by the upcoming international trade and transit agreements such as WTO and SAPTA. Changes would have to be initiated now to capitalize on the opportunities offered by the new world trading order. These changes would open up new trading opportunities based on comparative advantage principles.

The trade liberalization concept, under the South Asian Preferential Trade Agreement (SAPTA), has not materialized yet among the South Asian country members. Though there is scope for reaping benefits under this trade regime, Nepal is far behind in the steps to meet the quality and cost competitiveness for international trade.

Since the restoration of democracy in 1990 and the announcement of liberalized economic policies, Nepal has tried to convert itself from a high tariff import regime to a liberal one, with tariff rates reduced and simplified. Subsidies have been reduced or eliminated in agricultural inputs and outputs.

The requirements to be met to reap the benefits from change in the policies of new international trade are:

1. Total Quality Improvement: Nepal should improve its competitive edge in external trade, which needs improvements in the quality of products, as demanded by consumers in high level income markets. The livestock products with comparative advantage for production with quality are yak cheese and butter, which if packed in appropriate sizes and manufactured as per international specifications can command the external markets.

2. Promotional Requirements: If Nepalese fruits, vegetables, medicinal plants and herbs and woolen carpets can be properly advertised and promoted as manufactured on pure Himalayan climate with little application of chemicals they would command a good number of markets outside.

3. Reduction in Marketing Costs: To make Nepalese products more cost competitive, there is a need for reducing marketing costs through the development of transport infrastructure, improvements in research and extension services on production and post harvest operations. Inputs for production such as electricity, cold storage facilities and water supplies are also to be assured.

Timely changes and improvements are needed in trade and economic policies to stay ahead of the external trade opportunities provided by the new world trading order.

Nepal’s feed industry will have to face direct competition from India and other neighbouring countries. Once Nepal becomes a member of WTO, the country may face difficulties unless Nepal improves the quality, efficiency and cost competitiveness of production. As the ingredients are of a bulky nature and transport systems are rudimentary, Nepal will have to face the problem of higher marketing costs as well.
6. Demand for Feed and Feed Crops

6.1 Consumption behaviour

Per capita consumption of livestock products (meat, milk and eggs) is expected to increase along with an increase in income and a desire for wholesome nutrition by the growing population. According to predictions to year 2020 by FAO, meat, milk and egg consumption will grow at 3.7 and 3.1 and 4.3 per cent per annum respectively, in less developed countries.

The demand for feed is a derived demand and depends on the size of the livestock population. As per capita demand for animal protein increases, the result would be an increased demand for feeds and feed crops.

The population of Nepal was estimated at 22.9 million in 1999-2000 and is expected to grow at 2.5 per cent per annum. Income per capita is expected to grow at 2 per cent during the tenth plan period (2002-2007). The implications of this growth in population and income is that a major increase in livestock products will have to be produced to meet consumption as well as export requirements.

A substantial increase in population will occur in the urban areas. This will affect the types of livestock product and location and scale of production required.

Per capita consumption of livestock production in 1990-2000 and projected consumption are given in Table 6.1.

<table>
<thead>
<tr>
<th>Table 6.1 Per capita consumption of livestock products</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999-2000</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>Milk (kg)</td>
</tr>
<tr>
<td>Meat (kg)</td>
</tr>
<tr>
<td>Eggs (Nos.)</td>
</tr>
</tbody>
</table>

Source: Department of Livestock Services, 2000, Kathmandu.

In order to meet the increased per capita requirements by 2010, the level of production required is tremendous. The livestock population will have to increase and that will demand more feed, especially from poultry, dairy cattle and meat animals. The annual growth trend in demand for meat, milk and eggs was 2.9 per cent, 2.3 per cent and 3.3 per cent respectively.

Since urban consumption levels are higher than for rural ones for meat and eggs, the production pockets will have to be located in accessible areas. In the case of milk, consumption is high in rural areas due to the availability of milk and the difficulty in transporting it to urban areas.

The regional growth of nutritive livestock products will be centered in the Tarai due to a higher density of population in Tarai.

6.2 Consumption structure

Inadequate feed resources, qualitatively and quantitatively, is one of the major constraints to livestock resource management and increased animal production.

Available feed resources can be divided into:

(a) Low quality roughages (natural pasture and crop residues).
(b) High quality roughages (fodder crops, legumes, trees).
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(c) Agro-industrial by-products (milling by-products, oil meal and cakes), concentrates (compound feed of grains and agro-industrial by-products), and supplements (vitamin and mineral mixtures, urea, molasses blocks, by-pass protein).

At present, most of the feed supply for ruminants comes from rangelands, pastures and crop residues, which do not compete with human consumption.

Due to reduced grazing resources and increased demand for livestock products, the recent phenomenon has been to switch to high nutrient density manufactured feeds. Commercial feed is fed mainly to dairy cattle and poultry birds raised for milk, meat and egg purposes. Farmers supplement cattle feed with crop residues, fodder and forages to save on the cost of commercial feed.

Demand for Feed crops: The feed processing mills are supplied feed ingredients, particularly maize, on an annual contract basis from regular suppliers. They collect ingredients like rice bran, oil cakes, wheat bran and soybean cakes from paddy, wheat oil and soybean processing industries.

Smaller feed processing units collect the ingredients from the local middlemen and grain merchants. About 72 per cent of raw materials are estimated to be available within the country and only certain minerals, vitamins and proteins are imported.

The demand for poultry feed is fast rising. The local feed industries are not able to meet the rising demand and farmers in the Tarai areas are compelled to buy Indian manufactured feeds, which are available at lower prices due to the open border situation. The demand for cattle feed is also increasing along the milk-production pockets. Dairy cattle are stall-fed and require higher amounts of feed for lactating animals. The percentage of feed demand is 42 per cent for poultry and 58 per cent for cattle and other animals (such as draught animals, castrated goats and fisheries, etc). Feed demand for fisheries is not significant in Nepal.

The number of improved cattle is fast rising in the central, eastern and western development regions of the country and farmers treat the improved cattle as an important asset feeding the quality feed to their milk cattle. The population of improved breeds of poultry is estimated at 50 per cent of the total poultry population (Department of Livestock and APROSC, 1995).

The annual growth in demand for livestock feeds is rising at a rate of 3.24 per cent per annum. The variation in annual growth rate is 2.77 per cent in the case of feed for milk animals, 3.17 per cent in the case of feed for meat production and 4.25 per cent in the case of feed demand for egg production from poultry birds. Details are given in Table 6.2.

Table 6.2 Demand for concentrate feeds for production of livestock products

<table>
<thead>
<tr>
<th></th>
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<td>72</td>
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<tr>
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<td>153</td>
<td>158</td>
<td>168</td>
<td>176</td>
<td>184</td>
<td>192</td>
<td>4.25</td>
</tr>
<tr>
<td>Total</td>
<td>529</td>
<td>542</td>
<td>574</td>
<td>597</td>
<td>615</td>
<td>632</td>
<td>3.24</td>
</tr>
</tbody>
</table>

Assumptions:
Assuming all milch cattle are fed with commercial feeds.
Feed requirement for body maintenance not included.
Feed consumption efficiency of livestock and poultry for milk, meat and egg production estimated at 3:1, 2.5:1 and 2.5:1 respectively.
Source: Department of Livestock and APROSC, Kathmandu, 1995.
The scattered demand for feeds by the small-scale poultry and dairy farmers is being met by local feed dealers. These dealers also act as veterinary agents, suppliers of day-old chicks and buyers of poultry birds and eggs. In the case of milk, there are dairy cooperatives who collect milk from farmers and supply feeds.

