Forage and Pasture Development and Forage Seed Production in Nepal

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Introduction

Forage and pasture development is a new intervention for rural communities in Nepal. Before 1980, forage cultivation was confined to government farms and only 36 hectares of crop land were under forage cultivation. The primary limiting factor for forage and pasture development in Nepal is the conventional belief that livestock thrive on natural vegetation and crop residues. Yet the rising human population and improved living standards have increased the demand for various livestock products and high-yielding animals that require a high quality and quantity of fodder and sustainable management systems.

Currently, cultivated forage and pasture lands are the major sources of inexpensive, good quality feed for livestock. With the improvement in livestock breeds and farming systems, forage cultivation and pasture land improvement initiatives have significantly increased in Nepal. Presently, over 2,000 hectares of crop land are cultivated annually for forage production. Despite this significant achievement, pastoral development continues to occur slowly, hardly offsetting the severity of the country's feed deficit situation. One of the major limiting factors for the development of fodder and pasture production in Nepal is the availability of quality seed.

Forage and Pasture Development Activities in Nepal

Nepal's national forage and pasture development records date back more than 150 years. Forage and pasture development programmes were first initiated by the Rana Prime Minister in 1860. He introduced white clover seed into the Kathmandu Valley after visiting England. Now, white clover is well-naturalised and growing as a weed throughout Kathmandu Valley. In 1952, FAO conducted a study on forage and pasture development which formed the basis for development activities. During this time, several cheese factories were established in high altitude regions such as Rasuwa and Dolkha districts. Forage and pasture development programmes were carried out in the vicinity of these cheese factories.

In 1970, the Ministry of Agriculture established the Fodder and Pasture Centre at Khumaltar and Rasuwa. The FAO-funded Trisuli Watershed Project in Rasuwa and Nuwakot and the Swiss Aid Multipurpose Agricultural Centre Programme were simultaneously established. The ADB-assisted Livestock Development Project (LDP) commenced in 1980 and continued until 1994. This project aimed to develop forage crops specifically for the *Terai* and mid-hills. The project is now entering a third phase.

In 1983, the governments of Nepal and the People's Republic of China signed a treaty regarding the trans-frontier pasture areas in Mustang, Dolpo, Langtang, Humla, Khumbu, and Walangchung Gola. This project aimed to slowly phase out the transhumant movement of livestock herds from Nepal to Tibet (China) and vice versa. In order to help local people adjust to this change in migration patterns, Nepal implemented a 10-year 'Northern Belt Pasture Development Programme' (NBPDP) in high altitude districts bordering the Tibetan Autonomous Region, China. During this same period, FAO-funded a project to strengthen the Northern Pasture Programme. Similarly, the FAO Himalayan Pasture and Fodder Research Network was implemented throughout the Hindu-Kush Himalayas.

The Department of Livestock Services (DLS) is the sole government institution responsible for implementing forage and pasture development activities in Nepal. In 1994, a Pasture and Animal Nutrition Development section of DLS was established to plan, implement, and monitor forage and pasture development activities.

Forage and Pasture Development Trends

A few years ago, most of the seed required for domestic use was imported from India, the United Kingdom, U.S.A., New Zealand, Australia, Canada, Egypt, and Bhutan. Over 12 tonnes of forage and pasture seed were procured between 1980 and 1992, primarily by the above-mentioned FAO-funded projects and the ADB-funded Local Development Programme (LDP). These seeds were distributed to farmers and used for pasture development. Over 162 species and 371 cultivars of grasses and legume species were introduced and tested in Nepal through this initiative (Pande 1993).

Forage and pasture development activities have gradually increased since the 1980s. In 1980-81, only 36 hectares were under forage crop cultivation — most of which were located within government farms. Another 177 hectares of rangelands were improved by various means such as oversowing with exotic pasture species, constructing pasture paths, and building drinking water facilities for livestock, particularly around cheese factories. Since then, over 2,000 hectares of land have been transformed into different forage crops each year. Similarly, over 7,242 hectares of high altitude pastureland have been developed. Presently, the area under forage crop cultivation on private land is negligible. Only 0.05 per cent of all agricultural land in Nepal is used for forage cultivation. Similarly, only 0.4 per cent of native pastureland is developed for forage. Forage crop cultivation and pasture land improvement trends are presented in Table 1.

