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Vegetable Development in Nepal: Present Status, Future Strategy, and Constraints

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Introduction

Vegetables are important because they help to maintain a satisfactory nutrient level and hence are a protective food. Global consumption patterns indicate that roughly 75 per cent of all vegetables produced are consumed in the developed countries. In the developing countries, where malnutrition and food scarcity prevail, the consumption of vegetables is very low. In spite of the fact that vegetables and pulses are the cheapest sources of vitamins and proteins, compared to other sources such as meat, fish, milk, and eggs, the increase of vegetable production in developing countries has received inadequate attention. This is confirmed by the consumption pattern given in Table 6.1 which compares average consumption in countries of this region with the average given for developed countries.

Need to Increase Vegetable Consumption

The low intake of vegetables in the developing countries can be attributed to the fact that the major emphasis so far has been on the increased production of cereal crops. In the light of recent food production trends, a perceptible shift is already seen in the agricultural and food policies of some countries of this region. A number of them have achieved self-sufficiency in food. The increase in cereal production has been especially satisfactory during the last decade or so in the Asia-Pacific region. A point

TABLE 6.1
**Consumption of vegetables by developing countries in comparison to
 developed countries**

Countries	Per caput consumption of vegetables per year (kg)
Nepal	45.5
India	45.0
China	73.0
Indonesia	20.0
Malaysia	34.3
Average of developed countries	125.0

has now been reached where more attention to nutritional adequacy is essential. At present, we are guided by national average figures which mask inequalities in access to food by poorer sections of the population. Efforts should be made to express food availability in terms of those commodities that increase nutritionally adequate consumption at provincial, district, and household level, so that disparities in food availability are revealed. Where a single staple food forms an extremely high proportion of the food intake, deficiencies are almost certain to occur.

Source of Quality Food

Careful consideration, therefore, is required to mobilize some resources to improve the quality of food. This can be done by giving due priority to increasing the output of dairy products, meat, fish, eggs, fruits, and vegetables. However, since the average income of people in the developing countries is too low to meet expenses for higher consumption of dairy and meat products, the immediate need, or priority, should be to increase the production and consumption of nutritive horticultural products because these can be produced without involving high costs. Within the horticultural group, vegetable crops offer better scope due to their short maturation period, high rate of productivity per unit area, and their traditional use in local diets.

Proposed Strategy for Development

To achieve the desired goal of increasing vegetable production, an appropriate strategy needs to be developed. In the context of constraints in the developing countries, where population pressure on the land has already reached the limit, large-scale diversification of land use from important food and commercial crops may not be possible. The only strategy, therefore, is to increase the productivity. If we look into the production levels of horticultural crops, including vegetables, the yield in the developing

countries is less than half that of the developed countries. Therefore, a close analysis of the reasons for these low yields is needed and an appropriate programme must be initiated on the following lines:

- development of suitable varieties of vegetables that thrive under the day lengths of winter months in the tropics and sub-tropics,
- improvement of indigenous varieties of underexploited traditional vegetable crops,
- development of appropriate production technology for stress conditions,
- improvement in the availability of indigenously produced high quality seed,
- provision of appropriate extension support,
- provision of proper marketing, storage, processing, and price control mechanisms that assure fair prices for farmers as well as consumers.

In the light of the above strategies, His Majesty's Government of Nepal has given high priority to increasing vegetable production in order to satisfy the basic nutritional requirements of the people and to improve the standard of living of small farmers.

Various schemes launched by HMG/Nepal for these purposes, their achievements, and future strategies are presented in this paper.

Socioeconomic Significance of Vegetables in Nepal

Complementarity of Production Areas

Approximately 93 per cent of the population is involved in agriculture, and the average land holdings are 0.5 hectare in the hills and 1.5 hectares in the terai. The total population at present is 17 million, and the current growth rate is 2.6 per cent per year. The proportionate share according to geographical area indicates a growth rate of 1.3 per cent in the high hill and mountain areas, 1.8 per cent in the middle hills, and 14.1 per cent in the terai. As in other countries, in Nepal a substantial increase in urban population is taking place. In the Kathmandu valley the population has almost doubled during the last decade because of migration from rural areas. In the other urban areas of Nepal, the population growth trend is similar. In addition to the above population growth, the number of tourists visiting Nepal is also on the increase, and this means that at certain periods, additional demands for resources have to be met.

Due to the rapid urbanization process, the increase in demand for vegetables in urban areas has resulted in an excessive flow of vegetables from across the Indian border. This has happened because local production has not been able to meet the demand.

In rural areas, traditional vegetable production was restricted to a few limited varieties grown in kitchen gardens. The consumption pattern indicates that the current per caput consumption is 73 kg per annum in urban areas and 45.5 kg per annum in rural areas.

Transport and access problems in rural and remote areas means that vegetables are generally grown for local consumption only. The traditional farming community Jyapoos grow vegetables on a commercial scale for the expanding urban markets. In Kathmandu, as well as other urban areas, they practise intensive cultivation of small market gardens. Due to the rapid expansion of residential and industrial areas in the Kathmandu valley, there was a tremendous increase in land prices, which made these small farmers sell their land. This resulted in a reduction in the area under cultivation within the suburban area. To meet the demand for vegetables, commercial scale production has increased in some rural areas during the last decade. Taking advantage of the development of roads and the variety of agroclimatic conditions at different altitudes, the farmers have started growing vegetables during different seasons in order to meet the demand of consumption areas where vegetables cannot be grown all the year round. Table 6.2 outlines the vegetables supply network for Kathmandu valley.

Similar systems of supply and production exist for other towns and cities also. Generally, during the season, vegetables are produced locally and are not brought in from other areas because of the cost of transport and other expenses. Out of season, vegetables are brought from the outlying areas as high prices compensate for transport expenditure.

It is an increasing trend for farmers to establish vegetable production in areas that are less than five or six hours' walking distance from the road. Figure 6.1 shows the areas where commercial vegetable production has been established after the construction of roads. From Figure 6.1 it can also be seen that commercial vegetable production is expanding in the terai along the east-west highway, while off-season production is developing in the high hills, mid-hills, and inner valley regions located within the access corridors of the roads.

