

学位論文全文に代わる要約 Extended Summary in Lieu of Dissertation

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Title of Dissertation

学位論文要約 :
Dissertation Summary

1. Introduction

The Federal Democratic Republic of Nepal is situated in between longitudes 80⁰4'to 88⁰12'E and latitudes 26⁰22'to 30⁰27'N. The altitude ranges from 60 meters above sea level (ASL) to 8848 meters ASL. It is a landlocked country surrounded by the People's Republic of China on the north and the Republic of India in the east, west and south. The country has an area of 147,181 square kilometres with total cultivable land area of 3,091,000 ha. The population of the country is 26.49 million with an annual growth rate of 1.35 and a per capita gross net income of US \$703.

Agriculture and forestry are the two main sectors of the Nepalese economy. They account for 35.7% of the gross domestic product (GDP) and employ 65.6% of the total population. Still, 82.3% of the total population lives in the rural areas and agriculture is the main income source of 76.9% of the households. Vegetable farming has been the main source of cash income for a majority of Nepalese farmers (about 70%) across the country. As a result, culinary and subsistence vegetable farming has been gradually transformed into commercial vegetable farming. Both acreage and production of vegetables have increased in Nepal since the 1990s and the contribution of vegetable production to the nation's GDP and AGDP has been estimated to be 4.86% and 13.6% respectively. The area, production and productivity of fresh vegetables in the year 1990-91 were, respectively, 140,500 ha, 1,074,648 Mt, and 7,600 kg/ha. Similarly, the area, production and productivity of fresh vegetables during 2010-11 were respectively, 244,102 ha, 3,203,536 t, and 13,124 kg/ha demonstrating a significant increase in the acreage, production and productivity of vegetable crops in Nepal in two decades. On the other hand, the per capita consumption rate of fresh vegetables has also significantly increased from 48 kg in 1984 to 60 kg in 1995. The latest availability of 104 kg is still below the minimum requirement of 146 kg per person per year recommended by the World Health Organization (WHO) and Food and Agriculture Organization (FAO). Vegetables are among the national priority crops in Nepal because of their nutritional value, domestic market and a perfect cash generating commodity for farmers of all economic categories. Moreover, these crops are of short duration (semi-annual to annual), associated with lesser risk and require relatively small and short term investment than those required for other agricultural enterprises. Vegetable farming is labor intensive, and therefore creates local employment. Importantly, both women and man can significantly contribute in vegetable farming and both genders can have equal opportunity to contribute to their household income. This provides women a sense of confidence and economic security leading towards their empowerment and development.

On the other hand, the area under fresh vegetable production is expanding every year shows an increase in demand for quality seeds. In Nepal, hilly topography and remoteness are hindrance to market accessibility. However, it also creates an opportunity to engage poor rural farmers in the seed sector which is low volume and high value commodity. There is a substantial gap between the demand and supply of vegetable seeds in Nepal. This situation creates a market-based niche production of vegetable seeds and also reduces reliance on imported seed. The low-volume but high-value and non-perishable nature of vegetable seeds makes it a unique commodity for income generation to the disadvantaged groups (DAGs). Therefore, production and marketing of fresh vegetables and seeds offers excellent opportunity to improve the

livelihood of the people especially in the remote hills of Nepal. In the subsistence agriculture economy, maintaining the demand and supply of seed is vital to enhance agricultural productivity for improved livelihoods. The production of vegetable seeds in the country is gradually increasing since 1997-98. Thus, this study will perform the economic analysis (cost benefit ratio) of vegetable seed production and seed distribution system in the eastern Nepal.

With the objective of producing high quality vegetable seed to meet the national demand and expand the export potential, the Government of Nepal (GoN) started in 1975 seeking collaboration with international donors to promote seed-based enterprises in Nepal. As a result, a vegetable seed production program was initiated at the first time in Nepal in 1975. Many seed projects have been implemented in different parts of the country at that time by the Overseas Development Administration (ODA). It funded a project at the Pakhribas Agricultural Centre (PAC) for eastern hills of Mechi and koshi in eastern development regions and Lumle Regional Agricultural Research Centre (LRARC) for western hills of Kaski, Parbat and Myagdi of Nepal since 1976. Two seeds projects, one funded by FAO/DANIDA, and the other funded by the United States Agency for International Development (USAID) were implemented in different hill districts of east, central, and west of Nepal in 1980.

External assistance during the 1980s is considered to be instrumental in the development of the seed sector in Nepal. A Swiss-funded project with FAO technical assistance, named “Fresh Vegetable and Vegetables Seed Production Project” was launched in 1981 in association with the then Vegetable development Division of the DoA, which started focused intervention into vegetable seed sector. The project lasted till 1996, and provided inputs on introduction, improvement, recommendation and release of commercial varieties of vegetable seeds. Other projects also followed suit and are credited to have made important contributions in developing physical infrastructure and human resources for the vegetable sector. Some of the terminated projects such as KOSEVEG (an ODA/UK funded project), VFC/ Rapti, MARD (an USAID funded project), SPMP (GTZ funded project); and some of the recent projects such as Li-Bird, CBED/CIDA, CEAPRED/DANIDA, CEAPRED, SDC and SSSP- a DFID funded seed sector project active during early 1990s to early 2000s have worked towards commercialization of vegetable seed sector. The vegetable seed production industry of Nepal had largely benefited from Swiss contributions during the decade of the 80’s and 90’s in screening and identifying improved vegetable varieties, improving seed production technologies, developing physical facilities, and training farmers and government personnel in seed production.

2. Objectives of this study

The marketing of fresh vegetables is often reported to be chaotic as the middleman benefits substantially among the value chain actors whereas the production of vegetable seeds in the country is gradually increasing since 1997-98 with association of public private partnership program. Thus, these two studies will perform;

- I. Cost-benefit analysis of selected vegetable crops and vegetable seeds growers.
- II. Analyze the vegetables distribution system with profit margins of the value chain actors in the marketing system.
- III. Study existing price fixation mechanisms for the vegetables and vegetable seeds.