### 6.3 Feed and feed crop prices

Feed prices are determined through the interaction of demand and supply of feed crops. Major feed crops affecting feed prices are maize and soybean. Maize prices have consistently risen over the last few years. Maize price per kilogram has increased from Rs 4.76 to Rs 14.00 in the local market, registering a 20 per cent increment over the period of 1990 to 2001. The demand for maize is increasing both for manufacturing of feed and for meeting the food needs of the growing population. The price of soybean has increased by 9.71 per cent over the same period.

|----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-------------------|


Feed processing industries are competitive in the sense that there is no control over prices. There is free entry and exit in the industry. The prices are governed by the market prices of feeds across the border and are generally higher by 15 to 20 per cent depending on the transportation costs. The average prices of different types of animal feeds are given in Table 6.4.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Starter Ration</td>
<td>6.75</td>
<td>7.10</td>
<td>8.40</td>
<td>5.15</td>
<td>10.10</td>
<td>10.10</td>
<td>11.10</td>
<td>13.40</td>
<td>14.00</td>
<td>14.90</td>
<td>12.00</td>
</tr>
<tr>
<td>Grower Ration</td>
<td>5.60</td>
<td>6.30</td>
<td>7.30</td>
<td>7.85</td>
<td>8.65</td>
<td>8.65</td>
<td>9.70</td>
<td>11.75</td>
<td>12.40</td>
<td>13.90</td>
<td>14.82</td>
</tr>
<tr>
<td>Layer ration</td>
<td>5.70</td>
<td>6.35</td>
<td>7.40</td>
<td>8.00</td>
<td>8.85</td>
<td>8.80</td>
<td>9.80</td>
<td>11.90</td>
<td>13.65</td>
<td>14.30</td>
<td>15.08</td>
</tr>
<tr>
<td>Broiler Ration</td>
<td>7.20</td>
<td>7.60</td>
<td>8.90</td>
<td>9.60</td>
<td>10.70</td>
<td>10.65</td>
<td>11.75</td>
<td>14.20</td>
<td>15.00</td>
<td>15.60</td>
<td>11.66</td>
</tr>
<tr>
<td>Cattle Feed</td>
<td>4.43</td>
<td>5.10</td>
<td>6.10</td>
<td>6.54</td>
<td>7.50</td>
<td>7.40</td>
<td>8.30</td>
<td>9.80</td>
<td>10.70</td>
<td>11.90</td>
<td>16.86</td>
</tr>
</tbody>
</table>


The prices of eggs, poultry meat and milk show an increasing trend. This indicates that livestock farming, especially the dairy and poultry industry, is expanding along with the increased prices for livestock products (Table 6.5). There is a clear indication that this trend will continue in the future which is supported by the increase in per capita income and increased demand for nutritive food by the growing population.
If there is a slackness in the growth of feed processing industries and existing industries are not operated at their optimum capacity, there will be a widening gap between the feed requirement and supply in the country. Priority should be given to the establishment of private feed industries, along the poultry and dairy development corridors, so that increased feed supplies can be produced locally.

6.3.1 Prices of livestock products, feed ingredients and concentrated feeds

Increases in prices of meat, milk and eggs were observed for the period 1990 to 2001. Prices of feed ingredients, in terms of maize and soybean, also demonstrated an increasing trend. Positive trends in prices for major concentrated feeds are also observed, which are induced by increased demand for feed concentrates.

Feed processing industries are operating without control from the government system. Acts and regulations are not implemented effectively. Most of the feed industries operate on a competitive basis but they operate below their installed capacity due to a lack of raw materials and the smallness of the feed market. Some quantities of the required ingredients such as maize and soybean, are mostly collected on a local basis but the quality is doubtful. Other ingredients such as minerals and vitamins are imported.

The present supply of feed is not adequate to meet the growing demand for feed in Nepal. There is a fast growing poultry and dairy sector in Nepal which consumes the larger part of the feed supply. Due to the bulky nature of feed and high transport costs, the feed industries are generally located near the feed consumption markets.

It has been estimated that a high annual increment percentage in animal feed production will be required to meet the demand for livestock products in the coming decade (2001-2010). The annual demand for feed is projected at 976,216 mt in the coming decade (FAO/RAPA, 1999) as compared to 410,316 tons in 2000.

It was reported that there is a lack of adequate and quality maize supply within the country, which forces the feed manufacturers to resort to imports from India. Even though there is a quantity of maize available from the small individual producers, it is difficult for the manufacturers to collect small quantities from a multitude of producers which involves higher transport costs and collection costs. Additionally, the quality of the maize is not optimum because of the higher moisture content in it.

6.3.1.1 Price trends

Prices of feeds for layer poultry birds rose by 15 per cent per year during the period 1990-91 to 1999-2000.

The price of starter rations and grower ratio have also increased by 12 and 14 per cent respectively. Cattle feed prices demonstrated a 16.86 per cent annual increment during 1990-91 to 1999-2000.

The higher price of feeds is derived partly from the increase in maize and soybean prices that rose by 19.53 per cent and 9.17 per cent respectively, during the comparison period.

The increase in livestock product prices is due to the higher demand and limited supply of livestock products. Meat prices registered a higher price increment of 11 per cent in the case of chicken, 16 per cent for mutton and 16 per cent for buffalo meat annually during 1990-91 to 1999-2001 period.

Similarly, the price of milk has shown a 12.98 per cent increment on an annual basis followed by 9.43 per cent for the price of eggs. Details are given in Table 6.5.
Demand for Feed and Feed Crops

Table 6.5 Trends of retail prices for livestock products

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mutton</td>
<td>66.65</td>
<td>75.18</td>
<td>84.12</td>
<td>89.98</td>
<td>96.16</td>
<td>105.17</td>
<td>120.30</td>
<td>137.37</td>
<td>151.40</td>
<td>158.96</td>
<td>180.00</td>
</tr>
<tr>
<td>Chicken</td>
<td>66.94</td>
<td>69.87</td>
<td>75.48</td>
<td>84.42</td>
<td>87.21</td>
<td>98.83</td>
<td>113.48</td>
<td>124.92</td>
<td>128.34</td>
<td>135.41</td>
<td>140.00</td>
</tr>
<tr>
<td>Buffalo</td>
<td>27.36</td>
<td>31.57</td>
<td>34.83</td>
<td>37.19</td>
<td>43.87</td>
<td>49.56</td>
<td>53.12</td>
<td>54.97</td>
<td>63.40</td>
<td>69.45</td>
<td>73.50</td>
</tr>
<tr>
<td>Hen egg</td>
<td>2.31</td>
<td>2.42</td>
<td>2.63</td>
<td>3.93</td>
<td>3.20</td>
<td>3.53</td>
<td>3.80</td>
<td>3.88</td>
<td>4.16</td>
<td>4.38</td>
<td>4.49</td>
</tr>
<tr>
<td>Milk</td>
<td>9.57</td>
<td>11.01</td>
<td>11.47</td>
<td>12.72</td>
<td>13.31</td>
<td>14.89</td>
<td>16.93</td>
<td>17.65</td>
<td>19.34</td>
<td>20.31</td>
<td>22.00</td>
</tr>
</tbody>
</table>


6.4 Consumption response to market forces

In the following section, an attempt is made to see the consumption response of maize and soybean to market forces.

6.4.1 Maize demand for food

\[ \ln MFOOD_t = C_0 + C_1 \ln (MPP_t / RPP_t) + C_2 \ln PCI_t + C_3 \ln T \]

Estimation method: OLS

Number of observations: 20 (1980-1999)

Table 6.6 Maize demand for food

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Estimates</th>
<th>t-statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>C_0</td>
<td>11.86746</td>
<td>40.38</td>
</tr>
<tr>
<td>C_1</td>
<td>-0.073276</td>
<td>-0.38</td>
</tr>
<tr>
<td>C_2</td>
<td>0.255591</td>
<td>5.64</td>
</tr>
<tr>
<td>C_3</td>
<td>-0.164022</td>
<td>-3.41</td>
</tr>
</tbody>
</table>

R-squared = 0.80; Adjusted R-squared = 0.76; D-W statistics = 1.78.

The estimated function (Table 6.6) explains 80 per cent of the variations in maize demand for food and d-statistics indicate the estimated function is free from autocorrelation.

The price response to demand for maize for food purposes is, as expected, negative and small (-0.07), but not statistically significant. The main factor influencing food demand for maize comes from an increase in the income of the people. The results show that an increase of one per cent in income would lead to a corresponding increase by 0.26 per cent in maize demand for food. Furthermore, the negative coefficient for trend in maize demand for food indicates that there is a declining trend in the growth of maize consumption over time. This may be due to an increase in rice being supplied to the hills with increased transport access.