The important north-south corridors for vegetable production are:

- Dhangadhi to Dadeldhura—far western region
- Nepalgunj to Surkhet and Dang—mid-western region
- Bhairahwa to Tansen, Palpa, and Pokhara—western region
- Birgunj to Hetauda, Chitwan, Daman, Naubise, Kathmandu, Rani-pauwa, Trishuli, and Panchkhal—central region
- Biratnagar to Dhankuta, Hille, Sidhuwa, Angdim, and Ilam—Western region

TABLE 6.2
Supply of fresh vegetables to Kathmandu from different sources

Crop	Period of supply	Production areas
Tomato	Oct. to Feb. March to May June to Sept.	Sarlahi, Dhanusa, Bara Dhading, Nuwakot, Panchkhal, Kathmandu, Azamghat
Eggplant	Sept. to Dec Jan, Feb Mar, April, May June to Aug.	Sarlahi, Dhanusa, Bara Dhading Kathmandu, Pokhara
Onion	April to June	Dhanusa, Nuwakot, Bara, Saptari, Kathmandu valley
Radish	May to Oct. Nov. to Feb.	Palung, Ranipauwa Kathmandu valley
Cauliflower	Nov., Dec., Feb., March Sept. to Jan. Oct. to Dec. May to July, Sept., Oct.	Kathmandu valley Bara Nuwakot Tistung, Palung, Daman
Cabbage	June, July Dec. to March April to June	Daman Bara, Parsa Kathmandu
Carrot	June, July Nov. to May	Daman, Palung Kathmandu valley
French bean	April to July Oct. to Dec., March to May	Kathmandu valley Dhading
Sweet pepper	March to June June to Sept. Nov. to March	Dhading Kathmandu valley Lalbandi
Pea	Aug. to Oct. Oct. to Feb. March, April	Tistung, Palung Bara Kathmandu valley

Profitability of Vegetables

Specialized production techniques have been adopted by farmers, and, together with the naturally diverse climatic conditions, they have resulted in an attractive off-season vegetable market. Compared to food crops, vegetables are much more profitable in different areas of the country (Table 6.3).

Small Farmers' Participation in Vegetable Farming

Due to very small holdings (1.5 ha in the terai and 0.5 ha in the hills), most of the farming in Nepal is of a subsistence type. In the hills, partic-



Figure 6.1: Vegetable production areas in Nepal

ularly, the small size of the holdings together with the low soil fertility and lack of irrigation facilities make it very difficult for farmers to meet the minimum costs of living. This results in migration to urban areas, and to the terai, in order to find work.

Experience has shown that the introduction of high-yield, high-return vegetable crops, supported by a proper market mechanism, can greatly improve the incomes of small farmers, particularly in the hills, where labour is underused.

During the development of the vegetable programme in Nepal, it was found that, in the initial stages, farmers having larger holdings were attracted towards vegetable cultivation because of the profits involved. The programme started to expand because of the easy availability of inputs and technical know-how and consequently the participation of small farmers also increased. This resulted in an increase in labour costs and hence the profitability became less attractive for larger farmers. A new trend in vegetable cultivation, by landless farmers on land rented for a season, expanded because landless farmers were able to use family labour in production and marketing.

If we analyse the gross income a small farmer receives from marketing vegetables, we may well find that vegetable growing is more profitable when family labour is used. A breakdown of income based on an average gross return of Rs. 3000 from one *ropani* (500 m) is illustrated in Fig-

TABLE 6.3

Gross income received from vegetable cultivation in different areas of Nepal

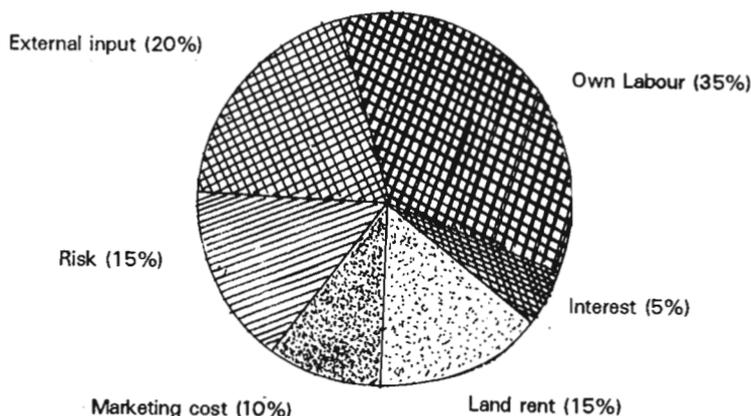
Area	Crop	Gross income per hectare (Rs.)	Remarks
Hills			
Naubise	French bean	60,000	Irrigated
District Dhading	Sweet pepper	70,000	Irrigated
	Eggplant	40,000	Irrigated
	Cucumber	50,000	Irrigated
	Tomato	60,000	Irrigated
	Radish	40,000	Unirrigated
Daman, Palung	Radish	40,000	Unirrigated
District Makwanpur	Cauliflower	55,000	Unirrigated
	Pea	40,000	Unirrigated
Ilam	Pea	45,000	Unirrigated
Kathmandu valley	Cauliflower	48,000	Irrigated
	Radish	25,000	Irrigated
	Pea	40,000	Irrigated
	Early cabbage	50,000	Irrigated
Terai			
Nawalpur	Tomato	30,000	Unirrigated
District Sarlahi	Sweet pepper	80,000	Unirrigated
	Tropical cauliflower	50,000	Unirrigated
	Watermelon	40,000	Unirrigated

Source: Department of Agriculture, Vegetable Division, 1988.

ure 6.2, which clearly demonstrates the attraction of vegetable cultivation for landless families and small farmers due to possibility of increasing family income by the use of family labour.

Agro-ecological Conditions and Institutional Support

The total surface area of Nepal is 145,685 km² and it is 880 km in length and 130 km to 240 km in width. The country is situated on the southern slopes of the Himalayas between 80° and 88°E longitude and 27° and 30°N latitude. The total area under cultivation in Nepal is 2.6 million hectares; one-third of this area is in the hills and two-thirds in the plains or foothills. The agroclimatic conditions, ranging from hot and humid in the terai to a typical temperate alpine climate in the high mountains, with a variety of ecological conditions at various altitudes, make it possible to grow a wide range of vegetable crops from tropical in the terai to sub-tropical and temperate in the middle and high hills. Every increase in altitude leads to cooler temperatures, and in winter sub-arctic to arctic conditions are experienced at high altitudes.