3. Methodology

Two field survey was conducted in a farming community of Patle/Khalde/Pansing, at Dhankuta Municipality-2 and 3, and Majuwa, located at Parewadin Village Development Committee - 6, Majuwa in Dhankuta district of Nepal to identify the production cost of French bean seeds and off-season cabbage producers’ level profit margin at nearest marketing hub, Sidhuwa *bazaar*; where farmers from the surroundings sale their produce to either co-operative or local collectors

respectively. The major three distinct markets; Dhankuta of Dhankuta district, Amarhaat market, Dharan of Sunsari district and Gudri market, Biratnagar of Morang district were selected for wholesale and retail level marketing margin study. The Koshi highway connects the collection hub to distinct markets with distance of 21 km for Dhankuta, 73 km for Dharan and 118 km for Biratnagar. A small number of value chain actors were involved in different functions (40 farmers for each study and 4 collectors including one co-operative, 7 wholesalers and 12 retailers for off-season cabbage value chain study) were interviewed using structured questionnaire for data collection. The secondary data were collected from the different sources such as stakeholders, line agencies, GoN, Nepal Agriculture Research Council (NARC), NGOs and INGOs. Collected data were tabulated, cross-tabulated, summarized and analyzed by @RISK software. At the beginning, data were collected for one *ropani* (500m²) area and converted to hectare prior to analyses.

4. Result and discussion

4.1. Study on vegetable production

4.1.1. Socio-characteristic of the respondents

In the study area, Parewadin VDC-6, Majuwa of Dhankuta district, the total number of respondent were randomly selected for the study. In term of the academic qualification of respondents, majority of respondents (72%) were literate, 12.5% were illiterate and 12.5% had high school level education. Only 3% of the respondents had higher education. The majority of the respondents have more than one hectare and less than two hectares land by 42.5% which was followed by 30% with more than two hectares and less than 3 hectares land. More than 3 hectares land holding percent of respondents was found 7.5% but less than one hectare land holding respondents were observed 20%. The average land holding and family size for per household was observed 1.69 ha and 6.57, respectively.

4.1.2. Vegetable crop selection and acreage, production and productivity

Cabbage was selected for fresh vegetable market study in Dhankuta district. Cabbage is very popular vegetable among the commercial vegetable growers of Dhankuta district. The crop is high yielding and less perishable than other vegetable crops such as tomatoes and leafy vegetable. As a result there is ease in market management including packaging and transportation. The total area covered by the cabbage and production in the district in 2010-11 was 1,450 ha and 28,650 t, respectively. About 70% of total production occurs during the monsoon season and 80% of produce get their way to neighboring districts and India. The total amount earned through the export was NRs. 137.52 million assumed by the DADO, Dhankuta on his own report. The *Green Coronet, F₁* (hybrid) variety of cabbage is commonly used by the cabbage farmers. In the past farmers used to grow Green Stone variety but later replaced by Green Coronet due to its self-life in the field at maturity. Green Stone was also vulnerable to head cracking in field if not harvested within fifteen days of maturity. Generally, seeding of cabbage for rainy season production completes in between April and June. On an average 32 days old seedlings are transplanted in the main field. Days to harvest started generally from three and half month after transplanting during this season. The seed rate was calculated as 325 gm/ha. Acreage, production and yield of cabbage in Dhankuta was 830 ha, 15,782 t and 19.01 t/ha in 2006-07. Similarly in the year 2012-13, the acreage, production and productivity were 1,490 ha, 44,180 t and 29.65 t/ha, respectively, demonstrating the significant increasing in the cabbage farming in the district. On the other hand, the acreage, production and yield for seasonal cabbage were 520 ha, 15,080 t, and 29 t/ha respectively in 2012-13 whereas the off-seasonal cabbage farming (summer and autumn) was found quite well by 970 ha, 29,100 t and 30 t/ha in the same year. The study result showed that productivity of off-season cabbage in the study area was observed 39.903 t/ha. The yield was prominently higher rather than district census (19.82 t/ha) and national census (16.8 t/ha) respectively in the year 2011-12.

4.1.3. Marketing channel for off-season cabbage

Fresh cabbage reaches to the ultimate consumers through the hands of various marketing agents involved in the marketing chain. Marketing channel also helps to determine the prices. Higher the number of middlemen in the channel, the higher is the price and *vice-versa*. The marketing channel involves two main places: collection hub and assembly points. Cabbage producers first bring their cabbage to the collection hub located along the road head, where the cooperative, collectors, marketing agents and wholesalers are located. From the collection hubs, cabbage is brought to major assembling centers like regional level wholesale markets and for further distribution to the wholesalers, retail markets and export to Indian border towns. The vegetables produced in this study area reach market mainly through Dhankuta–Dharan / Biratnagar-Kakarvitta- Silgudi (West Bangal of India) and Dhankuta- Dharan- Biratnagar- Joghani (Bihar Pradesh of India) corridor. At this assembly center a number of wholesaler/commission agents operate. Each of the players in the supply chain has their owned small business and operates by setting family members or staffs. The concept of a large company has not yet entered into cabbage trading. These types of wholesalers/commission agents have worked only on commission basis for the collectors/cooperative. The big traders and regional wholesaler work in 6 to 7% commission basis for collection centers and road head traders. As fresh commercial cabbages are produced in summer and autumn in the study area, it becomes an off-season vegetable for *Terai* and bordering Indian markets. It is, therefore, a seasonal business for the traders as the supply of this vegetable as off-season is limited to the months from May/June to October/November only. The off-season cabbage supply chains (market channels) in the study area are found only two based on co-operative and local level collectors. The co-operative based channel followed by the significant respondents (90%) whereas collectors based channels followed by only 10% of the total respondents.

