

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/339253499>

FEASIBILITY STUDY FOR ENGAGING YOUTH IN COMMERCIAL FARMING A technical consultancy report prepared for the Department of Employment, Ministry of Labour and Human Resources, Thimphu...

Technical Report · December 2015

CITATIONS

0

READS

121

7 authors, including:



Yadunath Bajgai

The Ohio State University

65 PUBLICATIONS 376 CITATIONS

SEE PROFILE



Mahesh Ghimiray

RNR Research and Development Centre, Bajo

58 PUBLICATIONS 278 CITATIONS

SEE PROFILE



Tanka Maya Pulami

Agriculture Research and Development Centre-Bajo, Wangdue Phodrang, Bhutan

18 PUBLICATIONS 8 CITATIONS

SEE PROFILE

FEASIBILITY STUDY FOR ENGAGING YOUTH IN COMMERCIAL FARMING

**A technical consultancy report prepared for the Department of
Employment, Ministry of Labour and Human Resources, Thimphu,
Submission date: 7 December 2015**



Prepared by:

*Dr. Yadunath Bajgai, Mahesh Ghimiray, Thinley Gyamtsho, Jigme, Tanka
Maya Pulami, Sonam Choephel and Gyeltshen Tshering.*

**RNR – Research and Development Centre, Department of
Agriculture, Ministry of Agriculture and Forest
Bajo, Wangdue Phodrang.**

December 2015.

Table of Content

1	BACKGROUND AND INTRODUCTION	1
2	OBJECTIVE OF THE STUDY	1
3	STUDY METHODOLOGY	2
4	SITES VISITED AND ASSESSED	3
5	MAIN FINDINGS	4
5.1	TECHNICAL FEASIBILITY	4
5.1.1	<i>Site Profiles</i>	4
5.1.2	<i>Feasible crops for commercial farming</i>	4
5.1.3	<i>Production inputs.....</i>	5
5.1.4	<i>Cropping calendar</i>	6
5.1.5	<i>Capital investment.....</i>	7
5.1.6	<i>Production economics and farm profitability</i>	8
5.1.7	<i>Stakeholder analysis</i>	9
5.2	POLICY ENVIRONMENT	10
5.2.1	<i>Existing policies.....</i>	10
5.2.2	<i>Regulatory framework.....</i>	10
5.2.3	<i>Technical support and skill development.....</i>	11
5.2.4	<i>Marketing of farm produce</i>	13
5.2.5	<i>Farm mechanization.....</i>	14
6	SUMMARY AND RECOMMENDATIONS	15
6.1	TECHNICAL.....	17
6.2	POLICY RELATED.....	17
6.3	PLAN OF IMPLEMENTATION	18
7	SITE PROFILE 1: PHANGYUL, WANGDUE	19
7.1	SITE INFORMATION.....	19
7.2	CLIMATIC CONDITIONS	21
7.3	PROPOSED CROPS	22
7.4	CROPPING CALENDAR.....	23
7.5	INPUTS REQUIRED.....	24
7.6	LONG TERM INVESTMENT PLAN (CAPITAL INVESTMENT)	25
7.7	ECONOMICS OF THE FARM	26
8	SITE PROFILE 2: BJENA, WANGDUE	27
8.1	SITE INFORMATION.....	27
8.2	CLIMATIC CONDITIONS	29
8.3	PROPOSED CROPS	30
8.4	CROPPING CALENDAR.....	31
8.5	INPUTS REQUIRED.....	32
8.6	LONG TERM INVESTMENT PLAN (CAPITAL INVESTMENT)	32
8.7	ECONOMICS OF THE FARM	33
9	SITE PROFILE 3: DAGA, WANGDUE.....	34
9.1	SITE INFORMATION.....	34
9.2	CLIMATIC CONDITIONS	36
9.3	PROPOSED CROPS	37
9.4	CROPPING CALENDAR.....	38
9.5	INPUTS REQUIRED.....	39

9.6	LONG TERM INVESTMENT PLAN (CAPITAL INVESTMENT)	39
9.7	ECONOMICS OF THE FARM	40
10	SITE PROFILE 4: RUBESA, WANGDUE	42
10.1	SITE INFORMATION	42
10.2	CLIMATIC CONDITIONS	44
10.3	PROPOSED CROPS	45
10.4	CROPPING CALENDAR	46
10.5	INPUTS REQUIRED	46
10.6	LONG TERM INVESTMENT PLAN (CAPITAL INVESTMENT)	47
10.7	ECONOMICS OF THE FARM	48
11	SITE PROFILE 5: TOEWANG, PUNAKHA	49
11.1	SITE INFORMATION	49
11.2	CLIMATIC CONDITIONS	51
11.3	PROPOSED CROPS	52
11.4	CROPPING CALENDAR	53
11.5	INPUTS REQUIRED	54
11.6	LONG TERM INVESTMENT PLAN (CAPITAL INVESTMENT)	54
11.7	ECONOMICS OF THE FARM	55
12	SITE PROFILE 6: DAWAKHA, PUNAKHA	56
12.1	SITE INFORMATION	56
12.2	CLIMATIC CONDITIONS	58
12.3	PROPOSED CROPS	59
12.4	CROPPING CALENDAR	59
12.5	INPUTS REQUIRED	60
12.6	LONG TERM INVESTMENT PLAN (CAPITAL INVESTMENT)	60
13	SITE PROFILE 6: CHUBU, PUNAKHA	62
13.1	SITE INFORMATION	62
13.2	CLIMATIC CONDITIONS	64
13.3	PROPOSED CROPS	64
13.4	CROPPING CALENDAR	65
13.5	INPUTS REQUIRED	65
13.6	LONG TERM INVESTMENT PLAN (CAPITAL INVESTMENT)	66
13.7	ECONOMICS OF THE FARM	66
14	SITE PROFILE 8: TEBESA, PUNAKHA	68
14.1	SITE INFORMATION	68
14.2	CLIMATIC CONDITIONS	72
14.3	PROPOSED CROPS	72
14.4	CROPPING CALENDAR	73
14.5	INPUTS REQUIRED	74
14.6	LONG TERM INVESTMENT PLAN (CAPITAL INVESTMENT)	75
14.7	ECONOMICS OF THE FARM	77
15	SITE PROFILE 9: SUNKOSH, TSIRANG	79
15.1	SITE INFORMATION	79
15.2	CLIMATIC CONDITIONS	81
15.3	PROPOSED CROPS	82
15.4	CROPPING CALENDAR	83
15.5	INPUTS REQUIRED	84
15.6	LONG TERM INVESTMENT PLAN (CAPITAL INVESTMENT)	84

15.7 ECONOMICS OF THE FARM	85
16 SITE PROFILE 10: MITHUN, TSIRANG	86
16.1 SITE INFORMATION.....	86
16.2 CLIMATIC CONDITIONS	88
16.3 PROPOSED CROPS	89
16.4 CROPPING CALENDAR.....	90
16.5 INPUTS REQUIRED.....	90
16.6 LONG TERM INVESTMENT PLAN (CAPITAL INVESTMENT)	91
16.7 ECONOMICS OF THE FARM	92
17 SITE PROFILE 11: HEBESA, WANGDUE.....	93
17.1 SITE INFORMATION.....	93
17.2 CLIMATIC CONDITIONS	97
17.3 LONG TERM INVESTMENT PLAN (CAPITAL INVESTMENT)	98
17.1 PROPOSED CROPS	99
17.2 CROPPING CALENDAR.....	100
17.3 INPUTS REQUIRED.....	100
17.4 ECONOMICS OF THE FARM	101

List of Figures

Figure 3-1: Presentation of findings.....	2
Figure 4-1: Location of farm sites in three Dzongkhags.....	3
Figure 5-1: Youth consultation in process at DAO meeting hall, Punakha	9
Figure 7-1: Wotokha Farm, Phangyul, Wangdue	20
Figure 7-2: Pictorial view of fallow land.	21
Figure 7-3: Climate information for Phangyul site.	22
Figure 8-1: Damchen Farm, Bjena: Wangdue	28
Figure 8-2: Pictorial views of proposed Damchen Farm, Bjena,Wangdue:.....	29
Figure 8-3: Climate information for proposed Damchen Farm under Bjena Geog, Wangdue	30
Figure 9-1: A map of proposed Umakhatey Farm under Daga Geog, Wangdue.....	35
Figure 9-2: Pictorial views of proposed Umakhatey Farm under Daga Geog, Wangdue:.....	36
Figure 9-3: Climate information for Umakhatey Farm under Daga Geog, Wangdue	37
Figure 10-1: Map of proposed Jazeepang Farm under Ruepisa, Wangdue	43
Figure 10-2: Pictorial view of proposed Jazeepang Farm under Ruepisa, Wangdue:	44
Figure 10-3: Climatic information of proposed Jazeepang Farm under Ruepisa, Wangdue.	45
Figure 11-1: Proposed Tshetaykha Farm map under Toewang Geog, Punakha.	50
Figure 11-2: Pictorial view of Tshetaykha Farm map under Toewang Geog, Punakha.	51
Figure 11-3: Climatic information for Tshetaykha Farm Toewang Geog, Punakha.	52
Figure 12-1: Proposed Bamjee Farm map under Toewang Geog, Punakha.	57
Figure 12-2: Pictorial view of proposed Bamjee Farm map under Toewang Geog, Punakha.....	58
Figure 12-3: Climatic information for proposed Bamjee Farm under Toewang Geog, Punakha.	58
Figure 13-1: Map for proposed Taraythang Farm under Chhubu Geog, Punakha.	63
Figure 13-2: Climate information for proposed Taraythang Farm under Chhubu Geog, Punakha.	64
Figure 14-1: Farm map for proposed Siluna (Upper) Farm under Toepisa Geog, Punakha.	69
Figure 14-2: Farm map for proposed Siluna (Lower) Farm under Toepisa Geog, Punakha.	70
Figure 14-3: Pictorial view of Siluna Farm under Toepisa Geog, Punakha.	71
Figure 14-4: Climatic information for Siluna (upper and lower) Farm under Toepisa Geog, Punakha.	72
Figure 15-1: Farm map for proposed Sunkosh Farm under Tsholingkhar Geog, Tsirang.	80
Figure 15-2: Pictorial view of proposed Sunkosh Farm under Tsholingkhar Geog, Tsirang.	81