Family Income Rs. 1,650 = Own Labour + Interest + Land Rent.

Figure 6.2: Cost structure on small farms, Rs. 3000 ropani gross income from vegetable growing in hills

Main Agroclimatic Regions

A short description of different agroclimatic regions of Nepal and their suitability for growing different vegetable crops is given below.

THE TERAI REGION

The terai is a flat region with elevations ranging from 50 to 500 m. The climate is tropical. The average daily temperature fluctuation is from 7°C to 24°C during December and January, and from 24°C to 34°C during May and June. The annual rainfall varies from 1000 mm (western parts) to 2000 mm (eastern parts). In the terai a wide range of vegetables are grown. The most important ones are tomato, eggplant, chilli, cucurbit, okra, onion, cauliflower, cabbage, potato, and sweet potato.

THE MID-HILLS REGION

The mid-hills consist of gently sloping hill and fertile valleys. The elevation ranges from 600 to 2000 m and, therefore, the climate is classified as sub-tropical to warm temperate depending upon altitude. The average daily temperature ranges from 2°C to 17°C in December and January and from 20°C to 27°C in May and June. The annual rainfall is essentially the same as that of the terai.

THE HIMALAYAN REGION

The Himalayan region is a high altitude area above 2400 m above sea level with snowfall in winter. The average daily temperature ranges

from 1°C to 10°C in December and January and 12°C to 21°C in June and July. During the warmer season radish, turnip, broad leaf mustard, and other vegetables are cultivated. These vegetables only require short growing seasons.

THE INNER HIMALAYAN REGION

The inner Himalayan region consists of dry, cool valleys similar to those of the Tibetan plateau. The elevation ranges from 2400 to 5000 m. The average daily temperature ranges from 1°C to 10°C in December and January and from 12°C to 21°C in June and July. Because of the arid conditions and plenty of irrigation, this area is most suitable for seed production of cabbage, carrot, late cauliflower, and beet.

Place of Vegetables in Cropping Patterns

The cropping pattern in Nepal is mainly rice-based because rice is the staple food of Nepal. In the high hills, however, where rice cannot be grown due to low temperatures, short-duration millet, pseudocereals, and maize are the main crops.

In the terai and mid-hills under irrigated areas vegetables are always grown as winter crops after rice. Vegetable farmers, however, who have developed proper drainage and irrigation facilities, grow vegetables very intensively round the year.

In a rice-based farming system, vegetables grown as a winter crop is beneficial to farmers for two reasons. First, economically it competes well with wheat and second, due to flooding for rice cultivation, the intensity of many soil-borne diseases is reduced.

In the hills under rainfed conditions, radish, pea, and cauliflower are grown as summer off-season crops. The classic example of this may be seen in Daman, Palung, Ranipauwa, and other similar areas. The relative returns from these vegetables are much higher than from the traditional millet and maize crop.

Institutional Support

For the development of vegetable production, a Vegetable Development Division was established in 1972 within the Department of Agriculture for vegetable research and promotion and generation of new technology. Thirty-three horticultural farms were established under different agroclimatic regions of Nepal to support the programme through verification of production technology and dissemination to the farmers in their respective command areas, using the extension services of the Department of Agriculture. These farms also support seed production and distribution of seeds.

On the basis of agroclimatic suitability, seven main farms have been selected as centres of excellence to support research, variety maintenance, and breeders and foundation seed production (Table 6.4). In the vicinity of these farms, contract seed production through contract farmers is also organized.

TABLE 6.4

Important farms used as centres of excellence to support vegetable programme

Name of place	Altitude (m)	Location
Marpha, District Mustang	2522	Located in inner Himalayan region, representing alpine temperate climate.
Juffal, District Dolpa	2242	Located in inner Himalayan region, representing alpine temperate climate.
Dadeldhura, for western region	1500	Located in mid-hill region, representing warm temperate climate.
Mushikot, District Rukum, mid-western region	1400	Located in mid-hill region, representing warm temperate climate.
Khumaltar, Kathmandu (as main centre and headquarters of Vegetable Development Division)	1350	Located in mid-hill region, representing warm temperate valley in central region climate
Paripatle, District Dhankuta, eastern region	1200	Located in mid-hill region, representing warm temperate climate.
Sarlahi, District Nawalpur, central region	100	Located terai, representing tropical climate.

Multidisciplinary Support

The Vegetable Development Division, though attached to the Department of Agriculture, receives multidisciplinary support from the National Agriculture Research and Service Centre (a newly established organization under the Ministry of Agriculture to support research activity) through the Division of Plant Pathology, the Division of Entomology, and the Division of Agronomy.

Marketing Support

For providing marketing support and a price information system there is the Department of Food and Agriculture Marketing Services (DFAMS). This department actively cooperates with the Vegetable Development

Division in identifying market problems and develops programmes to solve them.

Vegetable Production Programmes

Past Achievements

Although statistical data are scarce, a reasonable picture of the expansion of vegetable production during the last decade is presented in Table 6.5 which shows estimates of cultivated area and production under different programmes. From the table, it is evident that there has been a steady growth of vegetable production in terms of both area and yield. During the last 10 years the areas under vegetables increased by 35 per cent and total production by 85 per cent. The productivity per hectare is estimated to have increased by 38 per cent.

Types of Production Programmes

From the figures given in Table 6.5, it can be seen that major increases have been achieved by launching special production programmes. In view of the limited resources, this approach of launching special production programmes in selected districts and areas, by mobilizing all available resources, seems the most appropriate way of increasing productivity.

The three categories of programme approach adopted are described below:

SPECIAL PRODUCTION PROGRAMME

The special production programme is used in areas that have access to motorable roads and, hence, access to external markets. The inputs for increased production are provided by facilitating the availability of necessary resources. These include credit from the commercial banks, agricultural inputs such as seeds, chemicals, and fertilizers, training through extension programmes, field demonstrations, and farmers' field days.

Initially the programme is launched in two or three selected panchayats, because the diverse climatic conditions render any uniform practice approach impracticable. It has been found that when success in a specific area is achieved, the programme spreads more rapidly. Table 6.6 gives an indication of the success of this programme compared to the general and least priority programmes.