6.4.2 Maize demand for feed

\[ \ln MFEED_t = D_0 + D_1 \ln (MPP_t / RPP_t) + D_2 \ln MPRD_t + D_3 \ln EPRD_t + D_4 \ln MFOOD_t \]

Estimation method: TSLS

List of Instruments: C, MAH(-1), MYD(-1), MPP(-1)/RPP(-1), UPP(-1)/MPP(-1), PCI, MPRD, EPRD, and T

Number of observations: 20 (1980-1999)
Chapter 6

Table 6.7 Maize demand for feed

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Estimates</th>
<th>t-statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>$D_0$</td>
<td>-1.341689</td>
<td>-1.04</td>
</tr>
<tr>
<td>$D_1$</td>
<td>0.304587</td>
<td>1.15</td>
</tr>
<tr>
<td>$D_2$</td>
<td>1.247187</td>
<td>6.01</td>
</tr>
<tr>
<td>$D_3$</td>
<td>-0.023585</td>
<td>-2.27</td>
</tr>
<tr>
<td>$D_4$</td>
<td>-0.254086</td>
<td>-1.40</td>
</tr>
</tbody>
</table>

R-squared = 0.93; Adjusted R-squared = 0.92; D-W statistics = 1.84.

The estimated function (Table 6.7) explains 93 per cent of the variations in maize demand for feed, and d-statistics indicate the estimated function is free from autocorrelation.

The results show that the main factor influencing demand of maize for feed is livestock and poultry production in the country. About 20 per cent of maize production is reported to be used by the farmers to feed their animal stocks. The estimates of coefficients provide a clear quantitative explanation to the pattern of maize consumption for feed in the country. A one per cent increase in milk production is found to have affected a corresponding 1.25 per cent increase in maize demand for feed. Whereas, an increase in the production of eggs by one per cent results in a corresponding decline in maize demand for feed at the household level. This is because, the increase in commercial feed production to be supplied to the poultry industry may require an increase in sales of maize by the farmers. The estimate of coefficient shows that a one per cent increase in egg production would lead to a 0.02 per cent reduction in maize demand for feed used at the household level.

The results indicate that maize demand for feed does not decline with an increase in prices, but the coefficient estimated is not statistically significant. Processing industries are not in a position to maintain stock and have to purchase from India, even if the prices rise for maize. Similarly, maize demand for feed is found to be inversely related to its demand for food but this is again not statistically significant.

6.4.3 Maize demand for other uses

\[
\ln MOTH_R = E_0 + E_1 \ln (MFOOD_t + MFEED) + E_2 \ln MMPRD_t
\]

Estimation method: TSLS

List of Instruments: C, MAH(-1), MYD(-1), MPP(-1)/RPP(-1), UPP(-1)/MPP(-1), PCI, MPRD, EPRD, and T

Number of observations: 20 (1980-1999)

Table 6.8 Maize demand for other uses

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Estimates</th>
<th>t-statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E_0$</td>
<td>-2.053472</td>
<td>-0.96</td>
</tr>
<tr>
<td>$E_1$</td>
<td>0.894226</td>
<td>12.19</td>
</tr>
<tr>
<td>$E_2$</td>
<td>0.110191</td>
<td>0.50</td>
</tr>
</tbody>
</table>

R-squared = 0.98; Adjusted R-squared = 0.98; D-W statistics = 2.31.

The estimated function (Table 6.8) explains 98 per cent of the variations in maize demand, and d-statistics indicate the estimated function is free from autocorrelation. A one per cent increase in maize demand for food and feed would result in a corresponding increase of 0.89 per cent in maize demand for other uses. Maize demand for other uses could be for seed and beverage production, and for sale. However, the amount of maize kept for seed may be so small that it does not have a significant affect on maize demand for other uses.
6.4.4 Soybean demand for food

\[ \text{Ln SCON}_t = C_0 + C_1 \text{Ln (PCI)}_t + C_2 \text{Ln (SPP/CPI)}_t \]

Estimation method: OLS  
Number of observations: 12 (1988-1999)

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Estimates</th>
<th>t-statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>( C_0 )</td>
<td>7.693485</td>
<td>6.28</td>
</tr>
<tr>
<td>( C_1 )</td>
<td>0.463662</td>
<td>2.83</td>
</tr>
<tr>
<td>( C_2 )</td>
<td>-0.491219</td>
<td>-1.29</td>
</tr>
</tbody>
</table>

R-squared = 0.34; Adjusted R-squared = 0.19; D-W statistics = 1.94.

The estimated function (Table 6.9) explains 19 per cent of the variations in soybean demand, and d-statistics indicate the estimated function is free from autocorrelation.

The main factor influencing the demand for soybean is found to be the income level of the people. The results show that an increase of one per cent in income would lead to a corresponding increase of 0.46 per cent in soybean demand. The price response to demand for soybean is, as expected, negative and quite high, but the coefficient is not found to be statistically significant. The coefficient of \(-0.49\) per cent for price is quite high compared to \(-0.07\) per cent estimated for maize. This shows that soybean demand could be highly responsive to price compared to cereal grains, like maize.

6.5 Projection of demand for feed and feed crops

It is imperative that adequate nutritive food in terms of milk, meat and eggs be made available to meet the demand for quality food of the growing population. Income growth, urbanization and urban population growth have been the major factors determining the demand and composition of agricultural and animal products.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Asia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat</td>
<td>0.97</td>
</tr>
<tr>
<td>Milk</td>
<td>0.52</td>
</tr>
<tr>
<td>Eggs</td>
<td>1.07</td>
</tr>
<tr>
<td>Cereals</td>
<td>9.22</td>
</tr>
</tbody>
</table>

Source: IFPRI Research Report No 49.

Income elasticity is low for milk compared to eggs and meat among livestock production (Table 6.10). FAO has estimated an average annual growth of 3.7, 3.1 and 4.3 per cent for meat, milk and eggs respectively in developing countries.

The demand for feed is related to the demand for livestock products, which is a derived demand dependent on the size of the livestock population and on the feed consumption rate per animal.

<table>
<thead>
<tr>
<th>Item</th>
<th>New Era 1989</th>
<th>APROSC 1986</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price Elasticity</td>
<td>-0.35</td>
<td>-0.51</td>
</tr>
<tr>
<td>Income Elasticity</td>
<td>0.31</td>
<td>0.56</td>
</tr>
</tbody>
</table>


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The coefficients of demand for milk show that if the price of milk increases, the quantity consumed would not decrease much. The consumption of milk is inelastic in terms of both price and the income level of consumers. The coefficients indicate that if the income of the consumer increases this would result in a moderate increase in consumption only (Table 6.11).

At present, the demand for livestock feed is estimated at 632 thousand mt. The rate of feed consumption was increasing at an annual rate of 3.24 per cent during 1995 to 2000.

With increased numbers of improved cattle and poultry with exotic breeds replacing local breeds, the demand for commercial feeds will increase in the country - with the corresponding effect on demand for feed and feed crops. In the future, the trend will be towards the system of animal production oriented toward intensive agribusiness with the use of manufactured feeds.

Milk, meat and egg production is estimated to increase at a rate of 3, 2.95 and 4.20 per cent per annum during the period of 2001 to 2010. Milk production will reach 1,470 thousand mt in the year 2010. Meat and egg production is estimated to reach 250 thousand mt and 710 thousand mt respectively (Table 6.14).

The amount of commercial animal feed required to maintain the above production levels of meat, milk and eggs is projected at 874,000 mt. The present level of feed production is only 410,316 mt, indicating the need for accelerating feed production in the country.

To maintain the balance between demand and supply of commercial feed crops, careful and perspective planning is needed in the development of feed crops. Maize and soybean are the important crops in poultry feed. Maize, as an energy ingredient is used at 40 to 45 per cent and soybean at 10 to 15 per cent. Similarly maize and soybean are blended at the rate of 10 per cent and 2 per cent in case of cattle feed.

About 210 thousand mt of maize and 17 thousand mt of soybean was reported to have been used in the manufacture of livestock feeds in 1999-2000.

The demand for maize to manufacture animal feed is expected to rise by 342 thousand mt registering an annual growth of 5.51 per cent over the period of 2001 to 2010 (Table 6.12). The increased requirement can not be fulfilled from the rainfed summer maize production from the hills and mountains. There is little possibility of expanding the area and improving the per hectare productivity in those areas. There is also competition in the use of maize as food or feed. Increased maize production can be supplied to feed processing only if the production of paddy is improved in the hills - where rice in preferred over maize as a staple diet and maize use can be switched over to animal feeds. The production of soybean for the year 2000 is estimated at 24,872 mt.