Figure 15-3: Climatic information of Sunkosh Farm under Tsholingkhar Geog, Tsirang.	82
Figure 16-1: Farm map for proposed Minchuna Farm under Kilkhorthang Geog, Tsirang.	87
Figure 16-2: Farm map for proposed Minchuna Farm under Kilkhorthang Geog, Tsirang.	88
Figure 16-3: Climatic information for proposed Minchuna Farm under Kilkhorthang Geog, Tsirang.	89
Figure 17-1: Hebesa Farm map- Farm-A under Gasetsho-om Geog, Wangdue.....	94
Figure 17-2: Hebesa Farm map- Farm-B under Gasetsho-om Geog, Wangdue.....	95
Figure 17-3: Hebesa Farm map- Farm-C under Gasetsho-om Geog, Wangdue.....	96
Figure 17-4: Pictorial view of Hebesa farm.....	97
Figure 17-5: Climate information for Hebesa Farm, Gasetsho-om Geog Wangdue	97

List of Tables

Table 5-1: A typical farm inputs for commercial vegetable production.	6
Table 5-2: Crop calendar for selected vegetables.	6
Table 5-3: Capital cost needed to develop identified farms.....	7
Table 5-4: Production costs and incomes from vegetable farming in selected sites.....	8
Table 5-5: Expected farm profit from commercial production of selected vegetables.	8
Table 7-1: Site information for Wotokha, Phuangyul Geog, Wangdue.....	19
Table 7-2: Proposed crops for summer and winter season in Wotokha.....	23
Table 7-3: Crop calendar for selected vegetables.	23
Table 7-4: Yield and Input rates for material and labour per acre	25
Table 7-5: Summary of Capital Investment for Phangyul	25
Table 7-6: Crop production economics.....	26
Table 8-1: Site information for Damchen, Bjena Geog, Wangdue	27
Table 8-2: Proposed crops for summer and winter season at Damchen, Bjena.	31
Table 8-3: Proposed cropping calendar for summer and winter season at Damchen, Bjena.	31
Table 8-4: Production inputs and expected crop yield at Damchen, Bjena in per unit area (acre).	32
Table 8-5: Summary of capital investment required for Damchen, Bjena Geog, Wangdue.....	32
Table 8-6: Annual crop production economics for Damchen, Bjena Geog, Wangdue.....	33
Table 9-1: Site information for Umakhamey under Daga Geog, Wangdue.....	34
Table 9-2: Proposed crops for Umakhatey Farm under Daga Geog, Wangdue.....	38
Table 9-3: Proposed cropping calendar for Umakhatey Farm under Daga Geog, Wangdue.....	38
Table 9-4: Farm inputs and expected yield per acre for Umakhatey Farm under Daga Geog, Wangdue.	39
Table 9-5: Summary of Capital Investment for for Umakhatey Farm under Daga Geog, Wangdue.	40
Table 9-6: Annual crop production economics for Umakhatey Farm under Daga Geog, Wangdue.	40
Table 10-1: Site information for proposed Jazheepang Farm under Ruepisa Geog, Wangdue	42
Table 10-2: Proposed crops for Jazheepang Farm under Ruepisa, Wangdue.....	46
Table 10-3: Proposed cropping calendar for Jazheepang Farm under Ruepisa, Wangdue.....	46
Table 10-4: Farm inputs and yield per acre for Jazheepang Farm under Ruepisa, Wangdue.....	47
Table 10-5: Summary of Capital Investment for for Jazheepang Farm under Ruepisa, Wangdue.....	47
Table 10-6: Annual crop production economics for Jazheepang Farm under Ruepisa, Wangdue.	48
Table 11-1: Site information for proposed Tshetaykha Farm under Toewang Geog, Punakha.....	49
Table 11-2: Proposed crops for Tshetaykha Farm Toewang Geog, Punakha.....	53
Table 11-3: Proposed cropping calendar for Tshetaykha Farm Toewang Geog, Punakha.	53
Table 11-4: Farm inputs and expected yield in per acre for Tshetaykha Farm Toewang Geog, Punakha.....	54
Table 11-5: Summary of capital investment for Tshetaykha Farm Toewang Geog, Punakha.	54
Table 11-6: Annual farm production economic for Tshetaykha Farm Toewang Geog, Punakha.	55
Table 12-1: Site information for proposed Bamjee Farm under Toewang Geog, Punakha.	56
Table 12-2: Proposed crops for Bamjee Farm under Toewang Geog, Punakha.	59
Table 12-3: Proposed cropping calendar for Bamjee Farm under Toewang Geog, Punakha.	59

Table 12-4: Farm production inputs and expected yield for Bamjee Farm, Toewang Geog, Punakha.	60
Table 12-5: Summary of capital investment required for Bamjee Farm under Toewang Geog, Punakha.	60
Table 12-6: Annual crop production economics for Bamjee Farm under Toewang Geog, Punakha.	61
Table 13-1: Site information for proposed Taraythang Farm under Chhubu Geog, Punakha.	62
Table 13-2: Proposed crops for proposed Taraythang Farm under Chhubu Geog, Punakha.	65
Table 13-3: Proposed cropping calendar for proposed Taraythang Farm under Chhubu Geog, Punakha.	65
Table 13-4: Farm production inputs and expected yield for Taraythang under Chhubu Geog, Punakha.	66
Table 13-5: Capital investment required for proposed Taraythang Farm under Chhubu Geog, Punakha.	66
Table 13-6: Annual crop production economics for Taraythang Farm under Chhubu Geog, Punakha.	67
Table 14-1: Site information for proposed Siluna(Upper) Farm under Toepisa Geog, Punakha.	68
Table 14-2: Recommended crops for proposed Siluna Farms under Toepisa Geog, Punakha.	73
Table 14-3: Proposed cropping calendar for Siluna Farms under Toepisa Geog, Punakha.	73
Table 14-4: Farm production inputs and expected yields for Siluna Farms under Toepisa Geog, Punakha. ..	74
Table 14-5: Capital investment required for proposed Siluna (Upper) Farm under Toepisa Geog, Punakha.	75
Table 14-6: Capital investment required for Siluna (Lower) Farm-A under Toepisa Geog, Punakha.	75
Table 14-7: Capital investment required for Siluna (Lower) Farm-B under Toepisa Geog, Punakha.	76
Table 14-8: Capital investment required for Siluna (Lower) Farm-C under Toepisa Geog, Punakha.	76
Table 14-9: Capital investment required for Siluna (Lower) Farm-D under Toepisa Geog, Punakha.	77
Table 14-10: Annual crop production economics for Siluna (Upper) Farm under Toepisa Geog, Punakha. ..	77
Table 15-1: Site information for proposed Sunkosh Farm under Tsholingkhar Geog, Tsirang.	79
Table 15-2: Recommended crops for Sunkosh Farm under Tsholingkhar Geog, Tsirang.	83
Table 15-3: Cropping calendar for Sunkosh Farm under Tsholingkhar Geog, Tsirang.	83
Table 15-4: Farm production inputs and expected yields for Sunkosh Tsholingkhar Geog, Tsirang.	84
Table 15-5: Capital Investment required for proposed Sunkosh Farm under Tsholingkhar Geog, Tsirang.	84
Table 15-6: Crop production economics for Sunkosh Farm under Tsholingkhar Geog, Tsirang.	85
Table 16-1: Site information for proposed Minchuna Farm under Kilkhorthang Geog, Tsirang.	86
Table 16-2: Recommended crops for Minchuna Farm under Kilkhorthang Geog, Tsirang.	89
Table 16-3: Cropping calendar for Minchuna Farm under Kilkhorthang Geog, Tsirang.	90
Table 16-4: Farm production inputs and expected yields for Minchuna Farm, Kilkhorthang Geog, Tsirang.	91
Table 16-5: Capital investment required for Minchuna Farm under Kilkhorthang Geog, Tsirang.	91
Table 16-6: Farm production economics for Minchuna Farm under Kilkhorthang Geog, Tsirang.	92
Table 17-1: Site information for proposed Hebesa Farm under Gasetsho-om Geog, Wangdue.	93
Table 17-2: Capital investment required for Hebesa Farm-A under Gasetsho-om Geog, Wangdue.	98
Table 17-3: Capital investment required for Hebesa Farm-B under Gasetsho-om Geog, Wangdue.	98
Table 17-4: Capital investment required for Hebesa Farm-C under Gasetsho-om Geog, Wangdue.	99
Table 17-5: Recommended crops for Hebesa Farm under Gasetsho-om Geog, Wangdue.	99
Table 17-6: Proposed cropping calendar for Hebesa farm, Gasetsho-om Geog, Wangdue.	100
Table 17-7: Farm inputs and expected yield for Hebesa farm, Gasetsho-om Geog, Wangdue.	101
Table 17-8: Farm production economics for Hebesa farm, Gasetsho-om Geog, Wangdue.	101

FEASIBILITY STUDY FOR ENGAGING YOUTH IN COMMERCIAL FARMING

1 Background and introduction

Almost 60% of the Bhutanese population is young below the age of 22 years. The school enrolment of children and youths has increased over the years. However, this trend has brought about a situation where an increasing number of young people, including school leavers, are without gainful employment. Although the overall unemployment rate in the country averaged only 2.9% in 2013, the rate of unemployment among the youth between 15-24 years was more than 9% which is alarming. The unemployment rates are more pronounced in urban areas at more than 20% compared to rural areas. Therefore, creating jobs for the urban youth is certainly a key priority of the Royal Government of Bhutan. This has been adequately reflected in the 11th Five Year Plan running from 2013-18.

Among other sectors, agriculture still offers the maximum employment opportunities in Bhutan. Currently more than 62% of the population is engaged in agriculture. The traditional and subsistence agriculture is gradually transiting into modern farming using better technologies comprising of high yielding varieties, fertilizers, irrigation and farm machineries to minimize drudgery. The agricultural research and development efforts have transformed farming into a modern, creative and viable enterprise and business. The Ministry of Agriculture and Forests promotes commercial agriculture providing technical services and inputs. There are several success stories of farmers earning livelihood from agri-business such as vegetable production, poultry and dairy farming. Engagement of educated youth in agriculture based entrepreneurship is necessary not only to secure gainful employment for them but also to reduce our dependency on food imports and achieve a higher level of self-sufficiency and food sovereignty.

In view of the potential of agriculture sector in providing gainful employment, the Ministry Labour and Human Resources (MoLHR) is exploring the option of engaging youth in commercial agriculture. Therefore, MoLHR in partnership with UNDP-Bhutan wished to undertake a feasibility study of engaging youth in commercial agriculture based entrepreneurial undertaking in Wangdue and Punakha dzongkhags. MoLHR in consultation with DoA identified RNR RDC Bajo to undertake the feasibility study from October to December 2015.

2 Objective of the study

The main objective of the feasibility study is to identify suitable land which is fallowed or unused and assess the technical and economic viability of using the land for commercial farming in Wangdue, Punakha and Tsirang. The feasibility report includes site profiles taking into consideration land quality and access to the site, climatic suitability and potential crops for cultivation, crop productivity, market access and existence of farm infrastructures.