4.1.4. Pricing and price of off-season cabbage

In study, result shows that the product price has been fixed by the Sidhuwa Multi-purpose Co-operative Pvt. Ltd. under the market information system. It collects the market information from the Agri Produce Market Center (APMC), Amarhaat, Dharan, APMC, Gudri, Biratnagar and APMC, Birtamoad, Jhapa. And then, storing, processing, analyzing, and disseminating the information to the farming community. Although 86% of the cabbage head produced by the respondents were dealt by this co-operative significant number of respondents (78%) had not been satisfied with the price.

The monthly price analysis result shows that the price of off-season cabbage was NRs. 7.05/kg in the month of May/June. Due to the rainy season (monsoon period), the price is gradually increasing (NRs. 8.08/kg) till July/August but slightly decreased (NRs. 8/kg) in August/September. During the big festivals *Dashain* and *Deepawali*, price of cabbage was increased by NRs. 8.08 and 9.00 in the month of September/October and October/November. From November/December, the market of off-season cabbage is gradually substituted by seasonal cabbage, grown in the different part of the district and the *Terai* region. The price of off-season cabbage is going to decrease (NRs. 8.09/kg) in the month of November/December. Thus, farmers are not willing to produce cabbage during the normal season in the study area. Finally, the off-seasonal price of cabbage was observed NRs. 8.02/kg for the study area in the year 2011-12.

4.1.5. Cost of production and producers' profit margin

In general, the cabbage cultivation goes through six basic operations in the study area; nursery management for seedling production, land preparation for main seedling transplanting, transplantation, irrigation/fertilization/weeding and hoeing/pesticides spraying, harvesting and transportation to the road head collection hub. All these operations are done manually with the help of a pair of animal power (bullock) for main seedling transplanting bed preparation. However, it

was found very challenging to collect all the relevant information because of the lack of proper record keeping by the value chain actors (especially cabbage producers) and their crucial time for cabbage farming such as bed preparation, weeding and hoeing and fertilizing.

The production cost of hybrid off-season cabbage was observed NRs. 204,913/ha. Among the total cost, 94.3% was shared by variable/operational costs, and fertilizer (chemical and FYM) is one of the most expensive agriculture inputs shared NRs. 48,887 /ha (23.85%). In the case of labor requirement, total 422 man days of labors (NRs. 93,957) was required for cabbage cultivation for one hectare land with 45.85% of the total expenditure. The costs shared of animal power, fixed cost and others are observed NRs. 9,592 (20 days), NRs. 10,182 and NRs. 15,567 for one hectare respectively. Among the total cost 15% of cost (NRs. 26,728) claimed by the cabbage producers for their farm wastage and post-harvest handling losses occurred in transportation period between production field to collection hub.

The yield of hybrid cabbage was observed 39.903 t/ha. Similarly, the average sales price of cabbage was NRs. 8.02 per kg with gross income of NRs. 320,022/ha. The net profit amount and cost benefit ratio (CBR) was calculated NRs. 115,109 and 1.56, respectively. Hence, the production cost for one kilogram cabbage was NRs. 5.14 including the estimated 15% losses. The net profit margin from the off-season cabbage producers' was NRs. 2.88/kg.

4.1.6. Collector/wholesale level price

Increment in price from producer to wholesaler observed significant in off-season cabbage wholesale marketing. In Dhankuta, collectors directly supply cabbage heads to retailers at NRs. 10.50 including their collection charge, storage cost, load/unload cost with transportation charge of NRs. 2.48 (including profit margin of NRs. 0.50). Study did not find others market chain between collectors to retailers in the study area for the Dhankuta market. The collectors had charged the same expenses amount on different expenses heads such as collection, storage, load and unload, grading and packaging, etc excluding the transportation cost and local tax for distinct major market, Dharan and Biratnagar. Thus, the transportation cost and local tax during the transportation period of cabbage for Gudari market, Morang has been seen slightly higher rather than Amarhaat market, Sunsari. The total cost of collector was NRs 11.10/kg for Amarhaat market, Sunsari and Rs. 11.65 for Gudari market, Morang. Wholesalers from Amarhaat and Gudari market sell cabbage head to the local retail markets and other distinct markets, with an allocated total profit margin of around 17 and 16%, respectively. Among the allocated profits, they were reduced 6 to 7% for their own commission and remains had been paid to collectors/coop. Hence, the collectors earned NRs. 1.15 and NRs. 1.07 through one kg of cabbage from Amarhaat, Dharan and Gudri, Biratnagar markets respectively, which was about 9 to 10% of the profit margin allocated by the wholesalers.

4.1.7. Price increment at retail level

Retail price is synonymously known as consumers price. It is calculated by adding the transportation cost, local tax, cost for post-harvest handling loss and profit margin of the retailer in the wholesale price. Thus, the retail price for Dhankuta was observed NRs. 17.95/kg including the post-harvest losses NRs. 2.70/kg and retailers profit margin was NRs. 4.75/kg (26%). In Dharan retail market, NRs. 0.50 for transportation cost from Agri Produce Marketing Center (APMC) to retailers' shop, NRs. 0.1 for APMC management tax, NRs.3.60 for post-harvest handling loss and NRs.3.50 for retailers profit margin was allocated by the retailers. The total retailers price was NRs. 20.70/kg with 17% profit margin ratio. Finally, the retail sales price of per kg cabbage head was NRs.21.30 for Gudhari market of Biratnagar including NRs.0.2 for transportation cost from APMC to shop, NRs.3.60 for post-harvest handling losses and NRs.3.0 for the retailers profit margin. The profit margin was 14% in Biratnagar market.