The increased requirement of maize and soybean as feed crops will have to come from Tarai irrigated lands, where these crops can be expanded as a winter crop and road facilities are better for collection by industries.

6.5.1 Projections (2000 to 2010)

The parameters estimated for the model have been used to project some variables. Assumptions were also made. The relative price of maize to rice is taken to be constant at 1.15 for the whole projection period. Similarly, relative price of urea to maize is also taken as constant at 0.85. The per capita annual income in real terms is assumed to grow by 2 per cent during the period. Egg production and milk production, which are the major sources leading to demand for feed, are taken to maintain their growth for the period 1990-1999, i.e. 3.39 per cent for eggs, and 2.83 per cent for milk. The projections are presented in Table 6.14.

Maize production is projected to increase from 1,488,000 mt in 2001 to 1,942,000 mt in 2010 (Table 6.12). The increase in production will occur from productivity improvements.
Table 6.12 Projection of maize production and uses

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Production of Maize (mt)</th>
<th>Total Area (ha)</th>
<th>Feed (mt)</th>
<th>Food (mt)</th>
<th>Other Use (Seed, Liquor, Wastage etc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>1,488,350</td>
<td>822,567</td>
<td>220,500</td>
<td>1,080,725</td>
<td>187,125</td>
</tr>
<tr>
<td>2002</td>
<td>1,533,000</td>
<td>827,947</td>
<td>231,525</td>
<td>1,091,532</td>
<td>209,943</td>
</tr>
<tr>
<td>2003</td>
<td>1,578,990</td>
<td>833,298</td>
<td>243,101</td>
<td>1,102,447</td>
<td>233,442</td>
</tr>
<tr>
<td>2004</td>
<td>1,626,360</td>
<td>838,621</td>
<td>255,256</td>
<td>1,113,471</td>
<td>257,633</td>
</tr>
<tr>
<td>2005</td>
<td>1,675,151</td>
<td>843,916</td>
<td>268,018</td>
<td>1,124,605</td>
<td>282,528</td>
</tr>
<tr>
<td>2006</td>
<td>1,725,405</td>
<td>849,181</td>
<td>281,419</td>
<td>1,135,851</td>
<td>308,135</td>
</tr>
<tr>
<td>2007</td>
<td>1,777,167</td>
<td>854,417</td>
<td>295,490</td>
<td>1,147,209</td>
<td>334,468</td>
</tr>
<tr>
<td>2008</td>
<td>1,830,482</td>
<td>859,624</td>
<td>310,264</td>
<td>1,158,681</td>
<td>361,537</td>
</tr>
<tr>
<td>2009</td>
<td>1,885,396</td>
<td>864,802</td>
<td>325,777</td>
<td>1,170,268</td>
<td>389,351</td>
</tr>
<tr>
<td>2010</td>
<td>1,941,958</td>
<td>869,949</td>
<td>342,065</td>
<td>1,181,970</td>
<td>417,923</td>
</tr>
</tbody>
</table>

Source: Author’s calculation.

The price of soybean in real terms, is assumed to remain constant at 1990’s prices. Production of soybean in the country is projected to increase from 16,780 mt in 1999 to 24,872 mt in 2010 (Table 6.13).

Table 6.13 Projection of soybean production, 2000-2010

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Area of Soybean</th>
<th>Production in mt</th>
<th>Yield kg/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>19,956</td>
<td>17,301</td>
<td>867</td>
</tr>
<tr>
<td>2001</td>
<td>20,156</td>
<td>18,160</td>
<td>901</td>
</tr>
<tr>
<td>2002</td>
<td>20,357</td>
<td>18,708</td>
<td>919</td>
</tr>
<tr>
<td>2003</td>
<td>20,560</td>
<td>19,264</td>
<td>937</td>
</tr>
<tr>
<td>2004</td>
<td>20,970</td>
<td>20,026</td>
<td>955</td>
</tr>
<tr>
<td>2005</td>
<td>21,179</td>
<td>20,607</td>
<td>973</td>
</tr>
<tr>
<td>2006</td>
<td>21,390</td>
<td>21,219</td>
<td>992</td>
</tr>
<tr>
<td>2007</td>
<td>21,621</td>
<td>21,495</td>
<td>1,012</td>
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<tr>
<td>2008</td>
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</tr>
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<td>2009</td>
<td>22,055</td>
<td>23,202</td>
<td>1,052</td>
</tr>
<tr>
<td>2010</td>
<td>22,275</td>
<td>24,872</td>
<td>1,072</td>
</tr>
</tbody>
</table>

Source: Author’s calculation.
Chapter 6

Table 6.14  Projection of animal feeds, 2000-2010

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>Annual Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Milk production ('000 mt)</td>
<td>1,128</td>
<td>1,161</td>
<td>1,197</td>
<td>1,233</td>
<td>1,269</td>
<td>1,308</td>
<td>1,347</td>
<td>1,386</td>
<td>1,428</td>
<td>1,470</td>
<td>3.03</td>
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<tr>
<td>Requirement of feeds for milk production ('000 ton)</td>
<td>376</td>
<td>387</td>
<td>399</td>
<td>411</td>
<td>423</td>
<td>436</td>
<td>449</td>
<td>462</td>
<td>476</td>
<td>490</td>
<td>3.03</td>
</tr>
<tr>
<td>2 Meat production ('000 mt)</td>
<td>193</td>
<td>197</td>
<td>202</td>
<td>207</td>
<td>212</td>
<td>220</td>
<td>227</td>
<td>235</td>
<td>242</td>
<td>250</td>
<td>2.95</td>
</tr>
<tr>
<td>Requirement of feeds for meat production ('000 ton)</td>
<td>77</td>
<td>79</td>
<td>81</td>
<td>83</td>
<td>85</td>
<td>88</td>
<td>91</td>
<td>94</td>
<td>97</td>
<td>100</td>
<td>2.99</td>
</tr>
<tr>
<td>3 Egg production ('000 mt)</td>
<td>500</td>
<td>520</td>
<td>540</td>
<td>562</td>
<td>585</td>
<td>607</td>
<td>632</td>
<td>657</td>
<td>682</td>
<td>710</td>
<td>4.20</td>
</tr>
<tr>
<td>Requirement of feeds for egg production ('000 ton)</td>
<td>200</td>
<td>208</td>
<td>216</td>
<td>225</td>
<td>234</td>
<td>243</td>
<td>253</td>
<td>263</td>
<td>273</td>
<td>284</td>
<td>4.20</td>
</tr>
<tr>
<td>Total '000 mt feeds</td>
<td>653</td>
<td>674</td>
<td>696</td>
<td>719</td>
<td>742</td>
<td>767</td>
<td>793</td>
<td>819</td>
<td>846</td>
<td>874</td>
<td>3.38</td>
</tr>
</tbody>
</table>

Note: Feed requirement of livestock and poultry for milk, meat and egg production estimated on the basis of 3:1, 2.5:1 and 2.5:1 feed conversion ratio.
Source: Author’s calculation.
7. **Supply of Feed and Feed Crops**

7.1 **Production behaviour**

Feed supply in Nepal is dispersed along the rural and urban areas where livestock are raised. However, the large commercial feed manufacturing industries are concentrated in the accessible and urban peripheries, where modern poultry farms and dairy cows are kept to supply livestock products of milk, meat and eggs to the nearby markets.

In the growing feed market, there are local dealers who supply feed along with poultry/chicks, veterinary services and other inputs. The major feed manufacturers distribute their products through these small dealers, who serve the specific command areas. Only about 5-10 per cent of feed is directly supplied by manufacturing units to large cattle and poultry farms.

Feed manufacturing industries at present, are supplying about 65 per cent of the total requirement. The rest of the feed is being substituted by home-made feeds and other conventional fodder, pasture and forages. The feed supply deficit is largely responsible for the lower productivity of improved cattle and poultry birds. In some cases, when the supply of feed is too inadequate within the country, the big livestock farmers resort to substituting feed/grains imported from across the border.

Major feed ingredients such as meat, fish bone meals and vitamin and mineral supplements are being imported from India. Smaller manufacturers purchase ingredients from the wholesale grain traders who operate at local markets.