Role of Government Organizations, NGOs, and INGOs

At present, nine government farms (under DLS) are directly or indirectly involved in forage and pasture development activities.

Table 1: Area Under Forage and Improved Pasturelands

Fiscal Year	Forage Crop Cultivation (ha)	Pasturelands Improvements (ha)
1980/81	36	177
1981/82	139	175
1982/83	532	289
1983/84	407	371
1984/85	446	250
1985/86	329	898
1986/87	415	73
1987/88	330	898
1988/89	697	919
1989/90	880	853
1990/91	1061	1025
1991/92	1000	652

Four farms are located in the *Terai*; two farms are located in the hills, and three are situated in the mountains (Table 2). These specific farms are involved in forage and pasture development activities, producing a small amount of forage and pasture seed for their own consumption, whereas other farms are carrying out forage and pasture development as secondary programmes. Only surplus seed is sold to farmers.

In addition to DLS farms, different Forage and Pasture Research Stations exist under the auspices of the Nepal Agricultural Research Council. These include the National Pasture and Grassland Research Centre, Khumaltar, Lalitpur; the Regional Pasture Research Centre, Dhunche, Rasuwa; the National Sheep Research Centre, Jumla; the Agricultural Research Centre, Pakhribas; and the Agricultural Research Centre, Lumle. A reasonable amount of forage and pasture seeds is produced in these locations and available for distribution. In 1994-95, a total of 54 tonnes of forage seeds was produced in Nepal, 45 per cent of which are produced by farmers, and 52 per cent by government farms (Tables 3, 4 and 5).

Although the DLS is the primary governmental institution involved in pasture and forage development, many government and non-government organizations are involved in such activities in Nepal. The Nepal Agricultural Research Council is responsible for carrying out and studies on forage and pastures. The Institute of Agriculture and Animal Science, Rampur, the Institute of Forests, and the Department of Forestry and Soil and Water Conservation are all involved in forage and pasture development. NGOs and INGOs participating in such work include ICIMOD, King Mahendra Trust, ACAP, and SNV.

Role of the Private Sector

Forage and pasture development programmes in Nepal have tended to be successful when run in conjunction with dairy industries. In the milk shed areas around Janakpur, Bhairahawa, and Chitwan, forage cultivation (particularly during winter) is widely practised. In certain areas of Janakpur, Palpa, and Dang, forage seed production has become quite popular.

The primary forage crops cultivated by farmers are oats, vetch, berseem, stylo, and molasses. A reasonable amount of teosinte and lab-lab are also grown as summer crops. Similarly, perennial crops like napier, para, and broom are widely grown in the

Table 2. **DLS Government Farms Involved in Forage/Pasture Seed Production**

Region	Name	Major forage species
Terai		
1	Forage Development Farm, Janakpur	Berseem, Saftal, Oats Toesinte, Napier, Para Oats,
2	Forage Development Farm, Ranjitpur	Maize, Stylo Centro, Seratro, Kudzu Teosinte, MP
3	Forage Development Farm, Gaughat, Banke	Chari, Oat Joint Vetch
4	Forage Development Farm, Geta, Dhangadhi	Oats, Napier
Mid Hills		
1	Livestock Dev. Farm, Pokhara	Teosinte, Oats
2	Seed Dev. Farm Chitlang, Makwanpur	Oats, Paspalum
Mountains		
1	Livestock Dev. Farm, Jiri	Oats, Paspalum, Rye grass
2	Livestock Dev. Farm, Solukhumbu	Local grass, Phurcha
3	Livestock Dev. Farm, Panchasaya Khola	Oats, Paspalum

Table 3: **Seed Production at Government Farms, 1994/95 (2051/52)** (in kgs)