4.1.8. Factor for price increment and their share in marketing margin

Besides the production cost, for more marketing margin, cost of post-harvest loss and post-harvest handling including profit margin are the crucial factors during the marketing of off-season cabbage value chain. From the result of the study, the marketing margin observed doubled in the two regional level markets; Dharan and Biratnagar including local level market, Dhankuta for off-season cabbage value chain. Among these three markets, the greater increment on the profit margin can be seen in the Dhankuta market by 29% whereas the lowest profit margin was found in the Gudari market, Biratnagar by 23%. The profit margin was calculated on the Dharan market by 26%. The research result shows that post-harvest handling loss percent was higher in Gudari Vegetable Market, Biratnagar by 22% followed by Palika Vegetable market, Dharan with 17% whereas lowest percentage was calculated at Treveni vegetable market, Dhankuta by 15%. In this way, it is clear that the loss percent depends on the distance between the collection hub and retail level market place, and also depended on the post-harvest handling methods such as cleaning, packaging, and physical infrastructure structure. The post-harvest loss claimed by the cabbage producers' percent at the collection hub was observed 7.5%. During selling the cabbage heads, farmers usually keep 6-7 outer leaves instead of keeping 2-3 leaves along with heads. An observation in this aspect has revealed that 13.6% weight was increased than that of technicians' harvest method. Hence, the yield in farmers' field condition should be much higher. Generally, the collectors removes the unnecessary outer leaves and after then weight the cabbage heads. Thus, traditional prepost-harvest method is one of the causes of post harvest loss during the transportation between the production farm and collection hub.

4.1.9. Role of agricultural co-operative in study area

Off-season cabbage farming is one of the most important sources of cash income of the rural livelihoods of eastern hills in Nepal. Most of the farmers were off-seasonal commercial cabbage farming within mid and high hills (range of 1,500 to 2,200 meters ASL) and un-irrigated (rain-fed) condition during the month of June/July and November/December. The Sidhuwa Multipurpose Co-operative Pvt. Ltd., Parewadin -7, Sidhuwa, established in 1995 with the objectives of promote the vegetable growth in this region by timely providing the agricultural inputs, technical knowledge and involves in exporting of fresh vegetable marketing. As per the objectives, it has been playing the crucial role for commercial vegetable farming in this region. Recently, it has 284 registered members and more than 1200 have non-registered members in and around of the located VDC. During the surveyed period, we have found only four local level collectors including this co-operative involved in the cabbage value chain at the vegetable collection hub, Sidhuwa. Respondents were not transacting to others persons/group rather than the local level collectors, co-operative /group because of the unsecured of due payment. Farmers are supplying their cabbage to this co-operative because of its assured marketing and due payment over time. Thus, this market hub is captured with the co-operative and few local level collectors. On the other hands, small level cabbage producers' cannot take the risk because of their limited resources.

4.1.10. Profit probability on the off-season cabbage farming

The Monte Carlo simulation result shows that 90% profit probability was ranges between NRs. 48,636 to 196,062 whereas least profit probability range at less than NRs. 48,636 by 5%. But remains 5% profit probability was found for higher range of more than NRs. 196,062. The profit base line was observed NRs. 115,981.98 from the tornado graph and yield and per unit sales rate was highly sensitive for planting materials cost and power cost in the off-season cabbage farming.

4.2. Study on vegetable seeds production

4.2.1. Socio characteristic of the respondents

Out of 40 households surveyed for the study on vegetable seed production, the education level of the respondents show that significant percent (72.5%) literate (can just read and write but not have formal education) whereas the percentage of illiterate and SLC (School Leaving Certificate- Junior Level high School) passed level of respondents is equal by 12.5% and just 2.5% have Bachelor and above degree only. On the other hand, the majority of the respondents have small land holding. About 37.5% households have less than 0.5 hectares land whereas 40% of them have 0.51 to one hectare and remains 22.5 % have more than one hectare to less than two hectares land holding. The average land holding ratio of per household was 0.66 hectares and the family size per household was observed 5.35.

4.2.2. Vegetable crops and variety selection for vegetable seeds production study

French bean, *Phaseolus vulgaris L.* is selection for vegetable seed production study from Dhankuta district of the eastern part of Nepal. The seed production of French bean is also suitable and popular in Dhankuta district because the diverse agro-ecological and climatic condition. Since more than one decade, farmers of this area have been involved in French beans seeds production with the technical assistance of different stakeholders such as Seed Entrepreneurs' Association of Nepal (SEAN), Seed Sector Support Program (SSSP) and Agro-vet centers. *Trisuli* and *Four seasons, OP (Open Pollinated)* varieties of French bean are the most popular and commonly produce by the seed producers in this study area. Farmers planted this French bean (pole types) in June/July and harvested on November/December. Farmers sold seeds immediately after harvest and continued until the month of January. The seeds requirement ratio was calculated 39.3 kg/ha and 70% of respondents were using the *Trisuli* variety whereas 30% used *Four-season*.

4.2.3. Production cost of French bean seeds farming

The data analysis showed that cost of production of French bean seeds was found 106,088 NRs/ha. The total production cost was shared by inputs; seeds (39 kg/ha), Bamboo (274 no./ha), farm yard manure and/or compost (447 doko/ha), chemical fertilizers (50:54:20 kg/ha), pesticides (2110 ml/ha) and found to be 36.7%. In case of the labor force, a total 291 man days/ha were used and total cost for power including 17 days of animal power were observed NRs. 56,985 (53.7%). Similarly, share of fixed cost was 6.40% (NRs. 6792/ha) and seed transportation cost was shared 3.2% (NRs. 3441/ha). The per kg production cost of French bean seed was NRs. 84.10. The yield and sale price of French bean seed was found 1.285 t/ha and NRs. 128.5 per kg, respectively by the risk analysis result. The gross income from French bean seed production was NRs. 168,206.5/ha. Finally, net profit was calculated as NRs. 62,118.5 with 1.59 cost benefit ratio (CBR).