The energy component of feeds produced is based on maize and oilseed cakes (soybean, mustard and cotton). The protein component is mixed from the oilseeds, as well as from fish meal and bone meal. There are laboratory facilities but only in large manufacturing establishments.

*Figure 7.1 Flowchart on production and supply of feed*

![Flowchart on production and supply of feed](image)

Note: * The percentage refers to amount supplied and flow of feedstuff and feed crops.
7.2 Production structure

The number of feed manufacturing units in 1999-2000 were 154, located in 25 districts. In the distribution of the feed mills, about 60 per cent are in Kathmandu Valley and 40 per cent in the other Hill and Tarai districts. The operating units in the hills are generally small ones with a less than 300 ton capacity. They operate to meet the requirements of small poultry farms. These units do not have mixing equipment. There is little information with them on feed formulation and nutrition. Hence, the quality of feeds produced in these smaller units is variable. These units also depend on larger commercial units for the supply of ingredients like vitamins and concentrates.

There are about 20 to 30 large-scale feed manufacturing plants producing more than 10,000 mt per annum. There are also some medium scale industries producing 500 to 700 tons. Many of the feed industries operate below their optimum capacity utilization. It was reported that only 25 per cent of industries are operating above 80 per cent capacity. Most of the industries (about 60 per cent) were below capacity (within the range of 20 to 60 per cent). The main factors responsible for their low utilization was the non-availability of raw materials, particularly the seasonal crop maize, (maize is often infested by insects and aflatoxin), poor maintenance of machinery and variation in feed demand from the small buyers. The entrepreneurs establish feed processing industries often without logical analysis of the feed crop supply situation and marketing network. This leads them to lower utilization of industrial capacity due to non-availability of locally grown maize and soybean supplies.

Though the feed market is competitive, the big feed manufacturers have the upper hand in price setting. The prevailing prices for feed in the border area, is the determining factor which affects Nepalese feed prices. Local prices are 15 to 20 per cent higher in Nepal depending on the import price plus the transportation cost from the border. Nepal can not have its own independent price policy because the market is so small. Any amount of exports or imports can not affect the prices across the border.
7.3 Supply of feed crops

Major crops used for feed manufacturing are maize and soybean. Production of maize is mainly concentrated in the hills and is grown as a subsistence crop by small farmers in upland conditions. Maize is the second most important staple food crop in the county. About 80 per cent of the maize area is located in the hills. Maize is grown in upland areas under rain fed conditions and mostly on marginal land with millet in a relay system. Other important cropping patterns are maize associated with soybean, legumes, potatoes and upland rice. In the Tarai, there is potential for winter and spring maize which accounts for 20 per cent of the area.

Soybean accounts for 7 per cent of the area which is a major summer legume crop in the hills. Soybean intercropping with maize is popular and is normally grown in upland hills. Mustard crop is grown after maize in the hills.

Maize is grown in rural and mainly inaccessible areas. The production trend indicates that maize productivity has not improved over the last few decades due to poor varietal conditions and depleting soil fertility in the sloping lands of the hills. Moreover, maize as well as soybean are consumed locally as a stable diet by the local population and a marketable surplus of these crops is very much limited. It is difficult to collect the small amounts of maize produced by hill farms and is cost prohibitive due to poor transport conditions in this area. Production of maize, soybean and other feed crops takes place on small farms with the average farm size of less than one hectare. They are large in number and economically diverse. These producers are mostly mixed growers without specialization in any crop. About 80 per cent of small farmers grow maize and soybean as subsistence crops on their small farms.

Additionally, there are no storage facilities to maintain the quality of maize procured in these areas. There are other post harvest losses that make the cost of maize higher for the maize producers. Hence, the feed processors find it profitable and easier to procure maize from local Tarai-based wholesalers who normally get bulk supplies from across the border on a continued basis. About 40 per cent of maize as an ingredient was being imported by feed manufacturers in 1999-2000.

There is increasing evidence that demand for maize as a manufactured feed will have an upward trend in the future. This will compete with maize demand for food. In order to increase the amount of maize supplied to feed industries, it is required that production of alternative crops be increased in the hill areas.

There is very little possibility of expanding area under summer maize in the hill areas. The demand for maize as a feed crop is likely to increase at a higher rate, that is 5 per cent per annum. An increase in total production of maize for the period 2001 to 2010 is also limited at 3 per cent per annum. If the government envisages to maintain annual maize consumption for its increasing population at the rate of 45 to 50 kg, the country will have to produce more winter maize in Tarai where there is the possibility of increasing the crop area under maize or import larger quantities of maize required for feed production.

7.4 Production response to market forces

An attempt is made to evaluate the production response of maize and soybean in the following section to market forces.

7.4.1 Maize acreage

\[
\ln MAH_t = A_0 + A_1 \ln (\text{MPP}_{t-1}/\text{RPP}_{t-1}) + A_2 \ln MAH_{t-1}
\]

Estimation method: OLS

Number of observations: 20 (1980-1999)
Chapter 7

Table 7.1  Maize acreage function

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Estimates</th>
<th>t-statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>$A_0$</td>
<td>0.170596</td>
<td>0.15</td>
</tr>
<tr>
<td>$A_1$</td>
<td>-0.037483</td>
<td>-0.91</td>
</tr>
<tr>
<td>$A_2$</td>
<td>0.988338</td>
<td>11.39</td>
</tr>
</tbody>
</table>

R-squared = 0.89; Adjusted R-squared = 0.88; D-W statistics = 2.64; (Table value = 1.75).

The acreage function is the Nerlovian type, where area under maize is regressed as a function of the lagged area and lagged relative price of maize to its competing crop, i.e. rice. The partial adjustment hypothesis is consistent with an economy where there are rigidities that prevent complete adjustment in each period.

The estimated function (Table 7.1) explains 89 per cent of the variations in maize area, and t-statistics indicate the estimated function is free from autocorrelation.

The estimates of the function provide that area under maize is mainly based on last years’ area under the crop. Further, the cropped area is found to be not dependent on the relative price of the crop because the value of coefficient for the variable $(MPP_{t-1}/RPP_{t-1})$ is quite low and negative, but not statistically significant. These results are consistent with a subsistence economy under which maize is being cultivated in the country.

7.4.2 Maize yield

\[
\ln MYD_t = B_0 + B_1 \ln \left(\frac{UPP_{t-1}}{MPP_{t-1}}\right) + B_2 \ln MYD_{t-1} + B_3 \ln T
\]

Estimation method: OLS

Number of observations: 20 (1980-1999)

Table 7.2  Maize yield function

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Estimates</th>
<th>t-statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>$B_0$</td>
<td>0.338605</td>
<td>5.65</td>
</tr>
<tr>
<td>$B_1$</td>
<td>-0.354326</td>
<td>-4.88</td>
</tr>
<tr>
<td>$B_2$</td>
<td>0.542756</td>
<td>3.97</td>
</tr>
<tr>
<td>$B_3$</td>
<td>-0.068262</td>
<td>-3.18</td>
</tr>
</tbody>
</table>

R-squared = 0.81; Adjusted R-squared = 0.78; D-W statistics = 2.27; (Table value = 1.76).

The estimated function (Table 7.2) explains 81 per cent of the variations in maize yield, and t-statistics indicate the estimated function is free from autocorrelation.

The estimated coefficient of trend variable is small and negative, suggesting stagnation in maize yields during the period under consideration. Although there have been increases in area covered by improved varieties of maize over time, 34.4 per cent in 1980/81, 50 per cent in 1990/91 and 65 per cent in 2000/01, this has not been duly reflected in the yield of the crop. This indicates that there could be problem in the supply of other inputs, such as irrigation, fertilizer, etc.

Yield is found to be responsive to the price of urea relative to that of maize. The results indicate that a decrease in relative price of urea would lead to increase in the use of fertilizer, and consequently an increase in yield.

7.4.3 Soybean production

\[
\ln SPRD_t = A_0 + A_1 \ln \left(\frac{SPP_{t-1}}{CPI_{t-1}}\right) + A_2 \ln (SPRD_{t-1})
\]

Estimation method: OLS

Number of observations: 12 (1988-1999)
Table 7.3 Soybean supply function

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Estimates</th>
<th>t-statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>$A_0$</td>
<td>1.478176</td>
<td>0.77</td>
</tr>
<tr>
<td>$A_2$</td>
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<td>-0.91</td>
</tr>
<tr>
<td>$A_1$</td>
<td>0.894720</td>
<td>3.91</td>
</tr>
</tbody>
</table>

R-squared = 0.67; Adjusted R-squared = 0.60; D-W statistics = 2.17; (Table value = 1.645).