GENERAL PRODUCTION PROGRAMME

Under the general production programme no special efforts are made to mobilize facilities because of lack of resources and trained manpower.

TABLE 6.5
Vegetable production programme: Area and production, 1980/81 to 1989/90

Production programme	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90
Special programme	Area (ha) 1,306	1,445	2,020	2,735	3,200	3,665	3,800	4,125	4,430	5,032
	Prod. (mt) 7,836	13,005	18,004	27,350	32,000	40,755	45,600	53,949	62,202	75,380
General programme	Area (ha) 7,211	14,227	15,138	17,420	1,800	18,911	20,464	22,382	23,000	23,748
	Prod. (mt) 36,055	99,589	107,223	121,940	126,000	142,580	164,122	187,474	207,000	223,282
Least priority programme	Area (ha) 95,489	102,500	108,535	110,007	117,000	116,010	114,700	122,993	112,603	111,704
	Prod. (mt) 477,445	512,500	542,562	551,034	585,000	599,199	62,922	6,633,100	653,098	668,064
Total national programme	Area (ha) 104,006	118,172	125,694	130,162	138,200	13,586	138,964	139,500	140,033	140,524
	Prod. (mt) 521,336	265,094	667,789	700,324	743,000	782,534	838,948	874,523	922,118	967,167
Productivity in mt per hectare	5.0	5.28	5.31	5.38	5.37	5.64	6.03	6.26	6.58	6.88

TABLE 6.6
Estimated vegetable productivity by programme (mt/hectare)

Plan period	Special production programme	General production programme	Least priority programme	National average
Sixth Plan	10.0	7.0	5.0	5.37
Seventh Plan (1990)	15.06	9.06	5.98	6.88
Eighth* Plan (1995)	21.0	12.5	7.2	9.053

* Targets.

This programme is carved out with whatever resources are already available within the general framework of the government's developmental policies. Inputs are supplied as per requirements. The principal objective of this programme is to grow vegetables for local use in order to improve nutritional requirements.

LEAST PRIORITY PROGRAMME

The least priority programme has been initiated in the remote regions of the country where access to markets and roads is non-existent. The principal objective of this programme is to promote kitchen gardens. Logistically, farmers in these areas can only adopt low-input technology.

Future Targets and Policies of the Government

His Majesty's Government of Nepal, under its programme to meet the basic needs of the people of Nepal by the year 2000, has given priority to increase vegetable production in the country (Table 6.7) so as to raise rural income, improve nutrition, and increase exports. Towards achieving this objective, targets have been set to increase vegetable production from 970,000 to 1,515,000 mt by the year 2000, (Fig. 6.3) and to raise the per caput consumption of vegetables from 45.4 to 64.0 kg per annum.

Since population pressure on land is already very high, it has been realized that it may not be possible to diversify areas from other crops. The strategy, therefore, is to increase productivity.

Past experiences under the special vegetable production programme have proved that productivity per hectare can be increased by 300 per cent through the priority programme and 200 per cent through the general production programme.

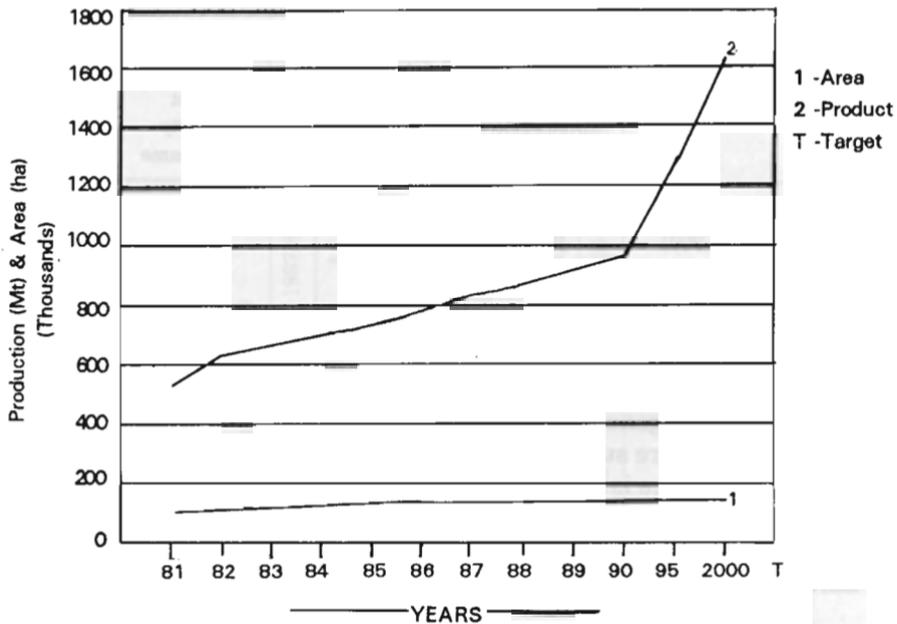


Figure 6.3: Growth trends of vegetable production in Nepal

TABLE 6.7
Targets of vegetable production programmes

Production programme		Eighth Plan	Ninth Plan
Special programme	Area (ha)	8,300	14,300
	Prod. (mt)	167,300	37,800
General programme	Area (ha)	29,000	34,000
	Prod. (mt)	362,503	510,000
Least priority programme	Area (ha)	103,200	92,200
	Prod. (mt)	743,042	756,045
Total national programme	Area (ha)	140,500	140,500
	Prod. (mt)	1,272,845	1,637,845
Productivity in (mt/hectare)		9.05	11.65

The Vegetable Seed Industry

Past Trend and Present Status

On the basis of area coverage, the annual requirement of vegetable seed in Nepal is estimated as 500 mt. Out of this total demand, current ef-

fective demand of seed that needs to be replaced every year due to poor storability, cross-pollination, and specific areas required for seed production, is estimated to be 300 mt. The remainder, since it is easy to produce by the farmers, is supplied through the farmer-to-farmer seed exchange system.