4.2.4. Profit probability on the French bean seeds farming

The risk analysis for French bean seeds production shows an exciting profit probability result. The profit probability was observed high by 90% on the profit ranges of NRs. -792 to 133,191 whereas least profit probability was observed by 5% on the range of less than NRs. -792 to -51399. But remains 5% profit probability was found higher on the range of more than NRs. 133,191. The profit baseline was observed NRs. 62,173.90 from the tornado graph and yield and per unit sales rate were highly sensitive for power (labor) cost and materials cost in French bean seeds farming. Although profit probability indicates the negative sign, the benefit-cost ratio (CBR) was observed 1.59, which was found better than off-season cabbage farming. The benefit cost ratio for off-season cabbage production was calculated 1.56.

4.2.5 Pricing and price of French bean seeds

Farmers from the French bean seeds farming study area have been produced seeds under the gentleman's agreement with Seed Entrepreneurs' Association of Nepal (SEAN), Seed Sector Support Program (SSSP) and local level Agro-vet centers, who is the representative/member of the SEAN. Thus, SEAN provides the inputs through his member to the farmers and farmers grew the French bean seeds and sells to SEAN throughout his member locally. The minimum sales price has already fixed during the agreement period with bargaining on the basic of prior sales rate. Generally, the sales rates of these seeds depend on its standard. While the seed laboratories tested the seeds and certified, after then farmers sales their French bean seeds to the SEAN and others. SEAN provides some additional amount on the sale rate as a premium/bonus according to the seed laboratory test result such as moister, germination and purity. Thus, the respondents' per kg sales price of French bean seeds were varied from each others. The per kg French bean seeds sales price was found NRs. 128.50 for the year 2011-12 according to the risk analysis (Monte Carlo Simulation) result.

4.2.6. French bean seeds distribution system in research area

Farmers were producing the French bean seed on the basis of gentleman agreement between the seed growers' group and local traders or the representative members of SEAN. Agricultural inputs such as seed, fertilizer and others materials were provided by the traders. If seed growers need technical assistance these were also provides by traders freely. Seed growers harvest the vegetable seeds at maturity; dry and cleans seeds prior sending seed samples to traders for laboratory analysis's which includes the tests for moister, germination, purity etc. Seeds are ready for sale once the laboratory test results are available. Majority of seed producers sell their French bean seed to the representative member of SEAN whereas a few producers sell seed to the local Agro-vet Centre directly. The SEAN members collect the seed from the community or seed growers and sell to the SEAN at Kathmandu. Furthermore, SEAN has treatment, labeling and packaging and re-wholesaling and retailing facilities in the places of high seed demand. The local Agro-vet Centre, who have directly purchased the French Beans seeds from the seeds grower were also involved in wholesaling and retailing activities. Besides these, Agriculture Research Station (ARS) and National Commercial Agriculture Research Program (NCARP), Pakhribas under NARC has also producing the foundation certify (or categorized as source) seeds of French Beans in every year as per the NARC annual program and distributing in the local communities and stakeholders also. In this way SEAN, seed producers' group in the study area and NARC has maintained the seeds production, demand and supply in the Dhankuta and neighboring districts such as Terathum, Bhojpur, Sankhuwasaba, Sunsari and Morang.

4.2.7. Role of Seed Entrepreneurs Association of Nepal (SEAN) on vegetable seeds sector in Nepal

SEAN was initiated in the year 1989 and registered with the Government of Nepal in 1991 as a non-profit organization. It is an association integrating Nepali seed entrepreneurs' engaged in production, processing, and marketing of Nepali seeds. SEAN works extensively with farmers and traders conducting field inspections as well as trade agreements with farmers and traders. SEAN's activities can be summarized as follows;

- Organize the seed entrepreneurs' (Seed firms and individuals) in the private sector;
- Organize regional seed production and marketing workshop and arrange contractual seed production and marketing planning between seed entrepreneurs and farmers;
- Promote production, processing and marketing of high quality seeds by the private seed entrepreneurs;
- Liaise and coordinate with GoN and related agencies of professional to promote and incorporate increased involvement of private sector in the National Seed Program;

- Liaise and coordinate with the seed related national and international agencies of professional to Promote exchange of scientific knowledge;
- Provide consultative service support national and international institutions/individuals in seed related issues.

There are many seed enterprises but no private seed companies that have substantial resources and investment into the sector. There are 897 registered seed entrepreneurs (seed dealers other than seed producer) of which 175 are the members of Seed Entrepreneurs' Association of Nepal. Also, the DoA has listed 1,853 agro-vets across the country. Most of the seed entrepreneurs, including agro- vets, deal with vegetable and flower seed along with other agricultural inputs like fertilizers, pesticides and small tools and implements. While some seed companies do carry out quality tests, none of the seed companies have own varietal development activities in the country.

4.3. Post-harvest management practices

In the both research areas, grading is not practiced for the French bean seeds and off-season cabbages. This is due to no or minimal price difference in the graded versus non-graded product, and the high labor requirement for grading. Also, storage of cabbages is not practiced, and farmer prefers not to harvest cabbage without the presence of the buyer.

4.4. Main papers published in the international journals

Besides these two research studies, two main papers were published in the international journals. The first main paper was published on “International Journal of Agriculture and Applied Science” and another once has been in press for the publication on “Agriculture Marketing Journal of Japan” during the Doctoral Degree study period. The author wants to discussion about these two manuscripts in summary;

4.4.6. MARKETING PRACTICES AND COST-BENEFIT ANALYSIS OF OFF-SEASON VEGETABLES PRODUCTION IN THE HILL AND TERAI REGIONS OF NEPAL

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This comparative study was conducted in two major vegetable production pockets each representing hill and Terai regions of Nepal. For a hill, a field survey was conducted in Bandipur-8, Yampa Phant of Tanahun district, whereas Ratnanagar to Bhandara region of Chitwan district was surveyed for *Terai* with 42 and 40 numbers of respondents respectively in September, 2010. Farmers were requested to list all vegetable crops they grow on their farm, and identify two highly profitable vegetable crops from the list. From the both study areas, bitter gourd, cabbage, cauliflower, cowpea, cucumber, and tomato were the crops commonly selected for this study. The seasonal and off-seasonal price trend, cost benefit analysis during seasonal and off-seasonal production of selected vegetable crops, and existing marketing practices were studied to identify the most profitable vegetable crops for commercial vegetable farming in each study area.