3 Study methodology

A technical team representing relevant disciplines was formed to carry out the feasibility study with the following members:

- 1) Dr. Yadunath Bajgai, Soil/farming systems agronomist and Team Leader
- 2) Mahesh Ghimiray, Plant breeder and Specialist
- 3) Thinley Gyamtsho, Engineer
- 4) Jigme, Horticulturist
- 5) Tanka Maya Pulami, Economist
- 6) Sonam Choephel, Fruit crops researcher
- 7) Gyeltshen Tshering, Vegetable researcher

Potential sites in the dzongkhag were identified in consultation with the District Agriculture Officers, Geog extension staff and Gups in some cases. Field visits to the identified sites by the team members and technical assessments were the main tool used in the study. All the sites were visited from mid-September to end of November 2015. The team members held several discussion sessions prior to visiting the fields.

In addition to field visits, desk review of relevant reports and documents (acts and laws related to land, water, crops, biodiversity etc, agricultural policies and strategies, youth policy, employment policy etc) was conducted. Analysis and synthesis of field data was carried out. A stakeholder meeting with the educated and unemployed youth of Punakha was done to seek their views.



Figure 3-1: Presentation of findings

4 Sites visited and assessed

A total of 11 sites in Wangdue, Punakha and Tsirang were visited by the team. Listed below are the different sites:

1. Phangyul, Wangdue
2. Bjena, Wangdue
3. Daga, Wangdue
4. Rubesa, Wangdue
5. Toewang, Punakha
6. Dawakha (Toewang), punakha
7. Chubu, Punakha
8. Toebesa, Punakha
9. Sunkosh, Tsirang
10. Mithun, Tsirang
11. Hebesa, Wangdue

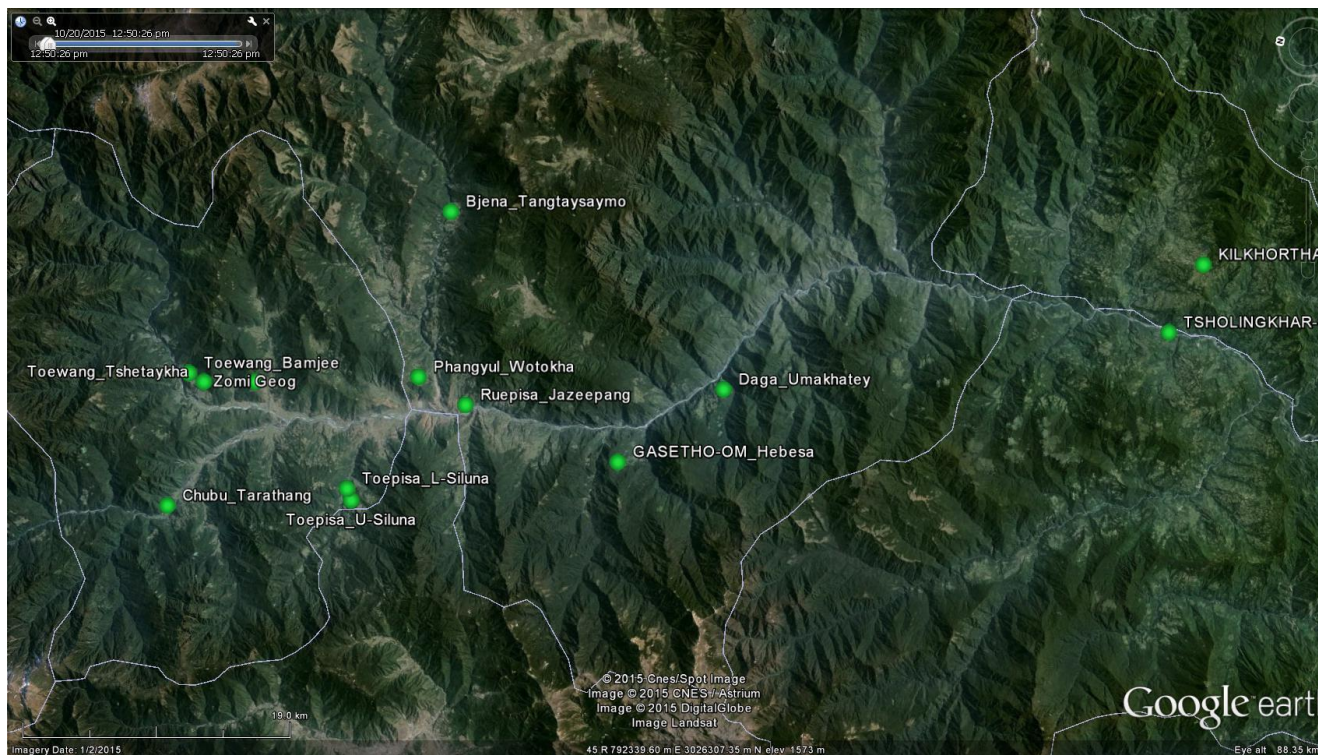


Figure 4-1: Location of farm sites in three Dzongkhags.

5 Main findings

5.1 Technical feasibility

5.1.1 Site Profiles

The ten identified sites fall in three altitude zones of low, mid and high with elevations ranging from 320 m to 1736 m. The lowest elevation site is in Sunkosh, Tsirang along the Punatshangchu river. The site in Dawakha under Toewang in Punakha has the highest elevation of 1736 m. Most sites fall under the mid to high elevation zone. Considering land types, majority of the sites have both wetland and dryland. Except for the Dratshang land in Chubu and the farm in Toewang, Punakha where half the farm area is cultivated by tenant farmers, all other farms lie fallow for a number of years. The farm in Sunkosh has been fallowed for over 25 years and it has been overgrown with large trees and thickets. As far as land ownership is concerned, except for Chubu, all the farms are owned by individuals with legal land records. In terms of access, all the sites are connected by farm roads or lie along national highways, except again Chubu which is about 1.5 hours walk from the nearest road point. A farm road is reportedly planned in the current five year plan.

Meteorological data were collected for nearest eight weather stations (Shengana, Punakha, Thinleygang, Gaselo, RDC Wangdue, Samtegang, Sunkosh and Damphu) to the indentified fallow sites in three Dzongkhags and the data were accessed from the Department of Hydromet Services. The altitude of the sites varied drastically from about 320 masl for Sunkosh to 1960 masl for Samtegang. The rainfall pattern over the all sites is generally monomodal. Generally, most of the rainfall occurs from the month of May to September, whilst the least quantity of rainfall occurs in months of January, February, November and December over the different sites. Annual rainfall ranges from 308 mm to 1467 mm. The maximum and minimum temperatures are most favourable for growing crops from the month of March to October; however temperatures are colder in January, February and November and December. However, specific climate data can vary from site to site depending up on altitude, aspects and terrain. To continue a commercial agriculture venture over the colder months the use greenhouses is suggested.

Wild animals are a problem in all the sites; none of the sites have fencing or any kind of protection from animals. Majority of the sites have access to irrigation water, with some sites requiring some investment in building or rehabilitating small scale infrastructure.

5.1.2 Feasible crops for commercial farming

With tropical to temperate climate, many kinds of agricultural crops can be grown in all the identified sites. Such crops include cereals, grain legumes, oilcrops, vegetables and fruit plants. However, for commercial farming in the Bhutanese context, one needs to consider the following:

- ✓ Initial investment need
- ✓ Crop gestation period
- ✓ Input requirement especially human labor
- ✓ Ease of farming
- ✓ Mechanization possibilities
- ✓ Production potential

✓ Market demand and price

In view of the above considerations, vegetable farming offers the maximum potential and a quick return to investment. The initial investments are relatively low, production is high like in any other hill terrain and market demand is almost insatiable. Crops are seasonal and can be raised quickly within 2-4 months. In the light of trade imbalance and Rupee deficit with neighboring India, the RGoB promotes domestic production of food crops including vegetables. Hence, vegetable production is prioritized.

Given the diversity of altitudinal and agroecological regimes, all sorts of summer and winter vegetables can be grown in all the identified farms. However, the following crops are recommended for their production possibility, market demand and the potential for income generation.

Summer: chili, tomato, okra, egg plant, beans, carrot, potato, ginger, gourds, radish, cucumber

Winter: cabbage, cauliflower, broccoli, pea, beans, mustard green, leafy vegetables, lettuce, garlic, coriander

High value perennial crop: Asparagus

Many subtropical and temperate fruit plants are feasible to grow in all the sites. But fruit plants have a longer gestation period of 3-5 years and require higher initial investment with proper planning during orchard establishment and adequate aftercare. Feasible fruit crops are listed in individual site profiles, which include citrus, kiwi, grapes, passion fruit, cardamom, avocado, pear, peach, mango and persimmon. We recommend that further analysis be done prior to establishment of commercial orchards.

5.1.3 Production inputs

For vegetable production, the most essential inputs are seeds or seedlings, manures or compost, fertilizers such as Urea, Single Super Phosphate (SSP), Muriate of Potash (MoP), manual labor and irrigation water. During the monsoon or summer season, rainfall suffices irrigation needs in vegetable production. During the dry or winter season, however, supplemental irrigation will be essential. Drip or sprinkler irrigation systems are economical in terms of water use. The labor days for the selected vegetable crops range from 47-108 days per acre (Table 1). If adequate organic manures are available, the use of synthetic fertilizers can be significantly reduced to save costs and avoid environmental pollution.

Table 5-1: A typical farm inputs for commercial vegetable production.

Crop	Seed rate (per ac)	FYM (MT/ac)	Fertilizer rate (kg/ac)				Labour (day/ac)	Yield (kg/ac)
			Urea	SSP	MoP	Suphala		
Chili	300 gm	8.0	100.0	150.0	25.0	0.0	84.4	2364.0
Tomato	160 gm	8.0	77.0	125.0	17.0	0.0	108.6	2629.0
Carrot	600 gm	5.9	15.0	25.0	40.0	0.0	54.3	2600.0
Potato	889.13 kg	3.5	84.0	200.0	53.0	0.0	105.0	6393.0
Egg plant	300 gm	8.0	70.0	175.0	20.0	0.0	80.0	1200.0
Radish	4 kg	5.0	44.0	125.0	34.0	0.0	57.4	3143.0
Beans	20 kg	2.6	22.0	187.5	0.0	0.0	59.6	1700.0
Broccoli	180 gm	7.9	75.0	150.0	25.0	0.0	70.9	1906.8
Garlic	175.7 kg	4.8	65.0	100.0	0	0.0	59.1	724.0
Pea	40 kg	5.2	44.0	187.5	50.0	0.0	51.8	1400.0
Cabbage	300 gm	7.4	75.0	150.0	25.0	0.0	68.3	2858.0
Cauliflower	180 gm	5.5	75.0	150.0	25.0	0.0	74.6	1600.0
Onion	1.6 kg	4.3	88.0	187.5	50.0	0.0	82.7	2772.9
Leafy Greens	1 kg	8	44.0	0	0	0	47.2	2106.1
Ginger	554.09 kg	5.6	65.0	100.0	0.0	0.0	60.9	2772.9

5.1.4 Cropping calendar

The cropping calendar is a tool that provides timely information about seeds to promote local crop production. It contains information on planting, sowing and harvesting periods of locally adapted crops in specific agro-ecological zones. It also provides information on the sowing rates of seed and planting material and the main agricultural practices. This tool supports farmers and agriculture extensionists in taking appropriate decisions on crops and their sowing period, respecting the agro-ecological dimension. It also provides a basis for emergency planning of the rehabilitation of farming systems after disasters. The crop calendar for the selected vegetables in the high altitude zone of Bhutan is presented as an example in Table 2. Specific crop calendars are provided in the site profiles.