The progress of organized seed production of assured quality through the efforts of Vegetable Development Division, Agriculture Inputs Corporation, and Seed Testing and Improvement Programme is given in Table 6.8. Organized seed production during the last 10 years has increased gradually from 10 mt to 131.0 mt in 1989/90. The target is to produce 210 mt during 1989/90, which is 42 per cent of the total demand for seed in the country.

TABLE 6.8
Progress of seed production in government farms and under the government-supported programmes through contract farmers

Years	Foundation and improved seed in government farms (mt)	Production in farmers' fields (mt)	Total (mt)
1975/76	9.0	1.0	10.0
1976/77	9.5	3.6	13.1
1977/78	10.4	5.2	15.6
1978/79	10.0	14.6	24.6
1979/80	12.0	8.0	20.0
1980/81	9.2	15.4	24.6
1981/82	9.5	29.2	38.7
1982/83	12.9	25.6	38.5
1983/84	11.6	26.0	11.8
1984/85	11.8	21.4	33.2
1985/86	11.0	38.7	49.7
1986/87	11.0	58.5	69.5
1987/88	11.0	70.0	81.0
1988/89	11.0	120.0	131.0
1989/90 Target	16.0	194.0*	210.0

* Out of this 50 per cent is for private entrepreneurs.

From table 6.8, it can also be seen that until 1984/85, the production of seed had been static. The main reason for this was poor marketing of seed, as the credibility of seed produced under the programme was not established among the farmers and the Agricultural Inputs Corporation's seed promotional programme was weak.

Profitability of Vegetable Seed Production

To improve the economy of farmers in remote hill areas vegetable seed

production offers good scope. Due to low volume, high value (average price Rs. 50 to 100 per kg), and its non-perishable nature (if properly dried and packed), vegetable seed production is becoming popular with farmers in remote areas such as Dolpa, Marpha, Tehrathum, Bhojpur, and Rukum. Care, however, is necessary to see that only such vegetable seeds be encouraged in remote areas which cannot be economically produced in the areas connected by road. Such seeds are of onion, radish, cauliflower, cabbages, leafy vegetables, sweet pepper, carrot and turnips.

Vegetable seed production is a risky venture, needing skilled and experienced farmers. Crop duration is longer and the input requirement is high, but in totality it offers good returns to the farmer. Table 6.9 gives an idea of the seed yield levels possible in Nepal and the gross return on current seed purchase prices. For comparison, seed yields that were obtained in developed countries are also listed.

TABLE 6.9
Comparative-seed yield/hectare and gross return from seed production

Crop	Area of production in Nepal	Max. seed yield in Nepal kg/ha	Gross return (Rs. /ha)	Seed yield in other countries (kg/ha)
Cabbage	Marpha	1000	120,000	1000-1200
Carrot	Marpha	1000	100,000	1200-1500
Radish	Kathmandu	1200	54,000	1500-1800
Cauliflower	Dolpa	300	60,000	300-400
Tomato	Nawalpur	160	28,000	200-300
Eggplant	Nawalpur	400	40,000	300-500
Pea	Bara	1200	18,000	1500-1800
Bean	Belkot	1000	50,000	1500-1800
Onion	Rukum	500	50,000	300-400
Chilli	Nawalpur	250	15,000	300-400
Okra	Nawalpur	1200	18,000	1200-1500

Organization for Seed Production

The Vegetable Development Division, with support from seven selected farms, Pakhribas Agricultural Centre, and Lumle Agriculture Centre, is responsible for the identification of suitable varieties and their maintenance through zoning at appropriate farms. Required quantities of foundation seed are also produced by these farms.

Commercial seed production is organized through contract farmers in the vicinity of farms responsible for seed production. Field verification is provided by trained technical officers from the respective farms. Checks and field inspections are carried out by the Seed Certification Inspector from the Seed Testing and Improvement Programme.

Seed lots from approved lots are tested in the programme's seed testing laboratories. Seed is cleaned at the farms where small-scale cleaning equipment is available.

Seed that meets the standards is procured by the organization on whose behalf the seed was produced by contract farmers. The main agency to procure seed from farmers so far has been the Agricultural Inputs Corporation—a public sector organization. Recently, private entrepreneurs have also started seed production through this system.

Role of Public Sector in Seed Industry Development

In the context of Nepal, AIC is a public sector organization supporting vegetable seed production and distribution. In any developing country where a competitive private seed industry does not exist, the public sector company can play an important role in programme development. To a large extent, the AIC has performed this function. The way has been paved for contract seed production, the procedures of commercial-scale production have been established, a pricing system has been developed, a certain level of quality standards has been set, and a seed distribution system through seed dealers has been developed.

A further function of this organization is to refine its operations and to provide fair competition to the private seed industry to maintain a commercial level of prices and quality.

Role of Private Sector in Seed Industry

In any country, it is impossible for a single public sector organization to handle the country's entire seed trade. To give a wider horizon to the seed programme, the participation of the private sector is very important.

Until recently, private sector participation in an organized vegetable seed programme was almost negligible in Nepal. Seed traders purchased seed from any source and marketed it to farmers at good profit. Within three years the demand for seed production by private entrepreneurs reached 100 mt, which is almost 50 per cent of the total organized seed production targeted for 1989/90.

Recently, an association of vegetable seed entrepreneurs has been established in Nepal. The participation of private enterprises in the vegetable seed trade has infused seriousness into the seed business and efficiency in production and distribution is improving.

Export of Vegetable Seed

Nepal has high potential to produce a wide range of vegetable seed due to availability of suitable agroclimatic conditions ranging from tropical to temperate. Comparatively cheap farm labour is another factor which makes this labour-intensive production more attractive and economical. The demand for vegetable seed in the countries of the region is increasing. The climatic conditions of most of the countries of this region are not congenial to commercial-scale seed production, so it offers Nepal a great opportunity to establish a seed export business with these countries.

A start has already been made in this direction. For the last two years, Nepal has exported radish seed to Bangladesh. During the current year, there is a confirmed demand for 25 mt of radish seed. Through unofficial channels, the seed of radish and cauliflower produced in Nepal is also finding its way into the bordering states of India. This trade needs to be regularized.