The supply function is the Nerlovian type where production of soybean is regressed as a function of the lagged production and lagged real price of soybean (deflated by the consumer price index). The partial adjustment hypothesis is consistent with an economy where there are rigidities that prevent complete adjustment in each period.

The estimated function (Table 7.3) explains 67 per cent of the variations in soybean production, and t-statistics indicate the estimated function is free from autocorrelation. Although the estimated $d$ is rather small, the conclusion should be taken cautiously in view of the smallness of the sample.

The estimated function provides that soybean production in the current year is mainly based on last year’s production. Further, production of the crop is found to be not dependent on its price. The coefficient corresponding to price is quite low and negative, but not statistically significant. The results are consistent with a subsistence economy under which soybean is produced in the country.

The available data on maize production and consumption in Table 7.4 and of soybean on Table 7.5 indicate that an increasing deficit of feed crops is likely to occur.
Table 7.4 Maize supply and use in Nepal

<table>
<thead>
<tr>
<th>Year</th>
<th>Maize Total Production + Import '000 mt</th>
<th>Total Supply - Export '000 mt</th>
<th>Domestic Supply + Feed mt</th>
<th>+ Food mt</th>
<th>+ Other Use</th>
<th>Total Domestic Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1974-75</td>
<td>826,700</td>
<td>826,700</td>
<td>826,700</td>
<td>82,000</td>
<td>650,580</td>
<td>94,120</td>
</tr>
<tr>
<td>1975-76</td>
<td>748,000</td>
<td>748,000</td>
<td>747,247</td>
<td>84,000</td>
<td>577,875</td>
<td>85,372</td>
</tr>
<tr>
<td>1976-77</td>
<td>797,000</td>
<td>797,000</td>
<td>794,845</td>
<td>85,000</td>
<td>621,175</td>
<td>88,710</td>
</tr>
<tr>
<td>1977-78</td>
<td>740,000</td>
<td>740,000</td>
<td>737,753</td>
<td>88,000</td>
<td>566,875</td>
<td>82,878</td>
</tr>
<tr>
<td>1978-79</td>
<td>743,000</td>
<td>743,000</td>
<td>741,677</td>
<td>91,000</td>
<td>567,350</td>
<td>84,237</td>
</tr>
<tr>
<td>1979-80</td>
<td>740,000</td>
<td>740,000</td>
<td>737,753</td>
<td>92,000</td>
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<td>75,244</td>
</tr>
<tr>
<td>1980-81</td>
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<td>743,000</td>
<td>741,677</td>
<td>98,000</td>
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<td>73,519</td>
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<tr>
<td>1981-82</td>
<td>752,000</td>
<td>752,000</td>
<td>751,899</td>
<td>98,000</td>
<td>565,275</td>
<td>75,244</td>
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<td>1982-83</td>
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<td>718,000</td>
<td>717,884</td>
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<td>1983-84</td>
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<td>761,000</td>
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<td>819,820</td>
<td>116,000</td>
<td>607,370</td>
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<td>1985-86</td>
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<td>873,750</td>
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<td>910,225</td>
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<td>1,071,610</td>
<td>1,071,590</td>
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<td>1,200,910</td>
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<td>1,230,950</td>
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<td>1,204,710</td>
<td>1,204,710</td>
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<td>1,290,500</td>
<td>1,290,500</td>
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<td>1,253,850</td>
<td>1,253,850</td>
<td>169,000</td>
<td>940,595</td>
<td>144,255</td>
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<td>1,302,116</td>
<td>1,302,116</td>
<td>1,302,116</td>
<td>173,000</td>
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<td>1,331,060</td>
<td>1,331,060</td>
<td>176,000</td>
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<td>1996-97</td>
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<td>1,312,000</td>
<td>1,311,542</td>
<td>186,000</td>
<td>974,957</td>
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<td>1997-98</td>
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<td>1,367,000</td>
<td>1,366,992</td>
<td>192,000</td>
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<td>1998-99</td>
<td>1,346,000</td>
<td>1,346,000</td>
<td>1,346,000</td>
<td>201,000</td>
<td>990,343</td>
<td>154,657</td>
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<tr>
<td>1999-2000</td>
<td>1,445,000</td>
<td>1,445,000</td>
<td>1,445,000</td>
<td>210,000</td>
<td>1,070,025</td>
<td>164,975</td>
</tr>
</tbody>
</table>

Table 7.5 Soybean production in Nepal

<table>
<thead>
<tr>
<th>Year</th>
<th>Area/ha</th>
<th>Yield/kg</th>
<th>Production/mt</th>
<th>P Price/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987-88</td>
<td>18,690</td>
<td>538</td>
<td>10,060</td>
<td>2.70</td>
</tr>
<tr>
<td>1988-89</td>
<td>20,710</td>
<td>564</td>
<td>11,680</td>
<td>3.87</td>
</tr>
<tr>
<td>1989-90</td>
<td>20,660</td>
<td>621</td>
<td>12,840</td>
<td>6.09</td>
</tr>
<tr>
<td>1990-91</td>
<td>21,340</td>
<td>597</td>
<td>12,730</td>
<td>10.82</td>
</tr>
<tr>
<td>1991-92</td>
<td>19,690</td>
<td>580</td>
<td>11,430</td>
<td>10.60</td>
</tr>
<tr>
<td>1992-93</td>
<td>20,220</td>
<td>581</td>
<td>11,750</td>
<td>12.51</td>
</tr>
<tr>
<td>1993-94</td>
<td>19,150</td>
<td>586</td>
<td>11,213</td>
<td>12.10</td>
</tr>
<tr>
<td>1994-95</td>
<td>21,543</td>
<td>654</td>
<td>14,090</td>
<td>14.49</td>
</tr>
<tr>
<td>1995-96</td>
<td>20,770</td>
<td>660</td>
<td>13,710</td>
<td>15.26</td>
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<tr>
<td>1996-97</td>
<td>20,980</td>
<td>687</td>
<td>14,420</td>
<td>16.56</td>
</tr>
<tr>
<td>1997-98</td>
<td>21,245</td>
<td>731</td>
<td>15,533</td>
<td>18.19</td>
</tr>
<tr>
<td>1998-99</td>
<td>23,046</td>
<td>773</td>
<td>17,820</td>
<td>20.28</td>
</tr>
<tr>
<td>1999-2000</td>
<td>19,759</td>
<td>849</td>
<td>16,780</td>
<td>20.77</td>
</tr>
</tbody>
</table>


7.5 Measures for closing the gap between demand and supply of feed crops

The internal supply of feed crops, namely maize and soybean, seems to be adequate for meeting the requirements of feed industries. On the other hand, it was also revealed during interaction with manufacturers that feed processing industries are, in practice, importing about 40 per cent of maize as a feed ingredient to supplement the local supply of maize. It is a strong contradiction that although the country is self-reliant in maize production, feed manufacturers have to depend on imports.

The reasons behind this contradiction are:

- Maize producers are subsistence farmers and they grow maize on small hill farms, which are not easily accessible by modern transport.
- The cost of assembling, transporting and marketing is so high that commercial feed manufacturers find it cost prohibitive to use local maize.
- The quality of yellow maize is so poor that it affects the quality of feed and animal health.
- In contrast to these constraints, the feed manufacturers find it cost-effective to obtain supplies from imports, where the marketing cost is cheaper than to collect maize from local sources.

Due to the above factors, local feed manufacturers are importing maize and this is likely to increase in the future.

In order to reduce these constraints, it was suggested by the manufacturers that the government should facilitate the production of maize by promoting appropriate varieties of maize, support the private entrepreneurs and traders in establishing collection centers, encourage contract procurement of maize from farmers by advance supply of credit and price fixation, develop storage and marketing facilities near production pockets so that local buying of maize for industries will not be cost prohibitive.