Table 5-2: Crop calendar for selected vegetables.

Vegetable	Growing season											
	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Cabbage			SAWING									
Cauliflower												
Broccoli												
Tomato												
Egg plant												
Chili												
Onion												

Pea													
Beans													
Radish													
Carrot													
Garlic													
Ginger													
Asparagus													
Potato													

5.1.5 Capital investment

A commercial farm requires basic farm facilities and infrastructures to function efficiently. Fencing is a pre-requisite in all the farms to protect crops from domestic and wild animals. The other basic requirement is the provision of irrigation water. Depending on the farm, proposed irrigation infrastructures include development of intake at the source, conveyance through HDPE pipes, storage tank and sprinklers. Land development is another major pre-requisite, requiring terrace formation or widening of existing terraces for efficient use of farm machines. In many cases, approach road to the farmland and internal access road within the farms need to be built. Labor huts, store, office and processing shed will be other requirements. For off-season cultivation of vegetables, protective green houses will be required. Depending on the size of the farm and the needed infrastructures in specific sites, the capital cost varies from Nu 1.186 million to Nu 10.02 m (Table 3).

Table 5-3: Capital cost needed to develop identified farms.

Site	Area (acre)	Total cost (mNu)	Unit Cost (m Nu/acre)	Remarks
Phangyul	11.0	3.457	0.248	Includes cost of fencing; land development; irrigation development; provision of labor huts, office, store, processing shed; access road and green houses for off-season production.
Bjena	5.6	1.853	0.289	
Daga	5.5	2.460	0.487	
Rubesa	4.6	2.256	0.478	
Toewang	5.0	1.929	0.259	
Dawakha	2.5	1.186	0.466	
Chubu	5.0	3.661	0.735	
Tebesa	19.1	6.909	0.894	
Sunkosh	4.3	1.994	0.469	
Mithun	2.8	2.014	0.711	
Hebesa	25.0	10.02	0.227	

5.1.6 Production economics and farm profitability

Determination of production economics is important to gauge the overall profitability of a farm or farming enterprise. In this study, the production economics of selected crops is computed based on the economic analysis conducted by the Department of Agriculture in 2013-14. The production cost taken into consideration includes that of seeds or seedlings, manures, fertilizers and manual labor that are seasonal and recurrent. Longer term or capital costs are excluded from the calculations.

Table 4 provides an overview of the production costs, gross farm income and net profit of the 10 identified farms in commercial farming of 11 selected vegetable crops which comprise of cole crops, root crops, solanaceae crops and legumes. The average cost of production is Nu 63,731 per acre. The variation among farms is explained by the farm size and the type of vegetable grown. The net profit is Nu 79,243 per acre from vegetable farming. This is assuming that irrigation facilities and crop protection measures like fencing are put in place. Depending on the type of vegetable crop grown, the farm profit varies from Nu 56,580 to Nu 105,647 per acre. Considering that the average profit from cereal farming falls below Nu 20,000, vegetable farming is much more profitable.

Table 5-4: Production costs and incomes from vegetable farming in selected sites.

Site	Area (acre)	Production cost (Nu)	Gross income (Nu)	Net farm profit (Nu)	Profit (Nu/acre)	Remark
Phangyul	11.0	793,830	1933,056	1139,227	103,566	
Bjena	5.6	407,118	902,696	495,577	88,495	
Daga	5.5	352,721	832,575	479,854	87,246	
Rubesa	4.6	251,686	637,993	386,309	83,436	
Toewang	5.0	302,482	593,801	293,404	58,680	
Dawakha	2.5	137,834	297,101	268,344	105,647	
Chubu	5.0	301,617	615,266	313,648	62,729	
Tebesa	7.3	439,440	852,476	413,036	56,580	
Sunkosh	4.3	278,507	587,863	309,355	71,943	
Mithun	2.8	176,267	383,772	207,505	74,108	
Average	5.4	344,150	763,659	430,625	79,243	

Vegetables differ in their production capacity and the market value or the price they fetch when sold. Some of the high value vegetables are chili, ginger, broccoli, pea, carrot, potato, cauliflower and beans (Table 5). The highest net profit of Nu 89,702 from an acre of land can be obtained from the cultivation of ginger followed by chili (Nu 82,550) and broccoli (Nu 67,647).

Table 5-5: Expected farm profit from commercial production of selected vegetables.

Crop	Yield (kg/ac)	Production Cost		Market price (Nu/kg)	Total income (Nu/ac)	Net profit (Nu/acre)
		(Nu/kg)	(Nu/acre)			
Chili	2364.00	15.08	35649.12	50.00	118200.00	82,550.88
Tomato	2629.00	16.70	43904.30	30.00	78870.00	34,965.70
Carrot	2600.00	9.76	25376.00	29.24	76024.00	50,648.00
Potato	6393.00	9.62	61500.66	18.40	117631.20	56,130.54
Egg plant	1200.00	13.65	16380.00	28.05	33660.00	17,280.00
Radish	1790.00	8.34	14928.60	15.07	26975.30	12,046.70

Beans	1700.00	14.64	24888.00	35.73	60741.00	35,853.00
Broccoli	1154.00	29.38	33904.52	88.00	101552.00	67,647.48
Garlic	662.00	73.00	48326.00	86.00	56932.00	8,606.00
Pea	1400.00	18.81	26334.00	48.00	67200.00	40,866.00
Cabbage	2858.00	9.76	27894.08	20.68	59103.44	31,209.36
Cauliflower	1600.00	20.31	32496.00	45.00	72000.00	39,504.00
Onion	1100.00	31.50	34650.00	40.00	44000.00	9,350.00
Ginger	2772.87	17.65	48941.16	50.00	138643.50	89,702.34
Leafy greens	10.15	31.00	314.65	80.00	812.00	497.35

5.1.7 Stakeholder analysis

Discussion on the study objectives and implementation was held with Dasho Dzongdas, DAOs, Land record officers and extension colleagues from Punakha, Wangdue and Tsirang Dzongkhags prior to field visits. The meetings had emphasized on identifying fallow lands closer to road connectivity and irrigation water and market access. Short-term crops like vegetables, mushroom and floriculture due to involvement of private land where lease period could be shorter or long term plan may not be certain. Dasho Dzongdags were of view that GRF land would be easier to administratively manage the enterprise.

Youth consultation was carried through holding a meeting and through telephone interviews with the unemployed youths of Punakha Dzongkhag. Besides youths, the consultation meeting was also attended by relevant stakeholders that included geog Administrative Officer, DAO and other Dzongkhag and geog agriculture officials. On the whole we have interacted with 12 youths, 10 girls and two boys and they studies from class VIII to Class XII. All the 12 youths that we had interacted had agricultural background as their parents were farmers and the youths had some experience in farming. Youths are interested in short term crops of vegetables mainly because of quick returns from the enterprise and the consulted youth were interested to work closer to their community. The youth expect new technologies like farm mechanization, off-season production through protected cultivation (greenhouse) and requires capacity development on relevant modern technologies. Youth would also like to avail grant or loan facilities to start the commercial agriculture.



Figure 5-1: Youth consultation in process at DAO meeting hall, Punakha

5.2 Policy environment

5.2.1 Existing policies

The current policy environment is favorable for agricultural development. The Economic Development Policy of the Kingdom of Bhutan, 2010 stresses that agriculture is a critical sector for a balanced and equitable development and to alleviate poverty. It promotes commercial farming, efficient irrigation systems and assured marketing. Identification of suitable crops for commercial farming and facilitation of land for large scale farming are given importance. Emphasis is also given for the farming sector to be mechanized and adoption of farming techniques for higher productivity and farm profitability.

Subsidy is a measure that keeps the price for consumers below market level, or keeps prices of producers above market levels or that reduces costs for both producers and consumers according to the Organization of Economic Cooperation and Development (OECD). The World Trade Organization (WTO) defines subsidy as a financial contribution by a government or any public body or any form of production or price support to confer benefits to producers and consumers. In Bhutan, agricultural subsidies have been provided since the start of the planned development in the 1960s. Farmers were provided with seeds and seedlings of improved varieties, fertilizers and plant protection chemicals. Irrigation facilities were developed and cash incentives provided for land development or terracing and for compost making. Many of these initiatives continue to date to encourage agricultural development. The Department of Agriculture (DoA) under the Ministry of Agriculture and Forests (MoAF) drafted a proposal for Subsidies in Agricultural Development in 2015 that implores the RGoB to increase investment. A subsidy of at least 5% of the agricultural GDP is proposed in line with the practices of the neighboring countries. The present level of subsidy is about 1% of the GDP. Subsidies are needed to promote improved seeds and plants, fertilizers, herbicides and agro-chemicals, farm machinery and labor saving devices, access roads, irrigation and land development.

Regarding taxation policy, at present there is tax exemption for inputs such as fertilizers and agro-chemicals needed in agriculture and in import of farm machineries and spare parts that are required for mechanizing the farming sector. The policy on import of seeds and plants is unclear; there are cases of tax imposition on seeds at the border gates. To encourage agriculture and food production, it is illogical to tax seeds and planting materials. However, import of food items such as rice, legumes and edible oil also remains tax-free which competes with and depresses domestic production. Bhutanese farmers are burdened with high cost of production arising from high labor and input costs and are unable to compete with cheaper imports. Such a trend needs to be halted and reversed.

5.2.2 Regulatory framework

A number of regulations exist for agriculture investment and development. For instance, Land Act 2007, Seeds Act 2000, Cooperatives Act 2001, Water Act 2002, Food and Nutrition Policy 2010 and Biodiversity Act 2003 are in support of agricultural development. The Policy and Planning Division (PPD) of MoAF developed Interim Guidelines on Lease of GRF Land for Commercial Agriculture in 2011 which also applies for leasing of private land. It defines commercial agriculture as the development and promotion of economically viable agricultural enterprise through optimum utilization of land and marketing system, such that these products are competitive locally, regionally

and internationally. Commercialization of agriculture should also promote and develop an efficient, competitive and sustainable agricultural sector for food security and improved livelihood while conserving the forest and environment. Commercial agriculture, within the guideline's purview, includes Field Crops, Horticulture and vegetables and Livestock farming.