Hybrid Seed Production

Because of the problem of patents and a demand for uniform and higher-yielding cultivars, the demand for F1 hybrid seed is on the increase. In some crops, hybrid seed production needs emasculation and pollination through manual labour. Due to cheap farm labour, this is one area which can be exploited by Nepal. In most cruciferous crops, though hybrid seed production is carried on by using self-incompatibility, the maintenance of self-incompatible lines requires a large labour force to undertake bud pollination. This can be undertaken in Nepal very economically.

For any developing country, it is very difficult to undertake research projects to develop its own hybrids, because of the high cost involved. To use farm labour and improve the economy of small farmers, hybrid seed production could be successfully launched through international cooperation and through organized custom production.

A start in this direction has already been made in Nepal. Through cooperation with the Asian Vegetable Research and Development Centre, hybrid seed production with heat-tolerant Chinese cabbage has been successfully launched. Under the ambient conditions of the mid-hills, it is possible to get excellent flowering and seed set of Chinese cabbage; successful maintenance of parental lines through bud pollination has been achieved. Hybrid seed produced in Nepal and the seed of parental lines have been tested by the centre and good results have been obtained. The testing of hybrid seed production on farmers' fields has been successful. Per hectare, a seed yield of 300 to 400 kg of hybrid seed has been achieved.

Hybrid seed production in tomatoes through a custom production arrangement with a private multinational company of the United States has been initiated through the participation of private entrepreneurs in Nepal. If successful, the programme will be expanded to other crops.

The FAO Fresh Vegetable and Seed Project

To support the HMG/Nepal effort to increase vegetable seed production in Nepal with a view to improve the nutrition of people and the economy of small farmers, a project of vegetable seed production was conceived in 1980. This FAO project of three years' duration was started in 1981 with funding from the Government of Switzerland. On the basis of successful implementation, the project entered into its second phase from 1984 to 1987. As the project created an impact and the need to support second generation problems was felt, the project was extended into a third phase of four years' duration that started from June 1987. Activities supported by the project and its impact are described in brief.

The First Phase, 1981–1983

The project activity in 1981 started with the objective of increasing the quality and quantity of seed production within the country, seed being a vital input for increasing production and productivity of vegetables.

For this, the project screened suitable varieties and, wherever possible, new stock seeds were imported to replace deteriorated seed stocks. Seed production technology was amended and field verification and seed standards were established. Seed production, processing, and storage facilities at five identified seed centres were completed.

Intensive seed production training to farmers, field-level technicians, and senior planners and officers was organized.

A systematic programme for variety maintenance and breeder and foundation seed production was started.

Since the development of a seed programme is a long-range activity, the project was extended into a second phase.

The Second Phase, 1984–1987

To achieve the main objective of increasing vegetable production through the use of locally produced high quality seed, a large number of field demonstrations were organized (annually 4000). These demonstrations were conducted only in selected pockets in the areas covered by the special production programme. Through these demonstrations, the credibility of seed produced within the country was established. This resulted in increasing demand for seed. The acreage under vegetable production started increas-

ing and second generation problems such as lack of market facilities, increased input supply, and proper pricing to farmers started to emerge.

On the seed production front, due to increased demand and by way of promoting private entrepreneurs, a need was felt to improve the seed distribution system through AIC. To meet increasing demand for seed from farmers, it became necessary to expand foundation seed production facilities, identify more areas for seed production, and train more farmers who could undertake seed production.

A need was also felt to identify appropriate measures to support a marketing and distribution system. To accomplish all these activities, the project was extended to a third phase of four years' duration, 1987–1991.

The Third Phase, 1987–1991

The project expanded its demonstrative vegetable production in 21 districts, covering 60 pockets supporting 2000 hectares of vegetable production. Inputs are supplied to farmers at commercial prices. Free support is given in the form of demonstrations (4000 annually) and intensive training and field days.

For making the programme self-sustainable, vegetable nurserymen are appointed in each production area. Through these nurserymen, vital inputs, i.e., chemical and technical know-how, are disseminated to farmers. Dealers linkages are established between these nurserymen, seed entrepreneurs, and plant protection chemical companies. In the area of seed production, sustaining support is provided to maintain varieties for foundation seed production and to introduce new technologies, including schemes for hybrid seed production. Support is provided to private entrepreneurs to increase seed production through contract farmers.

The Vegetable Seed Campaign Programme

With support from the FAO Fresh Vegetable and Vegetable Seed Production Project, funded by the People's Republic of China, the Vegetable Seed Campaign Programme was launched in 1982/83. Under this programme, a large number of field demonstrations were organized in the districts covered by the special production programme. Through massive field demonstrations and field days an impact was made on the farmers and sales of seed picked up. Growth of vegetable seed production during the last 10 years is given in Figure 6.4.

The Marketing Component

When the programme started expanding, second generation problems arose, such as the need for systematic marketing through development of

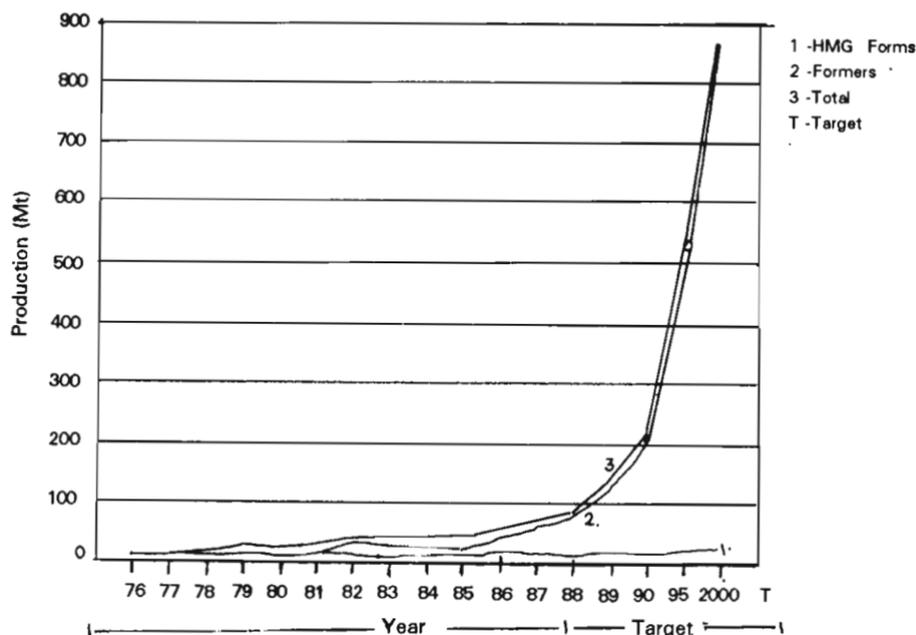


Figure 6.4: Growth trends of vegetable seed production in Nepal

farmers' markets and the establishment of collection centres and market yards.