The second alternative is to import from other countries which necessitates the involvement of hard currency that has other critical uses in the economy. The third alternative is to produce feed crops, i.e. winter maize, in the Tarai areas, which will replace the cultivation of
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wheat, mungbeans and other legumes that are in high demand as export crops. Whether the country can opt to lose the foreign market of such export crops is a question of hard choice.

The fourth alternative is to grow feed crops such as oilseed, soybean, millet or other crops along with maize, in hill valleys and on small-scale farms. These are also the CGPRT crops that deserve careful attention from planners to increase employment, nutrition and income of poor farms. Trading of these crops with neighbouring countries may be costly and against the well being of small farms.

The expansion of these coarse and dry land crops will encourage the diversification of crops and help in poverty alleviation. These crops are also used for human consumption which have implications for food security.

Hence, an effort is needed to examine the status, potentials and constraints of feed crop development and propose policy options for developing feed crop farming.

The increasing demand for feed crops for livestock production offers a large potential for increasing production of feed crops in poor and hilly areas of Nepal.

7.6 Government and private sector initiatives

Despite being an important area for livestock product development, feed crop research, development and extension has not been given due attention in the past by the government (Pariyar, 1994-95).

The major focus of government strategy has been on animal health and breed improvement of major livestock in the country. The institutions and manpower involved in the feed crop development sector have been negligible (MOA, 1991).

The financial resources invested in this activity are also meager. Scientist-level manpower involved in pasture and fodder was very much limited in 1999-2000.

The role of the government in livestock development has been to act as the provider of all services, mostly on a free of charge basis, in the allocation of public resources. This has not induced an output oriented program.

The potential contribution made by the private sector in feed production, poultry, meat and milk production needs to be appreciated by the public sector. The private sector is reluctant to invest in long-term research and development. They should be facilitated by the government sector in allocating research and other capital intensive activities.

7.7 Farmer participation in feed crop development

Farmer participation is an essential part of program implementation and sustained development of any commodity development program. Farmers have demonstrated their active participation in programs like dairy cooperatives, poultry farming and off season vegetable development activities, where they have experienced gainful economic activities and financial incentives for their participation. In feed manufacturing, we can observe the participation of private entrepreneurs but there is little participation from the side of feed crop producers i.e. farmers in feed crop research and development. Government agencies have not adequately realized the importance of farmer participation. Farmers are kept at the receiving end and government programs are not guided by the needs felt by the farmers.

Farmers should be informed about their role in feed crop development. The government should act as the facilitator to bring coordination between feed manufacturers and farmers. Farmers, as feed crop producers, should have a strong cooperative union with influencing bargaining strength in making contracts and determining prices of feed ingredients, as well as feed products with the feed manufacturers. Farmer cooperatives should have their own savings and credit associations so that capital financing can be made for infrastructures relating to collection centers and quality improvement of maize by storing in appropriate conditions. A
reduction in marketing costs can also be made by bulk transportation in accessible areas. Of late, there are developments in contract scheme production and procurement systems in feed crops, particularly maize, which are being practiced in the Kavre district of Nepal. The millers are assured supplies at a fixed contract price from the small maize farmers. This district has the facility of road transport which is better than in other districts.

7.8 Market development

Feed crop development planning should be market-led. Crop production planning should be integrated with marketing. Maize and soybean producers should be organized into cooperatives or producer groups who need to know the expected prices at the farm or wholesale markets. The price will guide them to allocate the area under crops, though at present price has little affect on the planted area because of the subsistence orientation of crop planting.

At the other end, feed manufacturers should be assured of the quality of the maize supply in required volumes at a reasonable price compared to border prices. This will help them to operate industries at an optimum capacity. If the feed producers can collect their requirement from a single procurement point, the cost of collection and marketing will be reduced and benefits of economies of scale can be generated. This will help the feed manufacturers as well as feed crop producers plan both the supply and demand of feed ingredients on a sustainable and profitable basis.

7.9 SWOT on feed crop development

SWOT analysis is a tool and an analytical method for an organization to measure its own strengths and weaknesses. This method helps to identify the target environment, the characteristics of that environment and can be classified as either threats or opportunities. A decision maker will be able to decide whether to expand output or that first solutions have to be found for a number of problem areas.

If the majority of the strengths of the business correspond with the opportunities of the market, then the decision maker will not find too many problems on his way. He can start developing an entry strategy.

If the list of weaknesses is long and the list of strengths is also long, then the list of environmental opportunities will be very long. The business should not expand production of the commodities being analyzed.

If however, the opportunities of the market correspond with the weaknesses of the business and the list of threats is too long then he will have to first the work on improvements in the organization before becoming involved with expansion activities. While finding solutions for the weaknesses, the list of weaknesses becomes shorter and the list with strengths will become longer.
If the weaknesses cannot be solved, the business will have to decide not to expand production. Thus, SWOT analysis can help management take justified decisions in expanding or curtailing production activities.

It is already proven that there is a rapidly growing livestock product industry supported by domestic feed farming and industry. These have supported crop diversification and helped alleviate poverty among the marginal farmers.

### 7.9.1 Strengths

The recent developments in feed crops and feed products has helped to eliminate food insecurity and these can be termed as strengths.

The growing demand for livestock in the country, leading to an accelerated requirement of commercial feeds is a contributing factor for diversified agriculture. The feed industry is being promoted by the private sector business community. Government interference is minimal in input and output pricing. If the country can maintain a competitive edge in the market price of feed and quality, Nepal has huge Indian market facilities, due to the open border and facilitating trade and transit treaties with India.

Nepalese entrepreneurs should recognize this strength of a wider market concept instead of limiting the market only within Nepal. The experience of the carpet trade with external markets is an example that Nepalese entrepreneurs with quality products, can use the wider market abroad. With WTO, the concept of the wider market, competitive edge and quality will be a growing reality.

Conventionally, Nepalese products carry an image of poor quality and cannot stand competition from quality products abroad. This image needs to be totally changed by introducing quality products and appropriate packaging. Building competitive edge is a must for expanding to the external markets.

To meet the increasing feed crop demand in the future, there is the opportunity of growing alternative oilseed crops (soybean, mustard, lentil and other legumes both in the hills and Terai). Maize grown in the hills has declining productivity per unit of land. There has been very slow technological improvements in maize cultivation.
Supply of Feed and Feed Crops

To support the feed processing industries’ demand for local feed ingredients such as maize and other crops, the government needs to develop contract buying of feed crops from the farmer groups by the processing industry. This provides an opportunity to improve farm employment and income to hill farmers, who have no gainful employment opportunities.

Additionally, Tarai can be made the production pockets of winter maize, where feed producers can collect maize without incurring prohibitive transport and collection costs.

In order to build competitive strength against Indian feed crop/feed supplies it is essential to minimize the cost of production of feed crops as well as feed. This can be accomplished only with careful planning.

7.9.2 Weaknesses and threats

1. The most pronounced weakness in the field of Nepalese feed crops and products are that the country has an open border with India. Nepal has no influence on price, irrelevant of the amount it exports to or imports from India.

2. Prices are higher within Nepal due to poor roads and transportation.

3. Institutions like the Nepal Feed Association and government agencies are not able to play a coordinating role for feed crop and product development.

Hence, the emerging gap between feed demand and supply will continue affecting consumer prices of livestock products. It is high time that government planning agencies give priority attention to feed industry development, taking into account the threats and opportunities outlined.