Name of the Farms	Oat		Vetch	Berseem	Kudzu	Lab-lab	Teosinte	Saftal	Joint vetch	Rye grass	Paspalum	Stylo	White-clove	Centro	Seratro	Des-modium
	Kent	Swan														
Fodder Dev. Farm, Janakpur	3250	-	300	3630	-	-	-	100	50	-	-	-	-	-	-	-
Fodder Dev. Farm	3339	3314	317	-	337	329	1610	-	-	-	-	400	-	50	50	-
Livestock Dev. Farm	1200	-	-	-	-	-	1750	-	-	-	-	-	-	-	-	-
Livestock Dev. Farm	2080	-	-	-	-	-	-	-	-	292	203	-	-	-	-	-
Livestock Dev. Farm	1700	-	-	-	50	-	1500	-	200	-	-	50	-	-	-	50
Sheep Dev. Farm, Chitlang	400	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sheep Dev. Farm, Panchasay	400	-	-	-	-	-	-	-	-	-	100	-	-	-	-	-
Yak Farm, Solukhumbu	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sheep Dev. Farm, Dhangadhi	1000	-	-	-	-	-	200	-	-	-	-	-	-	-	-	-
NARC, Rasuwa	300		-	-	-	-	-	-	-	-	-	-	10	-	-	-
NARC, Khumaltar	300	-	-	-	-	-	-		-	150	-	-	-	-	-	-
Sub-total	13969	3314	617	3630	387	329	5060	100	250	442	303	450	10	50	50	50

Table 4: **Seed Production at PFDP (FY 1986/87 to 1994/95)** (in kg)

FY	Stylo	Molasses	Desmodium	Total
1986/87	92.0	5.0	5.0	102.0
1987/88	194.0	44.0	83.5	321.0
1988/89	176.0	38.0	11.0	225.0
1989/90	386.5	166.5	15.3	568.3
1990/91	228.0	115.0	30.0	373.0
1991/92	181.8	152.3	24.3	358.4
1992/93	210.0	180.0	-	390.0
1993/94	350.0	250.0	-	600.0
1994/95	700.0	500.0	-	1200.0

Terai and the Middle Hills. Seeds are produced by private farmers, primarily for individual family consumption. Traditionally, seeds are only sold if surplus exists. However, due to increased demand for forage seed and the high profit it yields, many farmers are now beginning to cultivate seed. At present, over 20 districts are emerging as sources of different forage and pasture seeds.

Table 5: **Seed Production Record 1994/95 (2053/53)** (in kg)

Species	Govt. Farm (kg)	Private Sector (kg)*	Total
Winter Crop			
Oat	17,283	19,464	36,747
Vetch	617	305	922
Berseem	3,630	3,200	6,830
Saftal	100	-	100
Summer Crop			
Teosinte	5,060	654	5,714
Lab-lab	329	-	329
Velvet bean	-	25	25
Pasture			
Rye grass	442	-	442
Paspalum	303	-	303
wt clover	10	-	10
Stylo	450	824	1,274
Molasses	-	516	516
Perennial A			
Kudzu	387	-	387
J. vetch	250	-	250
Centro	50	-	50
Seratro	50	-	50
Desmodium	50	-	50
Perennial B			
Napier	NA	NA	-
Para	NA	NA	-
Broom	NA	NA	-
Fodder Tree			
Ipil-ipil	210	NA	210
Total kg	29,221	24,988	54,209
Per cent	53.9	46.1	100

Contribution of Farmers' Associations

In order to effectively implement their fodder development programmes, DLS has launched a Users' Group (UG) campaign throughout the country. Various UGs have been formed in response to local interest and motivation. Some of these include Forage Development Groups (*Ghans Bikas Samuha*) and Forage Seed Production Groups (*Biu Utpadan Samuha*). These UGs have emerged as potential seed producers, particularly in Palpa and Dang.