Through the marketing component in the project, pilot-scale studies to establish wholesale markets and collection centres have been initiated. On this basis, more support to improved marketing has been approved through the United Nations Capital Development Fund (UNCDF). A memorandum of understanding has already been signed between UNCDF and HMG to support market-related activities with a financial outlay of US\$ 11.8 million. This also includes support to private entrepreneurs through a venture fund to establish food processing, storage, transport, and seed industry.

Geographical Coverage of FAO Project

Details of project areas supported by the FAO Project are given in Figure 6.5.

Future Strategies and Programmes

Removal of Production Constraints

As vegetable production on a commercial scale is a new operation in Nepal, there are various constraints on production. Some of the con-

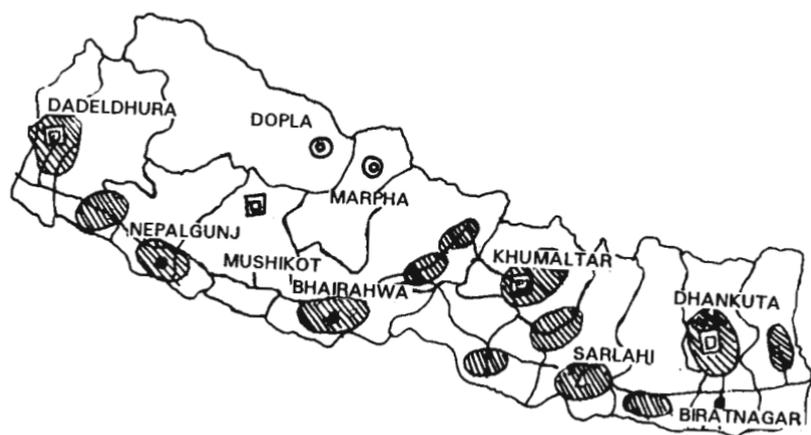


Figure 6.5: Location of project support areas

- ⊙ Alpine climate seed production centres
- ⊠ Warm temperate seed production centres
- △ Tropical vegetable seed production centres
- Transit seed stores
- ▨ Demonstrative vegetable production pockets
- ~ Roads

straints that need immediate attention are listed below:

1. **Safe use of plant protection chemicals:** Due to the low educational level of farmers, insecticides and fungicides are used indiscriminately. As there are no legal regulations for the safe use of these chemicals, a clear government policy needs to be developed. Haphazard import of insecticides and fungicides must be discouraged and only safe chemicals with low residual effects should be allowed importation or formulation in the country.
2. **Breeding of varieties suitable for local conditions:** With regard to the breeding of vegetable varieties on a global basis, all activity is in the hands of private multinational companies. It is difficult for developing countries to undertake this activity due to financial and manpower constraints. There is a need for a cooperative research programme between the countries of the region. International institutions such as the Asian Vegetable Research and Development Centre and ICIMOD can play an important role in bringing about this cooperation and should provide necessary support. Research activity being of a long-range nature, developmental aid programmes are unable to support this activity. Activity of this type has to start as a country programme rather than as a project.
3. **Improvement of traditional vegetables:** There are some vegetables tra-

ditionally grown in the countries of the region. Since these are of no commercial value, no multinational has done any research to improve cultivars for these crops.

There is great need for improved strains of these vegetables through simple selection and maintenance breeding.

As vegetables are grown under the short to intermediate daylength of the tropics, cultivars should be developed that can perform well under these conditions. This is perhaps the main reason that the yield of vegetables in this region does not match the yield of western countries.

4. Reduction of post-harvest losses: In the context of countries of this region, it is estimated that 25 per cent of fruits and vegetables are spoiled in post-harvest loss. If this loss is minimized by using appropriate and simple techniques such as taking out field heat, the availability of vegetables can be increased to meet the growing demand.
5. Promotion of processing industry: For all perishable fruits and vegetables, there is always a glut in production during the peak harvest season. Due to poor storage and distribution systems, prices drop to such a low level that farmers incur great loss. This glut could be avoided by promoting a food processing industry, developing the use of locally produced food products, providing incentives to the processing industry, and avoiding import of such items from other countries. There is great scope for both cottage-level and small-scale processing industries.

Improvement of Marketing Facilities

The success of any production-oriented programme depends upon the efficient marketing of produce. If produce is not sold at prices which are remunerative to farmers, further production is hampered and all efforts are in vain. In the vegetable development programme of Nepal, when it was realized that production levels had reached a commercial scale of operation, action to improve the marketing system was initiated.

Based on a pilot-scale support provided by the FAO project, HMG of Nepal acquired 2 hectares of land to establish a wholesale vegetable market in Kathmandu. The FAO project prepared a master plan to develop this area into a modern market for farmers. The UNCDF and HMG approved the investment of US\$ 4 million in various structures, including cold storage.

To provide support to the farmers in production areas, the UNCDF has also committed support to the development of collection sheds, market yards, and farmers' markets in other towns. Provision has also been made to develop approach roads between the production villages and the market yards and collection centres, through peoples participation.

Provision has been made to develop a master plan for fruit and vegetable marketing in Nepal so that all the activities in this direction are taken up in a properly coordinated way to avoid duplication.

Promotion of Private Participation through Venture Funds

It has been realized that the entire programme of production and marketing of agro-industries cannot be undertaken by government alone and that active participation of private entrepreneurs is a must.

To promote this, in addition to financial support, technical know-how in the management of the industry is very essential. For this, UNCDF has committed assistance to promote private participation in food processing, storage, transport, and seed industry through a venture fund.

A scheme is under consideration to establish a venture capital fund unit in collaboration with the banks and technical line ministry or departments. The venture fund will provide 30 per cent equity to project proposals with good potential which are duly approved by the technical departments. Private entrepreneurs will provide 10 per cent equity share in the form of land, building, equipment, or cash. Under this co-ownership, the responsibility of the technical department will be to oversee the proper financial management, accounting, and growth of the venture. The commercial bank concerned will provide credit to the extent of 50 per cent of the total equity value of the venture (see Annex 1 for model of the proposed venture capital fund).