Table 7.6 SWOT framework

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weakness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Increasing demand for livestock products.</td>
<td>1. Policy planning not oriented to feed crop and feed development.</td>
</tr>
<tr>
<td>2. No interference on (ingredients) input and output prices (livestock products).</td>
<td>2. Technology for feed processing weak.</td>
</tr>
<tr>
<td>3. Huge open border market for Nepalese feed crops and feeds.</td>
<td>3. Raw material availability to processing industries not adequate.</td>
</tr>
<tr>
<td>4. Increased demand for feed likely to continue.</td>
<td>4. Indian market prices dominate.</td>
</tr>
<tr>
<td>5. Dairy and poultry sector developing and expanding under the private sector.</td>
<td>5. Cost competitiveness is weak for local feed products.</td>
</tr>
<tr>
<td>6. Promotion of oilseed crop in the hills – a potential which can be used as a feed crop.</td>
<td>6. Market is fragmented and small.</td>
</tr>
<tr>
<td></td>
<td>7. Cost of transport and collection is prohibitive.</td>
</tr>
<tr>
<td></td>
<td>8. Government facilitation on research and market development is not available.</td>
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<td></td>
<td>9. About 40 per cent of the total maize used for feed is reported as imported.</td>
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<td></td>
<td>10. Quality of feed crops is poor.</td>
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<td></td>
<td>11. Industries not operating at full capacity.</td>
</tr>
<tr>
<td></td>
<td>12. Nepal Feed Association not able to play coordinating role in price, quality or other areas.</td>
</tr>
<tr>
<td></td>
<td>13. Import duties on ingredients very high.</td>
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<td></td>
<td>14. Storage facilities for feed and feed crops very poor.</td>
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<td></td>
<td>15. Tax policy is not conducive for feed development.</td>
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Continued………. 
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Table 7.6 SWOT framework (continued)

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Domestic markets can be expanded with improvements in road access for livestock products and feed crops.</td>
<td>1. Due to the open border, Indian prices dominate the local market prices.</td>
</tr>
<tr>
<td>2. Export of livestock products such as ‘yak’ cheese can be promoted.</td>
<td>2. Local prices are higher for livestock feeds and products than in India.</td>
</tr>
<tr>
<td>3. Private sector participation in livestock and feed development forthcoming.</td>
<td>3. Productivity improvements are constrained by the non-availability of blended feeds for animals.</td>
</tr>
<tr>
<td>5. Potential for winter maize expansion in Tarai.</td>
<td></td>
</tr>
<tr>
<td>6. Cost reduction for livestock products an opportunity.</td>
<td></td>
</tr>
</tbody>
</table>
8. Conclusions and Recommendations

The demand for animal feed is a derived demand which has been increasing as a result of the increased demand for livestock products and an increasing livestock population in the country. Other factors affecting the increased demand for animal feed are an increasing population, growing income levels and a desire to shift consumption to quality animal products from cereal grains. The annual growth rate of demand for feed was estimated at 3.24 per cent for the years 1990 to 2000.

Increasing numbers of dairy cattle, poultry birds, buffalo and goats of improved breeds are replacing the local animals and breeds. This has necessitated the use of blended and processed feeds, replacing conventional fodder and forages under the open grazing system to intensive stall feeding systems.

In the conventional feeding regime, energy supply for ruminants comes from rangeland, pastures and crop residues. About 35 per cent of animal productivity was estimated to have been lost due to inadequate and poor feeding systems in the past.

Major livestock populations consist of cattle (6.98 million), goat (6.45 million), buffalo (3.6 million), poultry (20 million) and piggery (0.91 million). The annual growth rates were 1.05 per cent for cattle, 1.73 per cent for buffalo, 1.88 per cent for goat, 4.17 per cent for poultry and 4.93 per cent for pigs during the period 1990 to 2001.

Total meat, milk and egg production was 194,258 mt, 1,124,132 mt and 507,323,000 units respectively in 2001. Per capita consumption was estimated at 10 kg of meat, 58 liters of milk and 25 units of egg in 2001.

To meet the increasing requirement of livestock products, Nepal imported 382,454 heads of buffalo, 465,506 heads of goat and 1,703,220 units of poultry bird, 929,276 liters of milk and 2,792,000 units of egg in 1998-99.

On the basis of feed conversion ratios of 3, 2.5 and 2.5 kilograms of feed to produce a kilogram of meat, milk and egg output respectively, the annual feed requirement has been estimated at 632,000 mt against the availability of 410,000 mt in 2000. The growth rate of animal feed is estimated at 3.38 per cent per annum and will increase to 874,000 mt by 2010.

There is a gap between the supply and demand of feeds (54 per cent). Supply is lagging behind the demand, which is reflected in the rising prices of major feed crops. The annual price of maize and soybean has increased by 20 and 10 per cent respectively.

The demand for animal feeds in the coming years will accelerate as the population’s income and desire to consume better livestock products increases. The total requirement of feed will rise to 874,000 mt in 2010 against the current availability of 410,000 mt in 2000. About 42 per cent of the demand for feed is estimated to have originated from poultry and 58 per cent from cattle and other animals.

To close the widening gap between the demand and supply of feeds, it is imperative that the following policy options be considered:

- Since the major feed ingredients are maize (40 per cent) and soybean (10 per cent) in the production of poultry and cattle feeds, the supply of these crops should be streamlined for the feed processing industries.
- At present, feed industries are facing difficulties in procuring quality maize in required volumes from the small maize farmers in the hills, where road access is poor and cost of transportation and collection is high.
- As a result, more of the feed processing industries are operating below full capacity utilization resulting higher costs of production.
After inclusion in the WTO, Nepal will have to face tough competition in terms of quality and price of feed from other countries. Hence, there is a need to introduce cost effective measures to make feed industries competitive in the market. It was reported that in 1999, the feed processing industries were importing about 40 per cent of total maize ingredients (84,000 mt) required for feed production. This is contradictory to agricultural policy of the country, which focuses on self-reliance in agricultural production, including maize and soybean.

To provide benefits to the poor and small-scale farmers in the hills and also promote living standards through the promotion of CGPRT crops, it is recommended that the government should facilitate the production of maize and soybean by developing contract farming in consolidated land blocks and by developing contract procurement with feed processing industries. This will help augment appropriate research and infrastructure development programmes in the hills.

The government should promote winter maize and soybean in Tarai, which will replace areas of crops such as wheat and legumes. Other available alternatives are to develop oilseed, millet and other crops on hill farms which will require additional collaborative efforts from the government and research and development centres like the CGPRT Centre.

8.1 Implications of SWOT analysis

On the basis of the SWOT framework, it is found that there is a strong potential for feed crop development, which is supported by the increasing demand for livestock products (2.89 per cent for meat, 2.83 per cent for milk and 3.39 per cent per annum for eggs).

The increased demand is likely to continue in the future, with 2.5 per cent annual growth in population and 2 per cent annual growth in personal income.

A fast growing poultry and dairy cattle sector will definitely push the demand for animal feeds and will bring a livestock revolution to the country.

Per capita consumption of meat and eggs is at present low, which needs to be promoted by making the supply of feeds available to the poultry and dairy enterprises. These enterprises are fast growing in the private sector, which is a good sign of competitive business and cost effectiveness.

However, there are also weaknesses and threats in the development of feed industries in Nepal. Government policy towards feed industries is not transparent and conducive for the fuller utilization of installed capacities. Feed industries are facing uncertainties about the delivery of raw materials such as maize and soybean, in required amounts and of appropriate quality. They have to resort to imports from abroad. This deprives the benefits to small hill farmers who lack market outlets for their products.

The open border market with India provides potentials as well as threats to Nepalese agriculture and product development. India provides a huge potential market for Nepalese products if they are cost competitive. On the other hand, Nepalese products have to compete with Indian products that are produced on a large-scale, with a wider technological know-how and with competitive prices in the market.

In terms of price efficiency, Indian products are comparatively cheaper than the Nepalese goods (example of dumping cheap paddy in the local markets). Nepal has to follow the price trends set by Indian markets for many agricultural commodities.

Hence, it is recommended that Nepal should monitor the development of technology, products and prices so that it can benefit from Indian market trends, arrivals and prices. Nepal can not have its own independent price policies but must adjust the internal prices in India border markets.
Some of the immediate policy improvements that need to be brought about in the feed sector by the government are as follows:

1. It is recommended that the Ministry of Agriculture give priority to increase the production of crops that are used in livestock and poultry feed, particularly yellow maize and oilseeds. The Ministry of Industry should discourage the import of edible oil and promote the oilseed solvent industry in the country.

2. His Majesty’s Government should establish an autonomous institution to address the problems faced by feed industries.

3. Low quality feeds, unhealthy competition from substandard eggs and chicks and other livestock inputs/products flowing from the border markets should be stopped.

Government Tax Policy on feed ingredients, feed additives and other associated inputs for poultry and livestock raising should be reviewed. Customs tax, sales tax, municipality tax, Chamber of Industry and Commerce tax and other taxes increase the cost of production by more than 50 per cent, making local products non-competitive to Indian imports.
9. References

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Pariyar, D., 1994-95. Existing Feed Situation a Different Region of Nepal and Strategies Developed to Increase Feed Production, Kathmandu.