The Forage Development Group in Palpa has formed the Palpa Forage Development Association - 2050, a registered local NGO. The farmers have been involved in stylo and molasses' grass seed production since 1984. Presently, the Palpa Forage Development Association is producing over 700kg of stylo seed and 500kg of molasses' seed annually. In addition to seed, stylo and molasses are a good source of fodder for livestock and are sold to the members of the Association.

Forage cultivation and seed production in Palpa is relatively new. Stylo and molasses' production began in 1980-81 through the Department of Livestock Services under the Tinau Watershed Project funded by HELVETAS. Seed was brought from Australia and about seven hectares of community land from Pokharathok

Village Development Committee were cultivated with stylo and molasses. Cultivation was successful and gradually expanded. Presently, over 175 hectares of afforested land are being cultivated with stylo and molasses. About 50 hectares of this land are used for stylo and molasses' seed production. This project is managed by 17 Farmers' Groups comprised of more than 541 farm families.

Stylo and molasses are not only good forage crops, but are also excellent for soil conservation. Stylo, a leguminous crop, fixes nitrogen and improves soil fertility; it is also hardy and performs well in unfertile soil and afforested areas. As stylo is perennial, once it establishes itself, it thrives. Stylo and molasses can be successfully grown at altitudes of up to 2,000 metres. Under Palpa's ecological conditions, these crops produce 20 tonnes of green matter/ha and up to 66kg seed per hectare. When management practices are optimised, however, 33 tonnes of green matter and up to 230kg of seed can be produced per hectare.

Forage and pasture seeds are expensive. The price of stylo seeds ranges from Rs 250 (threshed) to Rs 350 per kg (picked), molasses' seeds cost Rs 200 per kg. The Department of Livestock Services fixes prices in consultation with the UGs, respective farms, and Chief District Officers (CDOs). The Palpa Forage Development Association is earning over three hundred thousand* rupees each year from the sale of seeds alone. Last year, stylo was being sold on the black market for up to Rs 1,200 per kg.

The present stylo and molasses' seed production programmes are good sources of income generation, particularly for women and young children as they do most of the planting, harvesting, and threshing work. Earnings from the sale of seeds provide women with their own funds, called *'pewa'*. The plantation of stylo and molasses has also significantly reduced female workloads. Time previously spent collecting fodder can now be devoted to other activities. The Association deducts about 10 per cent of the profits earned from seed sales and deposits this money into a revolving fund. These pooled resources are then used for the construction of drinking water tanks, school building maintenance, trail construction, and other community activities.

Palpa's success has begun to be replicated in other areas. For example, stylo production was introduced into Dang in 1990-91, particularly to aid soil and water conservation. Presently, various Farmers' Group are involved in fodder cultivation and seed production in Dang. Similarly, in the *Terai*, successful berseem seed production has begun. Over eight megatons of berseem seed is now produced annually in Dhanusha, Mahottari, Sarlahi, Banke, and Dang districts. The government price of berseem seed is Rs 65 per kg. Oats, vetch, and teosinte are also grown for seed production.

Scope of Forage and Pasture Seed Production in Nepal

Many fodder seeds have potential for cultivation in Nepal. Berseem is suitable for the southern belt of the country, including the Dhanusha, Mahottari, Sarlahi, Banke and Dang districts — areas with adequate irrigation facilities. It is estimated that about 0.2 million hectares of paddy land could be used for berseem seed production in these districts, thereby producing a mini-

* There are currently approximately 63 Nepalese rupees to the US Dollar

mum of 40,000MT of seed per year (Pande 1995). Stylo seed has been successfully produced in Palpa, Dang, and Makwanpur up to altitudes of 1,500m. Seed production of oats, vetch, and teosinte has been successful in the *Terai* and middle hills. Temperate pasture species such as white clover, rye grass, cocksfoot, and paspalum grow well in Rasuwa, Mustang, Jiri, and Dolpa. Some native species found in temperate mountainous zones (*Elymus nutans, Pennisetum flaccidum,* and *Medicago falcata*) have potential for seed production.