The guideline provides an enabling policy platform for commercial agriculture while ensuring sustainable land resource use for income generating agricultural activities. It provides procedure for leasing out GRF land for commercial farming. Some of the salient features are:

- ✓ The RGoB shall encourage developing a long-term sustainable lease venture with an initial term of 30 years, which is subject to renewal.
- ✓ Government shall have the exclusive right to take over the "land" in the interest of the nation. However, taking over of the land shall be done only under unavoidable circumstances and compensation modalities for such acquisition shall be assessed by competent authority
- ✓ Lease proposal submitted by the proponent shall be assessed by the concerned relevant department/agency of the Ministry(s).
- ✓ The use and management of the "land" by the leaseholder shall be governed by the terms and conditions of lease. There shall be timely monitoring and evaluation mechanism to ensure proper use of the "land" for intended activity.
- ✓ The government shall facilitate commercial agriculture development by providing access to GRF land. However, any other additional infrastructure and maintenance of it shall not be the burden of the RGoB.
- ✓ In any circumstances, the "land" shall not be mortgaged or sublet.

Procedure for Land Lease

- ✓ The proponent shall identify and propose appropriate GRF land for lease and accordingly prepare project proposal using standard tools and guidelines with support from a respective department/agency and submit to the Dzongkhag
- ✓ The Dzongkhag Land Lease Committee upon receipt of the proposal shall carry out field verification and seek all necessary clearances.
- ✓ The DDLC shall compile and forward assessment report to the Ministry of Agriculture and Forests for recommended proposals.
- ✓ The Ministry upon receipt of the proposal shall review and Technical Working Committee (TWC) may make field verification if necessary.
- ✓ Based on the review or findings of the TWC, the Ministry shall endorse the lease proposal and submit to the National Land Commission for final approval.
- ✓ Upon endorsement of the proposal, Dzongkhag shall execute a lease agreement with the proponent(s).

5.2.3 Technical support and skill development

To provide technical support and develop skills of our youth in farming the RGoB has set up the Rural Development Training Centre (RDTC) in Zhemgang. The centre invites youths to join skill development trainings that will allow them to gainfully employ themselves and contribute to nation building based on agriculture. RDTC functions as a non-departmental organization guided by a

management board which is represented by the heads of organizations under the Ministry of Agriculture & Forests. The head of the RDTC reports to the Secretary of MoAF.

RDTC envisions building up a critical mass of educated farmers interested and capable to participate in commercial farming on an economically and environmentally sustainable basis. It is the knowledge centre that is able to impart skills and knowledge in modern day farming, at the same time contributing to improve the image of farming profession. It also supports formation of self help groups and networking for exchange of experience and collaboration. The training programs are packaged with different focus and target groups as follows:

Agricultural skills training program

Apprentice Training (ATP): Training of young school leavers (12-15 months - 7weeks of attachment and 8 weeks of schools) who are interested to join farming profession. A training program consisting of hands on training with the “master farmers” supplemented with theory knowledge and practical imparted in the school. The graduates of this training can join FBT to specialize in certain farm activities.

Farm Business Training (FBT): Short courses (3-6 weeks); enterprise-specific skills on new and existing farm enterprises (crops/horticulture and livestock) with economic potential; offered in decentralised locations; targeted at active farming population or people interested to build up small agri business.

Farm Management Programme

Short courses (2-5 days) in sequence, total duration 3-6 weeks; providing practical oriented knowledge of farm enterprise planning, including record keeping/simple accounting, laying base for optimal use of available resources and for (further) market-orientation, targeted at active farm managers/owners.

Group management program

Short courses of 3-5 days duration, various modules covering all aspects of group management viz. planning, meeting management and decision taking, book-keeping/accounting, record keeping, leadership skills, conflict management; can be selected.

Workshops/Seminar and Study Tour Program

Short tours 1day to 2 weeks; clear focus on specific topics or farm enterprises; stimulating exchange and linkages between linkages between farmers with similar interests; targeted at groups of farmers interested in specific enterprise or topic.

Youth Agriculture Awareness Program

Short courses during the school breaks and monastic schools, 1-2 weeks; introducing school children to simple, most common agricultural products (vegetables- kitchen garden, livestock); give insight into the variability of agriculture and wide range of other products; target interested school children of class 8 to class 12.

In addition to RDTC, RNR RDCs also provide tailor-made training on selected topics covering fruit plants, vegetables, and field crops. Interested youths can also opt for on-the-job training or attachment to the centre for skill development of their choice.

5.2.4 Marketing of farm produce

In order to provide marketing support and services to the farming community, the Department of Agricultural Marketing and Cooperatives (DAMC) was established in 2009. It aims to better equip and prepare the MoAF to cater to the needs of the rapidly transiting agriculture sector from a primarily subsistence to a major market economy, and to effectively implement the Cooperatives (Amendment) Act of Bhutan, 2009. It is mandated to promote marketing of RNR products through promoting efficient and effective marketing systems, facilitating institutional linkages and strengthening farmers groups and cooperatives. The specific objectives of the Department are:

- Transforming the RNR sector from subsistence to market oriented farming in order to bring improvements in rural economy.
- To establish efficient and effective marketing systems and structures to promote domestic markets.
- To develop and promote export markets for Bhutan's RNR products
- Create vibrant institutional linkages with relevant stakeholders.
- Awareness and registration of Farmers Groups and Cooperatives to give legal entity
- Monitoring and evaluation of registered Farmers Groups and Cooperatives
- Capacity building of registered FG/Coops/Private Sector.

In terms of policy, DAMC has developed the *Agricultural Marketing Policy of Bhutan* in 2013. The overarching goal of the Policy is to enhance the overall competitiveness, efficiency, effectiveness of the agricultural marketing system, along with improved market access for growers with farms of small to medium size, provision of better quality products to the consumer at reasonable cost, and promotion of local and national economic development. It has four main policy goals:

Policy Goal 1 --- Strengthened legal, macroeconomic and trading environment --- Favourable and stable legal and regulatory, macroeconomic and trading environment for performance of agricultural marketing activities.

Policy Goal 2 --- Enhanced value-addition --- Maximum, equitably distributed added-value gains from agricultural marketing activities.

Policy Goal 3 --- Strengthened agricultural marketing capacities --- Strengthened agricultural marketing institutions, entrepreneurship, infrastructure, financing and other capacities for efficient and effective agricultural marketing.

Policy Goal 4 --- Streamlined cross-cutting issues --- Maximum synergies and minimum adverse effects from exogenous factors affecting marketing of agricultural products.

Prior to the existence of DAMC, the Food Corporation of Bhutan (FCB) provided marketing services to the producers and still continues to support and complement DAMC in agricultural marketing. The FCB was established under the Royal Charter in 1974 by His Majesty the Fourth Druk Gyalpo in order to institutionalize a centralized procurement and distribution system of essential food supplies in the country. In 1992, FCB was delinked and registered under the then Companies Act of the Kingdom of Bhutan 1989, and later under the Companies Act of the Kingdom of Bhutan 2000. Today FCBL functions independently with no financial liabilities and

dependence on the government. FCBL promotes and supports marketing of Agricultural and Horticultural produce of the Bhutanese farmers by:

- ✓ Facilitating fair trade of Agricultural and Horticultural produce between the buyers and the Bhutanese growers through efficient and effective operations of the Auction Yards.
- ✓ Identifies, promotes and develops marketing of any agricultural produce independently or in collaboration with the Ministry of Agriculture.

5.2.5 Farm mechanization

Mechanization refers to use of machinery in farming activity. A mechanized farming is where farm machines replace human labour or assist humans in different farming activities by machines or technology. Mechanization plays a vital role in difficult mountain farming where human labor is scarce. To mechanize farming, the Agricultural Machinery Centre (AMC) was established in 1983 in Paro by the Ministry of Agriculture. It embarks on the program to mechanize Bhutanese agriculture through use of appropriate farm machinery, equipment and tools. Its functions include: modification and innovation of indigenous farming tools suitable to Bhutanese farms; promotion of improved agriculture technology in the country; effective and efficient distribution of agriculture equipment to the farmers; capacity development of the farmers in the use of improved technology and farming practices; and act as the regulatory body of quality and safety. AMC has a network of Regional Agriculture Machinery Centers (RAMC) in Paro, Wangdue, Khangma and Bhur.

Mechanization in Bhutanese farming is aimed at ending drudgery, saving costs and improving yield through the use of suitable farm machinery, tools and implements and sustainable farming practices. The largest support in farm mechanization is through the KR II Grant of Japan. Machinery received through the KR II grant is sold at subsidized rates to farmers. The other activity is the back-up support services such as the installation, repair and making available of spare parts. These are carried out through the four regional centres of AMC. AMC also has started machinery hiring services for farmers. A revised Guideline for hiring of farm machinery was approved by the MoAF in 2014. The objectives are to mitigate farm labour shortage and agricultural feminization; optimize land utilization, land intensification and promote agricultural commercialization; generate rural employment and enhance income of farming community; cover larger agricultural areas under mechanized farming; and improve accessibility of farm machines to poor and marginal farmers. Farm machineries available for hiring are:

Land preparation	: <i>Power tillers and tractors, with accessories such as reversible and rotary ploughs for power tillers; disc, harrow, planters and rotary attachments for tractors.</i>
Transplanting	: <i>Transplanters of different capacity or size</i>
Harvesting	: <i>Reapers, mini combine harvesters, potato harvesters</i>
Threshing	: <i>Pedal threshers, power threshers</i>
Transportation	: <i>Power tillers and tractors with trailer</i>
Water pumping	: <i>Portable water pumps</i>

Hiring services are made available from AMC's Farm Machinery Service Centres (FMSC), Regional AMC or RDCs. The District Agriculture Officers are provided information on the hiring services. The RNR Extension staff of Geogs put up requisition for hiring services in consultation with Gups. Preference is given to registered farmer groups over individuals, and accessibility and

irrigation facilities are considered. Machine operators and fuel are provided by AMC. The hiring service is available for a minimum of 1 day work and hiring rates are determined from time to time based on machine costs, depreciation and operational costs. Current applicable rates (per day), for instance, are as follows: Power tiller: Nu 1400, 50 hp tractor: Nu 3100, 34 hp tractor: Nu 2400, 18 hp tractor: Nu 1900, transplanter: Nu 1100, reaper: Nu 1600, water pump: 2000 and thresher: Nu 400. These hiring rates are much below existing market rates.