The production cost of tomato was highest in the both study areas (NRs. 193,660 for hill and NRs. 66,980 for *Terai*) followed by; cucumber (NRs. 176,840) in hill and cauliflower (NRs. 155,900) in *Terai* whereas lowest cost of production was observed for Cauliflower (NRs. 161,920) and cucumber (NRs. 93,930) in hill and *Terai* respectively. Similarly, the benefit: cost analysis result shows that cowpea was the most profitable crops with 2.22 and 1.52 CBR in the *Terai* and hill

regions followed by cucumber and bitter gourd with 2.03 and 1.44 CBR respectively. Cabbage and cauliflower were the least profitable crops with 1.04 CBR for *Terai* and 1.17 CBR for hill. Tomato and cucumber ranked in third position by 1.74 and 1.36 CBR for *Terai* and hill which were followed by bitter gourd and cabbage with 1.6 and 1.35 CBR respectively.

While the commercial vegetable farming was first introduced in the study areas, the limited numbers of farmers were producing the vegetables and they take their produce directly to the market. Usually, they have small capacity to produce, which only fulfill the local demand. They perform retailing activities directly. Those respondents, whose farms are situated near from the city, were still followed this simple market chain by 7% and 10% of the total respondents from hill and *Terai* respectively. Gradually the number of producers was increased, as a result markets of their produce also expanded. Being an off-seasonal, fresh and higher profit margin, some middlemen and retailers from the nearby market started approaching farmers for vegetables while vegetable reaches at a peak harvesting time. Almost (74%) of the respondents from hill and 20% of the total respondents from the *Terai* were used this market channels. Over the time new market chain (Producers to Wholesalers/middleman to Retailers to Consumers) was developed. Some wholesalers and middlemen from the regional markets and nearby markets and some youth in the village started collecting vegetables on an individual basis. Some of them were actively involved to date and 20% of the respondents from *Terai* and 19% of the respondents from hill were followed this market chain. The transformations of agricultural cooperative from urban to rural, farmers were united under the cooperative to settle down their problems. As a result, the Janajagriti Hariyali Fresh Vegetables and Fruits Product Cooperative Limited, Bhandara-1, Chitwan and Gramin Fresh Vegetables and Fruits Product Cooperative Limited, Chainpur-1, Chitwan are established in the study areas on the year 2000 and 2009 respectively. The new big market chains were in operation for the study area at Chitwan district and 50% of the total respondents were selling their produce through cooperative market chain (Producers to cooperative to Wholesalers/middleman to Retailers to Consumers).

The study revealed that the farmers' involvement in cooperative and proper record keeping system of income and expenditure help to make vegetable farming lucrative by increasing the profit margins and bargaining power for product pricing. In order to increase the strength of vegetable farmers, their own vegetable sales counters under the cooperative umbrella should be established in the district headquarters and nearest regional markets Pokhara and Kathmandu for hill and *Terai* respectively. Furthermore, modern and appropriate commercial vegetable farming technologies with training opportunities should be arranged by the concerned authorities and other stakeholders.

4.4.7. Highly profitable vegetable crops for commercial farming and existing market practices in Tanahun district of Nepal

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A field survey was conducted in a vegetable farming community of Yampa Phant, located in the Bandipur Village Development Committee- 8, in the Tanahun district of Nepal to identify the most profitable vegetable crops for commercial farming. Data were collected using a structured questionnaire prepared according to the objectives of this study in September 2010. Forty-two respondents were randomly selected for interview. Finally, the data was tabulated, cross-tabulated and analyzed at the United Graduate School of Agriculture Science, Ehime University, Matsuyama, Japan. In the household survey, farmers were asked to select two highly profitable vegetable crops among the vegetable crops they grow. Farmers were selected seven types of vegetables; cowpea, bitter gourd, smooth gourd, cucumber, tomato,

cabbage, and cauliflower. Cowpea was the topmost crop, preferred by 25% of respondents, whereas cabbage was the least preferred crop preferred by only 1% of the respondents. Similarly, cucumber and bitter gourd ranked second and third, preferred by 22 and 18%, whereas tomato, cauliflower and smooth gourd were preferred by 15, 14, and 5% of respondents at fourth, fifth, and second to last, respectively.

The cost of production per hectare of tomato was highest (NRs.193, 660/ha) which was followed by smooth gourd (NRs. 188,730/ha) and cucumber (NRs. 176,840/ha). But the least cost of production for cauliflower (NRs. 161,920/ha) was followed by cabbage (NRs.162,560/ha). Production cost for bitter gourd (NRs. 174,960/ha) and cowpea (NRs.168,900/ha) ranked fourth and fifth positions. Similarly, cowpea was the most profitable vegetable crop with 1.52 CBR followed by bitter gourd with 1.44 CBR. Smooth gourd was found to be the least profitable vegetable among the selected crops by 1.16 CBR. Cucumber ranked third by 1.36 CBR followed by cabbage with 1.35 CBR. Tomato and cauliflower ranked at fifth and sixth with 1.32 and 1.25 CBR respectively.