Nepal is now trying to become self-sufficient in tropical forage seed production, particularly for berseem, oats, stylo, and molasses. Yet production levels of temperate pasture seeds are far lower than domestic demands. In 1994-95, forage seed production reached 54 tonnes, 54 per cent of which was produced on government farms; farmers only contributed 46 per cent. Twenty species of forage and pasture seeds are produced on government farms. In contrast, farmers only grow six species for seed: oats, vetch, berseem, teosinte, stylo, and molasses. Oats and beerseem are the most popular seeds, contributing 68 and 13 per cent, respectively, to overall private seed production. In addition to these plants, a wide range of perennial forage species (napier, para, broom, setaria etc) is grown both on government farms and by private farmers.

Nepal has a forage and pasture seed deficiency of 38 per cent according to the DLS. If demands for seed dictated by INGOs and NGOs working in Nepal are included, this deficit percentage would significantly increase. Currently, the winter fodder seeds available meet only 57 per cent of the seed necessary to implement activities proposed by the DLS for 1995-96. Similarly, there is a 40 per cent deficiency of temperate pasture seeds (Table 6). Despite these deficiencies, stylo and molasses seeds are, ironically, in surplus. Old stock of these seeds is stored in the PFDP at Palpa.

The DLS target for Forage 'Mini-kit' Distribution in 1995-96 is 24,110 metric tonnes. It is assumed that about 25 per cent (6,027 packets) of the mini-kits will be berseem,

Table 6: **Demand and Supply Situation of Forage Seed 1995/96: (2053/54) (kg)**

Species	Available	Demand	Balance
Winter Crop			
Oats	36,747	54,431	-17,684
Vetch	922	16,937	-16,015
Berseem	6,830	6,407	+423
Saftal	100	-	+100
Sub-total	44,599	77,775	-33,176
Summer Crop			
Teosinte	5,714	5,714	0
lab-lab	329	329	0
Velvet bean	25	25	0
Sub-total	6,068	6,068	0
Pasture A			
Rye grass	442	570	-128
Paspalum	303	570	-267
White clover	10	760	-750
Sub-total	755	1,900	-1,145
Pasture B			
Stylo	1,274	760	+514
Molasses	516	380	+136
Sub-total	1,690	1,140	+550
Perennial			
J. vetch	250	250	0
Kudzu	387	387	0
Centro	50	50	0
Seratro	50	50	0
Desmodium	50	50	0
Sub-total	787	787	0
Perennial B			
Napier	NA	-	-
Para	NA	-	-
Broom	NA	-	-
Ipil-ipil	210	-	
Total kg	54,209	87,670	-33,461

70 per cent (16,877 packets) will be comprised of oat and vetch, and the remaining five per cent (1,206 packets) will be made up of other crops. The berseem mini-kit contain one kg of berseem seed with rhizobium. The oat mini-kit contains three kg of oats and one kg of vetch seed. Other mini-kit packages contain one kg of seed. The total seed requirements to produce these mini-kits is as follows: 6,027kg of berseem; 50,631kgs of oats; 16,877kg of vetch; and 1,206 kgs of other seed varieties - including joint vetch (*kudzu*), centro, seratro, desmodium, etc.

DLS has decided to target 353 hectares of farmers' land as potential winter forage development sites. Twenty-five per cent of this land will be covered with berseem and 75 per cent will be sown with oats and vetch. Similarly, the DLS has planned to develop about 379 hectares of native pasturelands for fodder development. About 50 per cent of this land will be located at high altitudes, while the remaining land will be cultivated at lower elevations. Seven hundred and sixty kg of white clover and 1,140kg of rye grass or paspalum will be needed to seed high pastures. Lower altitude pastures will require 760kg of stylo and 380kg of molasses.

To meet Nepal's growing demand for forage seeds, various private agencies are importing seeds from India. Yet they are generally poor in quality and not suitable for Nepal's growing conditions. Domestic forage and pasture seed production is increasing, however, especially in the milk-shed areas of the *Terai* and middle hills where dairy farming has been successfully adopted by farmers. Similarly, awareness of rangeland improvement issues is increasing in higher altitude areas near cheese factories.