6 Summary and recommendations

With increased level of school enrolment there is an increasing number of young people, including school leavers, without gainful employment. Therefore, engagement of educated youth in agriculture based entrepreneurship is necessary not only to secure gainful employment for them but also to reduce our dependency on food imports and achieve a higher level of self-sufficiency and food sovereignty. In view of the potential of agriculture sector in providing gainful employment, the Ministry Labour and Human Resources (MoLHR) is exploring the option of engaging youth in commercial agriculture by utilizing the currently available fallow lands. Therefore, MoLHR in partnership with UNDP-Bhutan wished to undertake a feasibility study of engaging youth in commercial agriculture based entrepreneurial undertaking. MoLHR in consultation with DoA has identified RNR RDC Bajo to undertake the feasibility study from September to December 2015. The main objective of the feasibility study is to identify suitable land which is fallowed or unused and assess the technical and economic viability of using the land for commercial farming in Wangdue, Punakha and Tsirang dzongkhags.

The study methodology included identification of potential fallow lands in consultation with Dzongkhag Administrations, assessment of the fallow lands for suitability for commercial agriculture, conduction of economic and meteorological analysis of selected potential crops and review of policy documents. Field visits to the identified sites by the team members and technical assessments were the main tool used in the study. The sites were considered potential if the sites had reasonable access to motorable road and irrigation water supply/source nearby, which are considered pre-requisite for commercial agriculture.

The rainfall pattern over the all sites is generally monomodal. Generally, most of the rainfall occurs from the month of May to September and the annual rainfall ranges from 308 mm to 1467 mm. The maximum and minimum temperatures are most favourable for growing crops from the month of March to October; however temperatures are colder in other months. Our stakeholder analysis with the 12 youths indicated that the youths were interested in short term crops of vegetables mainly because of quick returns from the enterprise and the consulted youth were interested to work closer to their community.

The study recommends that vegetable farming offers the maximum potential and a quick return to investment. The initial investments are relatively low, production is high and market demand is almost insatiable. Crops are seasonal and can be raised quickly within 2-4 months. The RGoB promotes domestic production of food crops including vegetables. Hence, vegetable production is prioritized. Given the agro-ecological diversity, several summer and winter vegetables can be grown in all the identified farms. Based on their production possibility, market demand and the

potential for income generation, chili, tomato, okra, egg plant, beans, carrot, potato, ginger, gourds, radish, cucumber are recommended for summer. In winter, cabbage, cauliflower, broccoli, pea, beans, mustard green, leafy vegetables, lettuce, garlic and coriander can be grown. High value perennial crops like Asparagus can also be cultivated. An overview of the production costs, gross farm income and net profit of the 11 identified farms in commercial farming of selected vegetable crops is provided. The average cost of production is Nu 63,731 per acre. For vegetable production, the most essential inputs are seeds or seedlings, manures or compost and synthetic fertilizers. If adequate organic manures are available, the use of synthetic fertilizers can be significantly reduced to save costs and avoid environmental pollution. The labor days for the selected vegetable crops range from 47-108 days per acre.

A commercial farm requires basic farm facilities and infrastructures to function efficiently. Fencing is a pre-requisite in all the farms to protect crops from domestic and wild animals. The other basic requirement is the provision of irrigation water. Land development includes terrace formation or widening of existing terraces for efficient use of farm machines. Approach road to the farmland and internal access road within the farms need to be built. Labor huts, store, office and processing shed will be required. For off-season cultivation of vegetables, protective green houses will be required. Depending on the size of the farm and the needed infrastructures in specific sites, the capital cost varies from Nu 1.186 million to Nu 10.02 m per farm.

Production economics is important to gauge the overall profitability of a farm. The average cost of production is Nu 63,731 per acre. The variation among farms is explained by the farm size and the type of vegetable grown. The net profit is Nu 79,243 per acre from vegetable farming. This is assuming that irrigation facilities and crop protection measures like fencing are put in place. Depending on the type of vegetable crop grown, the farm profit varies from Nu 56,580 to Nu 105,647 per acre. Considering that the average profit from cereal farming falls below Nu 20,000, vegetable farming is much more profitable.

On the policy front the agricultural development receives favorable support. The Economic Development Policy of the Kingdom of Bhutan, 2010 stresses that agriculture is a critical sector for a balanced and equitable development and to alleviate poverty. It promotes commercial farming, efficient irrigation systems and assured marketing. Identification of suitable crops for commercial farming and facilitation of land for large scale farming are given importance. Emphasis is also given for the farming sector to be mechanized and adoption of farming techniques for higher productivity and farm profitability.

The findings of the assignment were presented in a workshop to the Director General and officials of the Department of Employment (MoLHR), representative from the UNDP, relevant DAOs, and researchers and officials of the RDCs Bajo and Yusipang on 3rd December 2015 at TTI, Khuruthang. The findings were endorsed for submission.

Recommendations

6.1 *Technical*

- Basic practical-oriented training on various aspects of vegetable production needs to be provided to the youth before they can embark on farming. RDTC Zhemgang and RNR RDCs will be the appropriate institutions to do this.
- In order to ensure the success of the project or farming enterprise, the youth entrepreneurs need to be technically supported by RNR RDCs and the local extension staff for any production related activity. Similarly, support for market information, linkages, and facilitation has to be provided by relevant agencies.
- Seeds of superior varieties of vegetables, including hybrids, have to be made available to the growers in order to reap better harvests and maximize incomes. Seeds are the basic input in farming and yield is determined by the quality of the sown seeds.
- For youths interested in commercial orchard development, further analysis on the production economics, marketing and farm profitability including break-even analysis should be done.

6.2 *Policy related*

- Compared to many countries around the world, the farming sector in Bhutan receives negligible support from the government in terms of budget allocation, incentive mechanisms for farmers or subsidies for farming. This makes the local production of food crops even less competitive with ever growing imports. The government needs to review and rethink on devising appropriate mechanisms to make local produce more competitive in the market.
- Seeds and planting materials imported from third countries and new technologies like green houses are liable for taxation although farming provides livelihood and employment for majority of the Bhutanese people and that food sufficiency and security is a priority agenda of the government. Such a policy contradicts the stated goal of food self-sufficiency at the country level and deters potential farmers from embarking on agri-related activities or business. This needs to be corrected.

6.3 *Plan of implementation*

- Choose a few sites to commence implementation of the commercial farming on a pilot basis engaging youth. We recommend the site in Daga, Wangdue to start with, since the owner of the farm, an IT graduate keenly interested in farming, is looking for the kind of support that MoLHR and MoAF are planning to provide to youth.
- Identify/enlist interested youths and enroll them for basic agricultural or horticultural production training. Some basic leadership training may also be required so that some of the youths can lead the program.
- Negotiate land lease agreements with the land owners for use of their land for commercial farming following MoAF Guidelines. MoLHR in consultation with Dzongkhag administration will be the appropriate agency for this. Except for Daga where the land owner himself wants to start commercial farming, all other land owners are inclined to lease out their land.
- Develop basic facilities and infrastructure at the selected sites. Seek donor funds or financial support from the RGoB for capital investment.
- Arrange for essential production inputs like seeds, seedlings, fertilizers etc in the pilot site to initially demonstrate the potential of commercial farming. MoAF should have no difficulty making such one-time arrangements.

7 Site Profile 1: Phangyul, Wangdue

7.1 Site Information

Table 7-1: Site information for Wotokha, Phuangyul Geog, Wangdue

Name of land owner	<i>Sangay Lham and Zomba Lham</i>
Total area	<i>11.35 acres</i>
Dzongkhag	<i>Wangdue Phodrang</i>
Geog	<i>Phangyul</i>
Chewog	<i>Phangyul</i>
Location	<i>Wotokha</i>
Altitude	<i>1676 m</i>
Land aspect	<i>South-east</i>
Land type	<i>Wetland land and dryland</i>
Land status	<i>Fallow for 5 years</i>
Land Tenancy	<i>Private</i>
Soil type	<i>Clay loam</i>
Distance from highway	<i>9 km (3.5 km from the new road plan)</i>
Distance from town	<i>11 km Bajo town</i>
Natural Vegetation	<i>Mixed pine</i>
Cropping system	<i>Rice-Wheat-Vegetables</i>
Climatic information	<i>Winter minimum temp: 5°C, summer 22°C; Summer min 18°C, max 30°C, rainfall min 0 mm, max 135 mm</i>
Existing Infrastructure	<i>Connected to farm road, electricity connected, no fencing, land terraced, Slope degree: 5-15°</i>
Distance from irrigation water	<i>Perennial spring water source measuring 1 liter/8 second within the proposed land</i>
Irrigation water source type	<i>Perennial spring water source measuring 1 liter/8 second</i>
Problem and constraints	<i>Wild animal, stray cattle</i>

WOTOKHA FARM (Phangyul)