It is also envisaged that when the scheme is successful, entrepreneurs can become the shareholders of the venture capital fund unit.

Annex 1

A model of the proposed Venture Capital Fund

Objective	<p>To assist emerging entrepreneurs to develop and expand their business.</p> <p>To assist with short-term funds for new venture investments.</p> <p>To assist entrepreneurs to replicate (take over or expand) present investments in horticulture and seed production and to extend present marketing and storage facilities.</p> <p>To support entrepreneurs with skills in:</p> <ul style="list-style-type: none"> - technical know-how, - general accounting and auditing, - marketing and sales promotion, - generation management, and - financial analysis as to budgeting, break-even, cash flow, and other required analysis programmes. <p>To complement existing financial like the Intensive Banking Programme or general bank lending.</p>
Background	<p>Small emerging entrepreneurs need assistance to start and consolidate business in horticulture seed production, storage, and marketing.</p> <p>The business needs to be assisted by financial input and appropriate know-how.</p> <p>Existing financial sources are mainly bank loans or credit extended by suppliers, but a new venture most often has to find its own financial source during its inception. To obtain bank financing for new ventures is also a cumbersome procedure, especially when the equity in the project is limited and the project is a new venture. The support of a venture-capital fund (equity participation) will assist entrepreneurs by:</p> <ul style="list-style-type: none"> - helping to achieve higher equity, which will strengthen the project's possibility to attract bank financing, - the presence of a co-owner who can assist in management and other technical back stopping, and - lessening the financial burden on a new venture through equity participation.
Proposal	<p>A Venture Capital Fund is established through a grant from . . .</p> <p>A Venture Capital Fund is managed by an autonomous board of directors representing:</p> <ul style="list-style-type: none"> - Ministry of Agriculture, - Nepal Rastra Bank, - two major commercial banks (NBL 51 per cent HMG and RBB 100 per cent), and - a selection from future clients who have benefited from the Fund and made contributions towards the Fund. <p>Technical support is made available through</p> <ul style="list-style-type: none"> - the project (Ministry of Agriculture), - the project (Nepal Rastra Bank), and

- two major commercial banks (the technical support shall not debit any cost to the Venture Capital Fund or to any prospective client).

Duties/ Obligations

Ministry of Agriculture (unit . . .) responsible for technical clearance, technical know-how, close supervision of the project
Nepal Rastra Bank (unit . . .) responsible for monitoring and maintaining the fund

Commercial banks (unit . . .) responsible for financial analysis

The fund will build up its own competence in the field of:

- management,
- accounting and auditing (which can be charged), and
- marketing and sales promotion.

Procedures

Applications must always be channelled through the Ministry of Agriculture, which is responsible for:

- appraisal,
- technical clearance, and
- necessary market surveys.

Financial clearance as to equity participation is approved by the Board of Directors of the Venture Capital Fund after financial analysis.

Client/applicant should always be able to support the investment with his own equity of at least 10 per cent of total financial requirements. This equity can come from contributions of land, buildings, machinery, vehicles, cash, or bank accounts.

The Venture Capital Fund can contribute additional equity up to three times the clients contribution.

Other necessary financing shall be obtained from bank/supplier or other common financial institution through ordinary application procedure (and preferably assisted by the technical staff involved).

Bank finance will be 'secured' by an equity ratio up to 40 per cent which is for more than ordinary loan applications,

Example

Total financing requirements	NRs. 1,000,000 out of which:
working capital	NRs. 200,000
fixed assets	NRs. 800,000
financing	NRs. 1,000,000
client's own contribution	NRs. 100,000
Venture Capital Fund contribution	NRs. 300,000
bank financing	NRs. 600,000

Only bank financing will carry any cost, while the equity will give a return when the project has reached a sufficient level of viability.

Equity participation by the Venture Capital Fund is expected to be repaid from profits generated by the investment, thus leaving the entrepreneur as sole owner of the project within a given time.

As long as the Venture Capital Fund is co-owner of the project, the Fund shall have a final right to:

- close the project if mismanaged, unavailable, or not utilized as planned,
- recover any amounts from project assets/proceeds whenever needed,
- obtain information from bank accounts, project accounts, or any other information deemed necessary, and
- monitor the progress of the project and assist in know-how.

The entrepreneur is the sole manager of the project and shall furnish the Fund with information as agreed upon.

The entrepreneur shall always have the right to cease participation of the Fund by repayment of the equity contribution made by the Fund.

Repayment to the Fund shall be made by the project (entrepreneur) from the profits generated on a scheduled basis.

As long as the project obtains equity participation from the Fund, the entrepreneur is obliged to purchase shares in the Fund on a yearly basis in advance up to a value of 2 per cent of equity contributed by the Fund.

Example

1st Jan. 1989 Equity from the Fund	NRs 300,000
Shares to be purchased	NRs 6,000
1st Jan. 1990 Equity from the Fund	NRs 250,000
Shares to be purchased	NRs 5,000
1st Jan. 1991 Equity from the Fund	NRs 150,000
Shares to be purchased	NRs 3,000
1st Jan. 1992 Equity from the Fund	
Nil	

The entrepreneur will retain shares with a face value of NRs. 14,000 in the Fund.

Future Objectives

To make the Venture Capital Fund autonomous

To have the participation of successful entrepreneurs on the board of directors of the Fund

To employ a managing director of the Fund

To generate sufficient earnings from capital investments to sustain losses (write-off) and managerial expenditure.

A Venture Capital Fund of US\$ 2.5 million will:

- On an annual and on-going basis be able to assist some 50 entrepreneurs with an equity participation of NRs. 200,000 each (or 10 entrepreneurs with NRs. 2,000,000 each)

With the following prerequisites the Fund will be able to invest balances kept at around 10 per cent.

- Entrepreneurs make a yearly contribution of 20 per cent towards increasing the equity of the Fund.
- Entrepreneurs make an average repay to the Fund five years after an initial grace period of two years
- Failing projects (total write-off) do not exceed 10 per cent.