Government Policies and Programmes

The Government of Nepal has been promoting forage and pasture development in a variety of ways. Government agencies such as DLS have helped with the production of forage crops and seeds, as well as the supply of planting materials, quality control, and facilitating marketing and distribution of seeds and planting materials. The DLS and other agencies have been promoting forage and pasture production by distributing forage mini-kits and fodder trees to farmers, supplying vegetative materials for perennial forage crops, implementing native pasture improvement projects, developing silvi-pastoral and agro-forestry incentives, and establishing forage nurseries and forage seed production resource centres. The government has also been organizing training for farmers and supplying technical staff in relevant fields, as well as publishing leaflets, booklets, and extension materials related to rangeland development.

DLS has also been registering forage seed producers and establishing rural seed banks. Farmers who could potentially produce fodder seed are registered through this orgainzation. These farmers are then given the necessary technology and resources for quality seed production. Similarly, Users' Groups help establish rural forage seed banks for which DLS provides technical and financial support of up to Rs 3,000 (US$ 50). This money, once matched by local UGs, is deposited in a revolving fund. Such endeavors have encouraged the successful propagation of berseem and oat crops. However, in temperate environments, pasture crops are limited by the availability of land for pasture seed cultivation. The implementation of all of these programmes depends on strong people's participation

DLS has fixed the minimum germination percentage of different types of seeds and their purity standards through HMG's Nepal Seed Board in order to control seed quality. DLS has fixed prices of these items after consulting respective government farms, farmers' representatives, and Chief District Officers in order to regulate seed prices and the costs of planting materials (see Annex 2).

Major Limitations and Constraints

Subsistence-oriented Production

Most of Nepal's farmers are subsistence-oriented producers. Farmers grow a variety of crops in relatively small amounts to support their families. Specialisation or commercial production of crops, especially forage seeds, is not part of traditional farming systems. Farmers involved in forage production grow some seeds for future use and only sell their surplus when available.

Farmers are primarily concerned with growing crops for domestic consumption. Any changes in traditional farming systems affect food supply. Many winter and summer forage crops compete with food crops such as wheat and maize. Consequently, most farmers are reticent to grow fodder on valuable and scarce cultivable land.

Seed Quality

Most of the seed produced on government farms and by individual farmers is of poor quality. Similarly, berseem seed imported from India has been reported to include many weed seeds.

Training and Skills

Forage and seed production is highly specialised and requires trained manpower — skills that are lacking at both government and private, local levels. Government staff need to be trained in quality founder-seed production, breeding, and processing, while farmers should be trained in the production of grower seeds, quality control, harvesting, processing, and proper seed storage.

Forage Seed Production and Distribution

There is no organized programme in Nepal for the production and distribution of forage seed. DLS and other organizations involved in the promotion of fodder and pasture development activities are more concerned with promoting production levels than the marketing aspects of such endeavours.

A large quantity of forage seeds is imported from India, particularly from Sitamathi, Bihar, and Gorakhapur, U.P. It is estimated that about 800-1,000kg of berseem and 300-5,000kg of oat seeds are brought from India and sold throughout Nepal. These seeds are less expensive than locally produced seed, though the quality is low.

Recommendations

Forage seed production programmes should be well organized. A national-level institute responsible for the production, processing, quality control, and marketing mechanisms of fodder seed should be established. Forage production (including seed/planting materials) should be promoted as a potential source of income generation, particularly for rural farmers. Export possibilities, particularly to other SAARC countries, should be explored. A specialised farmers' association should be formed for this purpose. Old seed stocks at government farms should be immediately replaced with high-quality seeds sup-

plied by registered seed growers in order to maintain variety, purity, and high seed production levels.

Government and non-government efforts should be directed towards the extensive use of fallow crop lands for forage cultivation to solve winter feed deficits and improve soil fertility. Farmers involved in forage seed production should be trained in quality seed production and processing. Farmers in seed production districts should be provided with the necessary equipment for seed processing and quality control. Rules and regulations to control the quality of seeds produced should be amended by the agencies concerned.

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