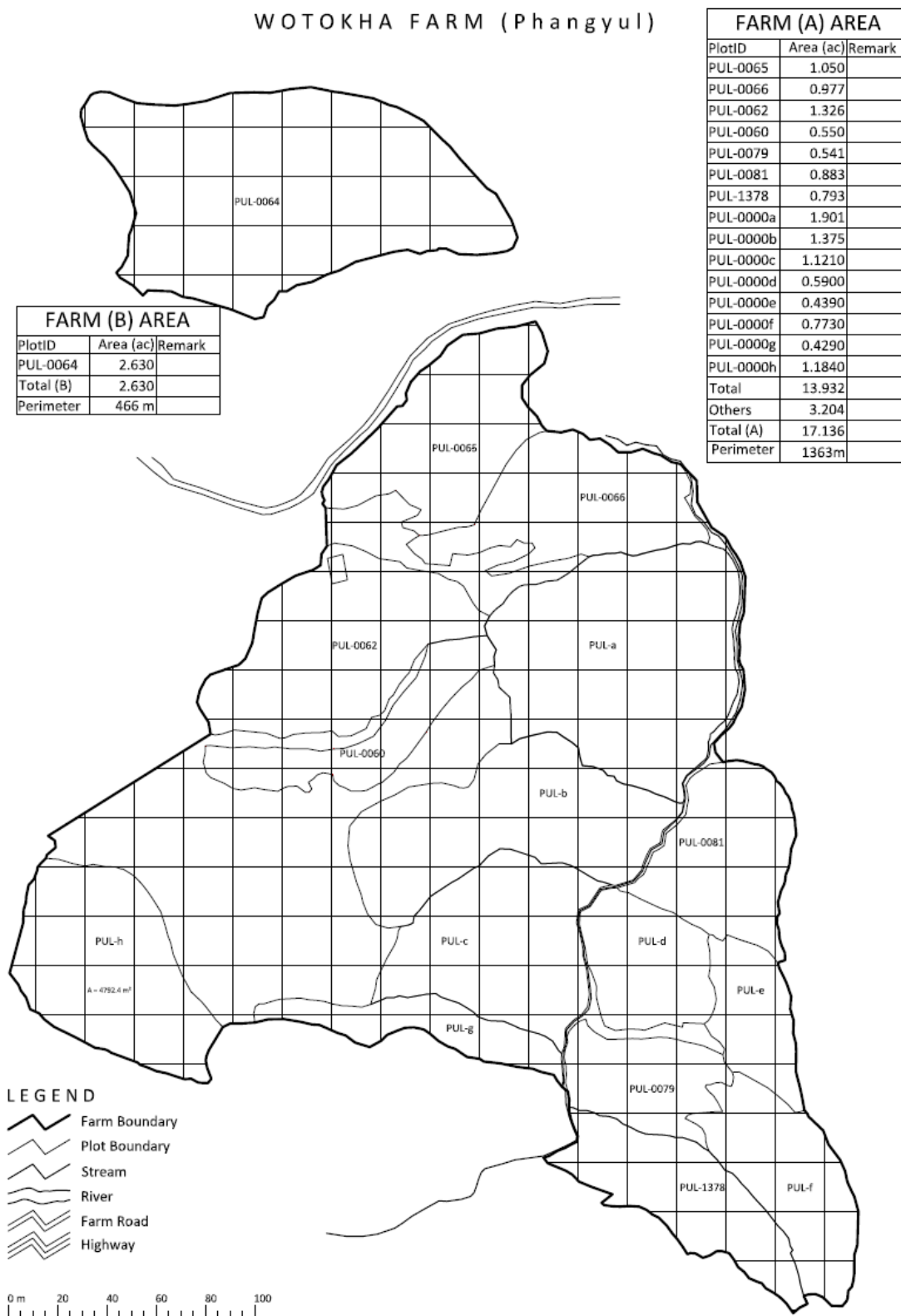


Figure 7-1: Wotokha Farm, Phangyul, Wangdue



(a)



(b)



(c)



(d)

Figure 7-2: Pictorial view of fallow land.

(a) Preliminary discussions on site identification, (b) Identified site is being assessed by team embers, (c) A view of the identified fallow land, and (d) A view of the other part of the fallow land.

7.2 Climatic conditions

For Phangyul, meteorological data were collected from Samtegang weather station which is the closest weather station with similar altitude. The rainfall pattern over the sites is monomodal. Generally, most of the rainfall occurs from the month of June, July, August and September, whilst the least quantity of rainfall occurs in months of January, February, November and December over the different sites. Total annual rainfall is estimated to be 932 mm. The maximum and minimum temperatures are most favourable for growing crops from the month of March to October; however temperatures are colder in January, February, March, November and December.

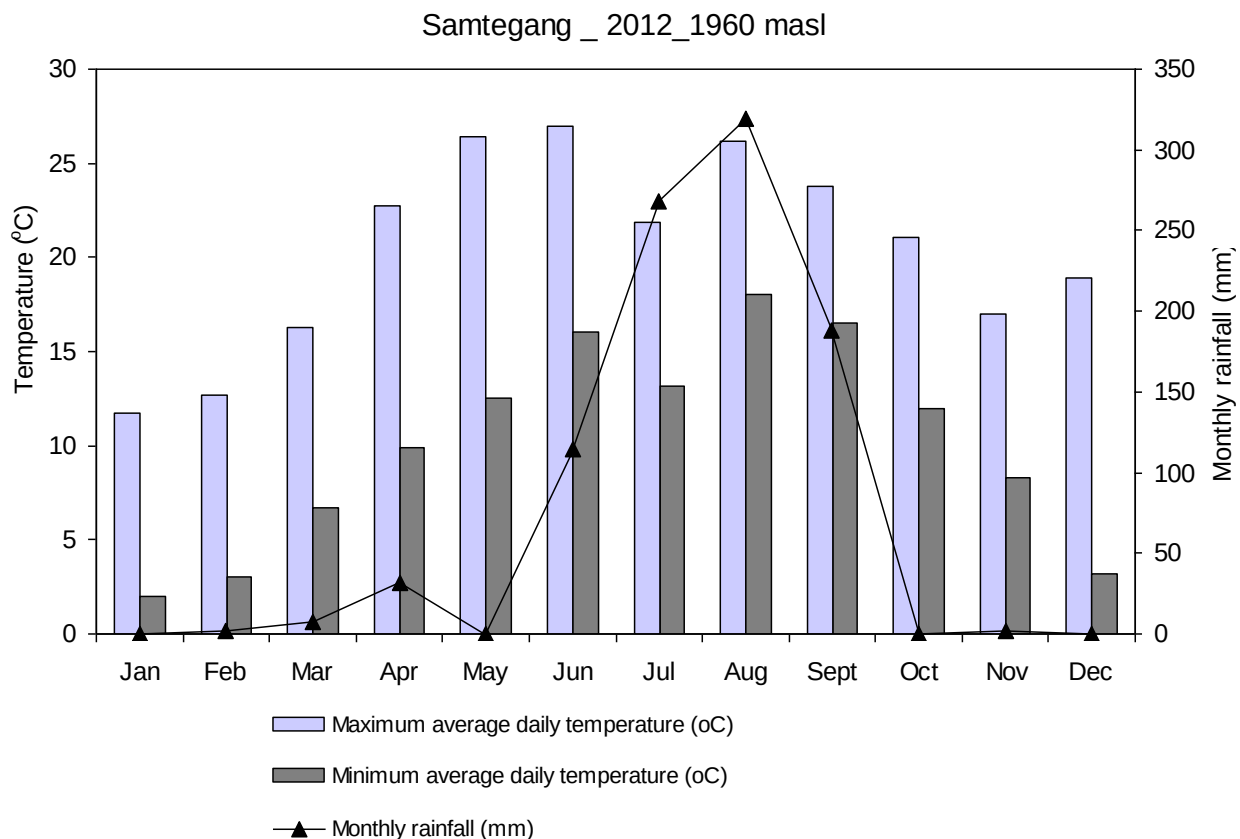


Figure 7-3: Climate information for Phangyul site.

7.3 Proposed Crops

The land is feasible for both summer and winter vegetable crops. Among the vegetables, the following crops are selected based on climatic suitability, production, market demand and income from their sale.

Summer crop: chili, egg plant, ginger, tomato, potato, radish, pumpkin, cucumber, ladies finger, carrot, onion

Winter: cabbage, broccoli, cauliflower, coriander, mustard green, garlic, radish, lettuce, carrot, pea, bean, onion

As a longer term farm plan, perennial vegetables such as Asparagus can be cultivated. In addition, the farm can also be grown with fruit plants. The following fruit plants are feasible:

- Kiwi
- Grapes
- Passion fruits
- Cardamom

- Avocado
- Peach
- Pear
- Pomegranate
- Persimmon

However, for immediate economic gain, we propose cultivation of seasonal vegetables. Of the total farm area, the land can be divided to grow the summer and winter vegetables as follows:

Table 7-2: Proposed crops for summer and winter season in Wotokha

Summer		Winter	
Crop	Area (ac)	Crop	Area (ac)
Chili	2.0	Broccoli	2.0
Tomato	1.0	Garlic	2.0
Carrot	1.0	Pea	2.0
Ginger	2.0	Cabbage	1.0
Egg plant	1.0	Cauliflower	1.5
Radish	1.0	Leafy green	0.5
Beans	1.0	potato	2.0
Onion	1.5		
Leafy green	0.5		
Total	11.0	Total	11.0

7.4 Cropping calendar

The cropping calendar for different vegetables is presented in the Table below.

Table 7-3: Crop calendar for selected vegetables.

Vegetable	Growing season											
	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Cabbage			SOWING									
										HARVESTING		
Cauliflower			SOWING									
Broccoli			SOWING									
Tomato		SOWING										
Egg plant			SOWING									
Chili			SOWING									
Onion												

Table 7-4: Yield and Input rates for material and labour per acre

Crop	Seed rate	FYM (MT)	Fertilizer rate (kg)				Labour (day)	Yield (kg)
			Urea	SSP	MoP	Suphala		
Chili	300 gm	8.0	100.0	150.0	25.0	0.0	84.4	2364.0
Tomato	160 gm	8.0	77.0	125.0	17.0	0.0	108.6	2629.0
Carrot	600 gm	5.9	15.0	25.0	40.0	0.0	54.3	2600.0
Potato	889.13 kg	3.5	84.0	200.0	53.0	0.0	105.0	6393.0
Egg plant	300 gm	8.0	70.0	175.0	20.0	0.0	80.0	1200.0
Radish	4 kg	5.0	44.0	125.0	34.0	0.0	57.4	3143.0
Beans	20 kg	2.6	22.0	187.5	0.0	0.0	59.6	1700.0
Broccoli	180 gm	7.9	75.0	150.0	25.0	0.0	70.9	1906.8
Garlic	175.7 kg	4.8	65.0	100.0	0	0.0	59.1	724.0
Pea	40 kg	5.2	44.0	187.5	50.0	0.0	51.8	1400.0
Cabbage	300 gm	7.4	75.0	150.0	25.0	0.0	68.3	2858.0
Cauliflower	180 gm	5.5	75.0	150.0	25.0	0.0	74.6	1600.0
Onion	1.6 kg	4.3	88.0	187.5	50.0	0.0	82.7	2772.9
Leafy Greens	1.0 kg	8	44.0	0	0	0	47.2	2106.1
Ginger	554.09 kg	5.6	65.0	100.0	0.0	0.0	60.9	2772.9

7.6 Long term investment plan (Capital investment)

The farm needs the following investment and farm infrastructures:

- Fencing
- Land Development
- Irrigation
- Approach road
- Internal farm road
- Infrastructure (office, huts, store, processing shed)

Table 7-5: Summary of Capital Investment for Phangyul

SN	Farm infrastructure	Qty/unit	Rate	Amount	Remark
1	Electric fencing	1,363 m	46.24	63,030	From detail estimate
2	Irrigation- Intake	1 No	10,000.00	10,000	Lump sum
3	Irrigation- Conveyance (50mm HDPE pipe)	10 m	235.21	2,352	BSR item code PO0018
4	Irrigation- Storage	100 cu.m	11,300.00	1,130,000	Based on RDC Bajo tank
5	Irrigation- Application (sprinkler)	13.93 acre	100,000.00	1,393,000	
6	Road- Approach (5m wide)	10 m	425.72	4,257	Formation cutting- earth
7	Road- Internal farm road (4m wide)	200 m	222.10	44,420	Formation cutting- earth
8	Land Development	2 acre	20,000.00	40,000	
9	Infrastructure- Office	1 Block	200,000.00	200,000	
10	Infrastructure- Huts	5 Block	50,000.00	250,000	
11	Infrastructure- Store	1 Block	100,000.00	100,000	
12	Infrastructure- Processing shed	1 Block	150,000.00	150,000	
13	Green house	2 Block	70,000.00	140,000	
A	Total			3,457,059	
B	Unit cost (Nu per acre)			248,174	

7.7 Economics of the farm

Basic crop production economics and farm profitability are calculated and shown in the table below.