While the commercial vegetable farming was first introduced by Lumle Agriculture Center (LAC) in this study area, the limited numbers of farmers (15-20 households) were engaged in vegetables farming and they used the preliminary market channel (Producers to Consumers) for selling their limited produce. This mainly observed in nearby markets such as Dumre, Anbukhairani and Damauli. Still 7% of the total respondents were using this direct market chain to sell their vegetables at local markets. Gradually the number of producers was increased, as a result markets of their produce also expansion. Being an off-seasonal, fresh and higher profit margin, some middleman and retailers from the nearby market started approaching farmers for vegetables while vegetable reaches at a peak harvesting time. Almost (74%) of the respondents were used this market channels. Over the time new market chain (Producers to Wholesalers/middleman to Retailers to Consumers) was developed. Some wholesalers and middleman from the regional markets and nearby markets and some youth in the village started collecting vegetables on an individual basis. Some of them were actively involved to date and 19% of the respondents from hill were followed this market chain. The big and long market channels (Producers to cooperative to Wholesalers/middleman to Retailers to Consumers and Producers to farmers' groups to Retailers to Consumers) have been seen in the past but prevailed only for a few months because of the obstacles in vegetables transportation during political conflict (1996 to 2006). During this period, the main highway, Prithivi Rajmarga was frequently closed by security personnel (almost every night) thus interfering with the timely supply of vegetables to the Pokhara wholesale market as the vegetables transaction came to peak early in the morning. In the year 2008, the existing but inactive Andimul Fresh Vegetables Produce Cooperative Limited re-formed and all vegetable farmers came under this cooperative and then constructed a new vegetable collection center in association with the District Agriculture Development Office (DADO), Tanahun. The cost of shed burned by the government of Nepal (GoN) through DADO, Tanahun and land was donated by the local landlord, Mr. Shanta Kumar Shrestha. Recently, Bhatbhateni Super Market, Pokhara branch has provided space for vegetable marketing inside its shopping complex within the low commission basis. The cooperative has been granted this golden opportunity by the owner, Mr. Min Bahadur Gurung, to serve the Pokharali consumers directly with their vegetables produced locally. To promote vegetables production and its marketing, transportation facilities were provided by the supermarket free at cost also.

The study revealed that the farmers' involvement in cooperative and proper record keeping system of income and expenditure help to make vegetable farming lucrative by increasing the profit margins and bargaining power for product pricing. In order to increase the strength of vegetable farmers, their owned vegetable sales counters under the cooperative umbrella should be established in the district headquarters Damauli and regional market Pokhara. Furthermore, modern and sustainable vegetable farming technologies should be promoted and disseminated through the DADO and other stakeholders.

5. Agricultural policies in Nepal

Nepal is predominantly an agricultural country and hence, the importance of this sector's development can hardly be exaggerated, especially in coping with increasing globally food crisis. In the light of the major role played by agriculture sector in the country's economy; the employment opportunity provided by this sector at the village level; the potential overall food security of the country and the gradual commercialization of agriculture at present, the development of agricultural sector is the undeniable need of today. Since agricultural development is the very foundation for the sustainable economic development and the major source of income and employment for the majority of Nepalese, agriculture sector received top priority since the early periodic plans and policies of the nation.

One of the important government policies in the 8th Five Year Plan (1991-1996) is to improve the agricultural marketing system through government and private sector participation. The Plan recognized that unless appropriate marketing infrastructure is developed and other related support is provided, it will not be possible to increase the production and consumption of agricultural commodities. Therefore, Nepal approved a twenty years Agriculture Perspective Plan (APP) in 1995 to accelerate agriculture growth for fast-track poverty reduction in a sustainable way. Similarly, the Tenth Five Year Plan (2002-2007) was specially formulated as Poverty Reduction Strategy Paper (PRSP) to the mainstream and orient overall development efforts to break the poverty trap and economic stagnation. The preliminary contribution of agriculture and forest sector is estimated to be 34% in the GDP during FY 2012-13. Thus, special attention is paid to the formulation and implementation of appropriate plan and policies for the development of this sector under the Agriculture Perspective Plan (APP). Some main agricultural plans and policies in Nepal are;

- I. Agriculture Perspective Plan (APP), 1995
- II. Periodic Plans
- III. National Agriculture Policy (NAP), 2004
- IV. National Agro-biodiversity Policy, 2006
- V. Seed Act, 1988 and its first amendment, 2008
- VI. Seed Production Guidelines, 1998
- VII. National Seed Policy (NSP), 1999

Review of past policies indicates that seed was not explicitly prioritized as a key input and carrier of new technology in agriculture. For instance, the APP, the leading policy document, did not include seed as one of the priority inputs. Similarly, the NAP and the current interim plan did not adequately emphasize the importance of seeds. Considering the weaknesses of the past, GoN has issued *National Seed Vision, 2013-2025 (Seed sector development strategy)* in April 2013. Its objectives are;

- to increasing crops productivities
- to rising income and generating employment through self sufficiency
- to import substitution and export promotion of quality seeds

Similarly, policies such as Agri Business Promotion Policy (ABP)- 2008, National Cooperative Policy (NCP)- 2012, Supply Policy- 2012, National Tea Policy- 2000, National Coffee Policy- 2003 and, Science and Technology Policy- 2004 were issued to fulfill the overall development of agricultural sector by the Government of Nepal. Due to the rapidly growth population and migration system from rural to urban, the productive agricultural land convert into residential area day by day. To maintain the food security problems, Government of Nepal has issued the *National Land Utilization Policy, 2011* in 18th April, 2011.

6. Conclusion and recommendation

Majority of the farmers from this study area cultivated off-season cabbage followed by green pea, cauliflower, radish and others. Potato farming is another most important crop for the mid hill and un-irrigated condition after then off-season cabbage. Farm families of cabbage producers and French bean's seed producers were involved in pre-production and post-production activities. They were also employed in transporting the product from the farm to the road head collection hub/ assembly centers. A large number of people were employed in the total supply chain, mostly loading/unloading, transporting, grading, cleaning and packaging the vegetable and seeds. With the promotion of export and product diversification in processed products, this sector could generate relatively large employment opportunities.

It is observed that off-season cabbage and French bean seeds production is increasingly important for the cash income of farmers in study areas. It provides higher returns to farmers compared to other annual crops, especially to small holder farmers who possess limited land. The trend towards increasing production also indicates that this sector is supporting the mission of rural poverty reduction as well as in uplifts the farmers' economic and social status. Therefore, it has a positive economic implication for Nepalese farmers. There is high positive correlation between the amount of cabbage sales and total household income of the farm family. Cabbages are, as yet, not a very important export commodity for Nepal, but it could emerge as an important commodity to garner foreign currency. Off-season cabbage and French bean cultivation, especially during rainy season, also helps to minimize soil erosion, thus its production is environmentally friendly and sustainable. The government policies and programs aim to focus summer season vegetable crops cultivation such as off-season cabbage and French beans in the hills as it appears to be helping to minimize soil erosion and increase the greenery in the hills as well as improving the overall quality of the farming land.

The inputs analysis showed powers cost (manpower and animal power) and fertilizers (FYM and chemicals) are the main inputs in the cabbage farming and French bean seeds production by 50 and 22%, and 53 and 17%, respectively. Defiantly, labors use trends in vegetable cultivation is higher than others cereals production. This may be even higher in the areas where transportation system is infrequent and/not available. Farmers were using higher rates of nitrogen and phosphorous fertilizers and lower rates of potash than recommended doses. The chemical fertilizers were applied at the rate of 157:157:29 and 49:53:20 N:P:K kg/ha for the off-season cabbage and French Beans seeds faming, respectively. The recommended ratio of the N:P:K by the VDD is 100:60:50 and 25:40:60 kg/ha for the cabbage and French Beans farming. In term of the farm yard manure, the application for the cabbage farming (118 Sack=7 t/ha) was observed lower than the recommended quantity of 16 t/ha. Thus, farmers need to rationalize the uses of labors, chemical fertilizers and FYM to increase productivity and profitability of vegetable farming.

The price increment at consumers level was observed for the off-season cabbage production in three distinct markets; Dhankuta, Dharan and Biratnagar. Despite of a common perception the study showed that post-harvest loss was more prominent factors than the profit margin set by the value chain actors for wide gap in marketing margin in off-season value chain. Thus, proper attempts to reduce post-harvest loss in off-seasonal cabbage value chain could be important avenue for narrowing the gap of marketing margin. Attempts should begin at farm level to minimize the post-harvest losses. These efforts may include improved production technology, adoption of appropriate time and method of harvesting, smooth post-harvest handling of the cabbage heads during harvesting, grading, loading and unloading, and transportation. Discouraging heaping of perishable products, regular removal of unmarketable portions (i.e. disease and damaged part, too small size, unnecessary leaves and steam) and grading also contribute to minimize the postharvest losses.

Similarly, using product friendly packaging materials and package size, keeping perishable and light weight products on the top of pile during transportation storage control in ripening and weight loss by maintaining relative humidity and

temperature in storage particularly at wholesale/commission level and minimized risk of microbial contamination are recommended in reducing post-harvest loss in off-season cabbage value chain. Farm level pre and post-harvest and post-harvest training should be a dynamic to reduce the farm level wastage and post-harvest loss for concern authorities. On the other hand, the physical infrastructure such as condition of the road and mean of transportation play important role in post-harvest loss.

Door to door household survey adopted in this study revealed that cabbage and bean seed producers did not follow proper record keeping system. The proper record keeping system of the total expenditure and return from the off-season cabbage and French bean seeds farming has been recommended. This record helps farmers to calculate profit and loss and also provide basic for product pricing.

Fresh vegetables and vegetable seeds are biological materials; therefore importing countries requires phytosanitary and/or Pesticide Residue Analysis (PRA) certification for every consignment. During the field surveyed it was noted that cabbage exporters doing their trade without certification as it requires some resource and time. Lack of system in place for certification, weak harmony among regulatory authorities and lack of resource for effective implementation of quarantine procedures are major challenges for regulating agricultural product between two countries. Therefore, for an efficient trading, the government should make provision for the urgent delivery of such services.

All cabbage fields in study area were under a hybrid cabbage variety, Green Coronet. No research activities were noticed in the field level to identify and select other suitable varieties to replace the current one, in case such need appears on account of diseases and decreased productivity. Therefore, research should be in place to identify other varieties.

Similarly, a wide gap was observed between demand and supply of the French bean seeds in Nepalese seeds markets. Farmers should be motivated on French bean seeds production as the market for quality seeds is available and the agro-climatic condition of the study site is highly favorable for French Beans seeds production. Without any logistic support of the concerned authorities, farmers were producing French Beans seeds in the support of private sector, SEAN in the study area. Thus to meet the national demand and supply of French Beans seeds, DADO need to regularize the vegetable seeds production program to expand the seeds acreage in the district in collaboration with the private vegetable seeds sectors.

The quality development, renovation, maintenance of existing infrastructure: agricultural roads, collection centers, agricultural produce marketing centers, and new construction such as quality controlled laboratories, collection hubs, well marketing information systems and agricultural roads should be arranged under the infrastructure development program by central and local governance for connecting the production field to market hubs/collection centers. This study revealed that a large number of human labors were used in cabbage transportation from production sites to collection hubs. Development of infrastructure would be necessary to make vegetable farming attractive and profitable.

Regarding the marketing, all cabbage growers in study site and surrounding villages, Basantapur, Chitre, Jorpati and Pakhribas are recommended to come together under the umbrella of Sidhuwa Multipurpose Co-operative Limited. It is suggested to approach DADOs, local governances and Regional Agricultural Directorate (RAD) to open own vegetables wholesales sales counters at APMC, Amarhaat, Dharan, Sunsari and APMC, Biratnagar, Morang.

(注) 要約の文量は、学位論文の文量の約 10分の1として下さい。図表や写真を含めても構いません。(Note)
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