Table 7-6: Crop production economics.

Crop	Yield (kg/ac)	Production cost		Proposed area (acre)	Total production (kg)	Production cost (Nu)	Market price (Nu/kg)	Total income (Nu)	Net Profit (Nu)
		(Nu/kg)	(Nu/ac)						
Chili	2364.0	15.1	35649.1	2.0	4728.0	71298.2	50.0	236400.0	165101.8
Tomato	2629.0	16.7	43904.3	1.0	2629.0	43904.3	30.0	78870.0	34965.7
Carrot	2600.0	9.8	25376.0	1.0	2600.0	25376.0	32.0	83200.0	57824.0
Potato	6393.0	9.6	61500.7	2.0	12786.0	123001.3	18.4	235262.4	112261.1
Egg plant	1200.0	13.7	16380.0	1.0	1200.0	16380.0	32.0	38400.0	22020.0
Radish	1790.0	8.3	14928.6	1.0	1790.0	14928.6	15.1	26975.3	12046.7
Beans	1700.0	14.6	24888.0	1.0	1700.0	24888.0	35.7	60741.0	35853.0
Broccoli	1154.0	29.4	33904.5	2.0	2308.0	67809.0	88.0	203104.0	135295.0
Garlic	724.0	73.0	52852.0	2.0	1448.0	105704.0	86.0	124528.0	18824.0
Pea	1400.0	18.8	26334.0	2.0	2800.0	52668.0	48.0	134400.0	81732.0
Cabbage	2858.0	9.8	27894.1	1.0	2858.0	27894.1	20.7	59103.4	31209.4
Cauliflower	1600.0	20.3	32496.0	1.5	2400.0	48744.0	45.0	108000.0	59256.0
Onion	1100.0	31.5	34650.0	1.5	1650.0	51975.0	40.0	66000.0	14025.0
Ginger	2772.9	17.7	48941.2	2.0	5545.7	97882.3	80.0	443659.2	345776.9
Leafy greens	2106.1	10.2	21376.8	1.0	2106.1	21376.8	16.3	34413.5	13036.7
Total						793829.7		1933056.9	1139227.1

Estimation of costs and profits and evaluation of the economic feasibility of production techniques are aspects of the management of a farm as a business enterprise. The production economics of the selected crops are computed for both season summer and winter seasons. The cost of production is based on the Vegetable Production Economics conducted by Horticulture Division, DoA, MoAF. For land preparation, the prevailing AMC hiring rates for power tiller are used in the calculations. Market price is taken at prevailing wholesale market rates. Labour cost is averaged at Nu 340 per day which includes meals and refreshment.

The gross value of production is calculated based on the average yield of vegetables in Bhutan (Agriculture Statistics, 2014). The production costs include materials inputs like seeds, manures, chemical fertilizers, plant protection and labour inputs needed for production of the crop in each season. The total production cost incurred per year is computed at Nu72,166 per acre or Nu793,830 for the whole farm of 11 acres. The total income that will be generated from the farm is Nu1,933,056 per year or Nu 175,732 per acre. After deducting costs, the net profit is Nu1,139,227 per year from the farm which works out to Nu103,566 per acre.

8 Site Profile 2: Bjena, Wangdue

8.1 Site Information

Table 8-1: Site information for Damchen, Bjena Geog, Wangdue

Name of land owner	<i>Lhatru (Combined 8HH)</i>
Total area	<i>5-6 ares</i>
Dzongkhag	<i>Wangdue</i>
Geog	<i>Bjena</i>
Chewog	<i>Ngawang</i>
Location	<i>Gangtesemo (Damchen in Thram Record)</i>
Altitude	<i>1717m</i>
Land aspect	<i>South west</i>
Land type	<i>Wetland</i>
Land status	<i>Fallow for 3 years</i>
Land Tenancy	<i>Own/private</i>
Soil type	<i>Clay loam</i>
Distance from highway	<i>0 km (Below highway)</i>
Distance from town	<i>12 km (Bajo Town)</i>
Natural Vegetation	<i>Broad leaf</i>
Cropping system	<i>Rice-vegetables/wheat/mustard</i>
Climatic information	<i>Winter minimum temp: 5°C, summer 22°C; Summer min 18°C, max 30°C, rainfall min 0 mm, max 135 mm</i>
Existing Infrastructure	<i>-</i>
Distance from irrigation water	<i>Below the highway, farm house with electricity, irrigation canal exists, land terraced wetland, sloping land with about 30 degrees</i>
Irrigation water source type	<i>Steam water</i>
Problem and constraints	<i>Wild animals, lack of fencing,</i>

DAMCHEN, Bjena: WANGDUE

FARM AREA		
PlotID	Area (ac)	Remark
BIE-0043	0.154	Fallow
BIE-a	0.469	Fallow
BIE-b	0.910	Fallow
BIE-c	0.181	Fallow
BIE-d	0.371	Fallow
BIE-e	0.346	Fallow
BIE-f	0.803	Fallow
BIE-g	0.308	Fallow
BIE-h	0.262	Fallow
BIE-i	0.403	Fallow
BIE-j	0.614	Fallow
BIE-k	0.085	Fallow
BIE-l	0.182	Fallow
BIE-m	0.362	Fallow
BIE-n	0.408	Fallow
Total	5.888	
Gross	6.410	
Perimeter(m)	970	

LEGEND	
	Farm Boundary
	Plot Boundary
	Irrigation Channel- Main
	Irrigation Channel- Distribution
	Stream
	River
	Footpath
	Farm Road
	Highway
	Electric Post

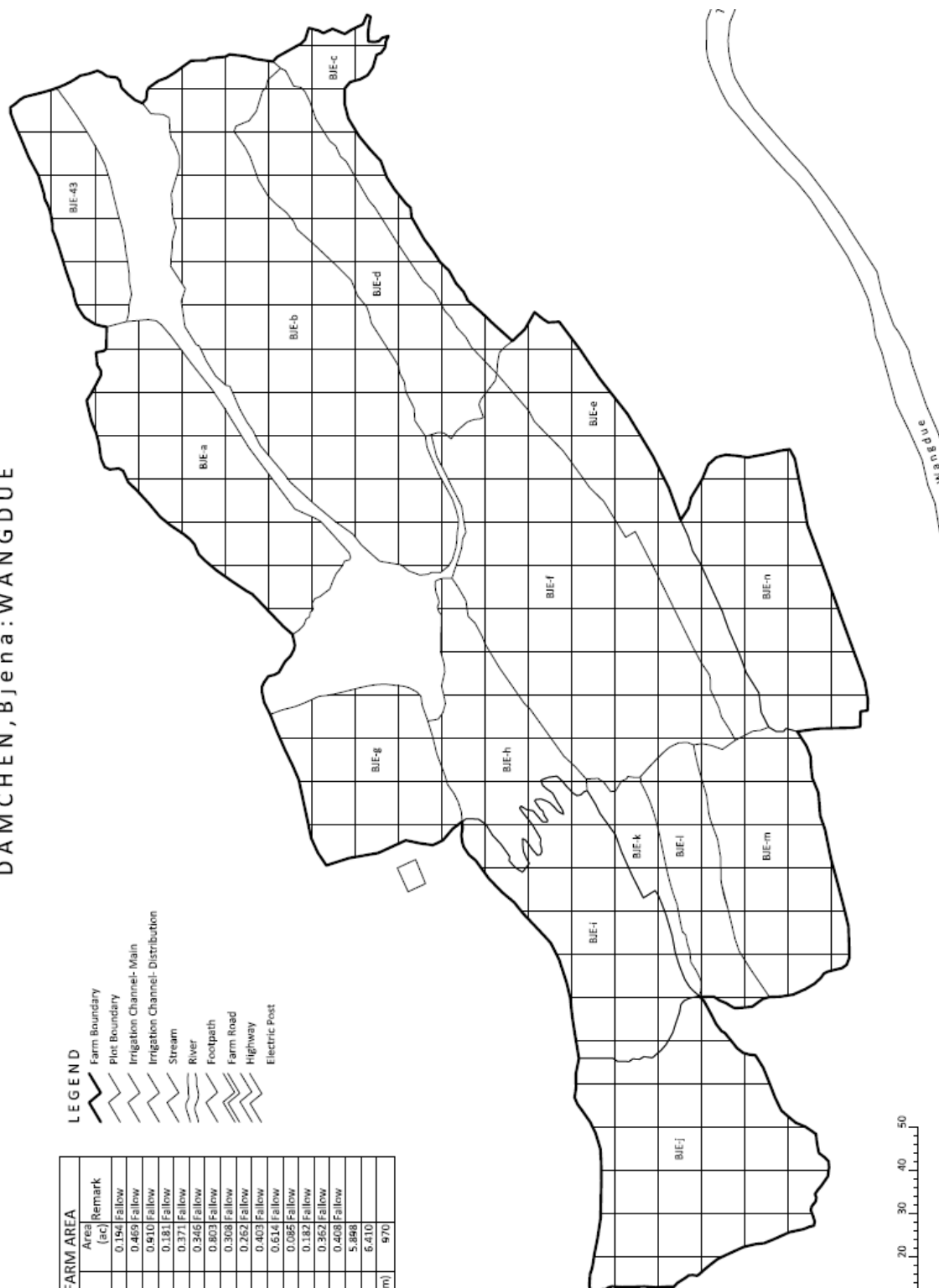


Figure 8-1: Damchen Farm, Bjena: Wangdue



(a)



(b)



(c)



(d)

Figure 8-2: Pictorial views of proposed Damchen Farm, Bjena, Wangdue:

(a) Discussion on site identification with Tshogpa, DAO, Agriculture EA, (b) land is adjacent to Trongsa-Wangdue Highway, (c) a view of the identified fallow land, and (d) a closer look at the fallow land.

8.2 Climatic conditions

Meteorological data was collected for nearest weather station (RDC Wangdue) from the identified fallow land for commercial agriculture. The rainfall pattern is monomodal with maximum rainfall occurring from the month of May to September, whilst the least quantity of rainfall occurs in months of January, February, November and December. The annual total rainfall is estimated for the site to be 675 mm. The Maximum and minimum temperatures are most favourable for growing crops from the month of April to October, however temperatures are colder in January, February and December.

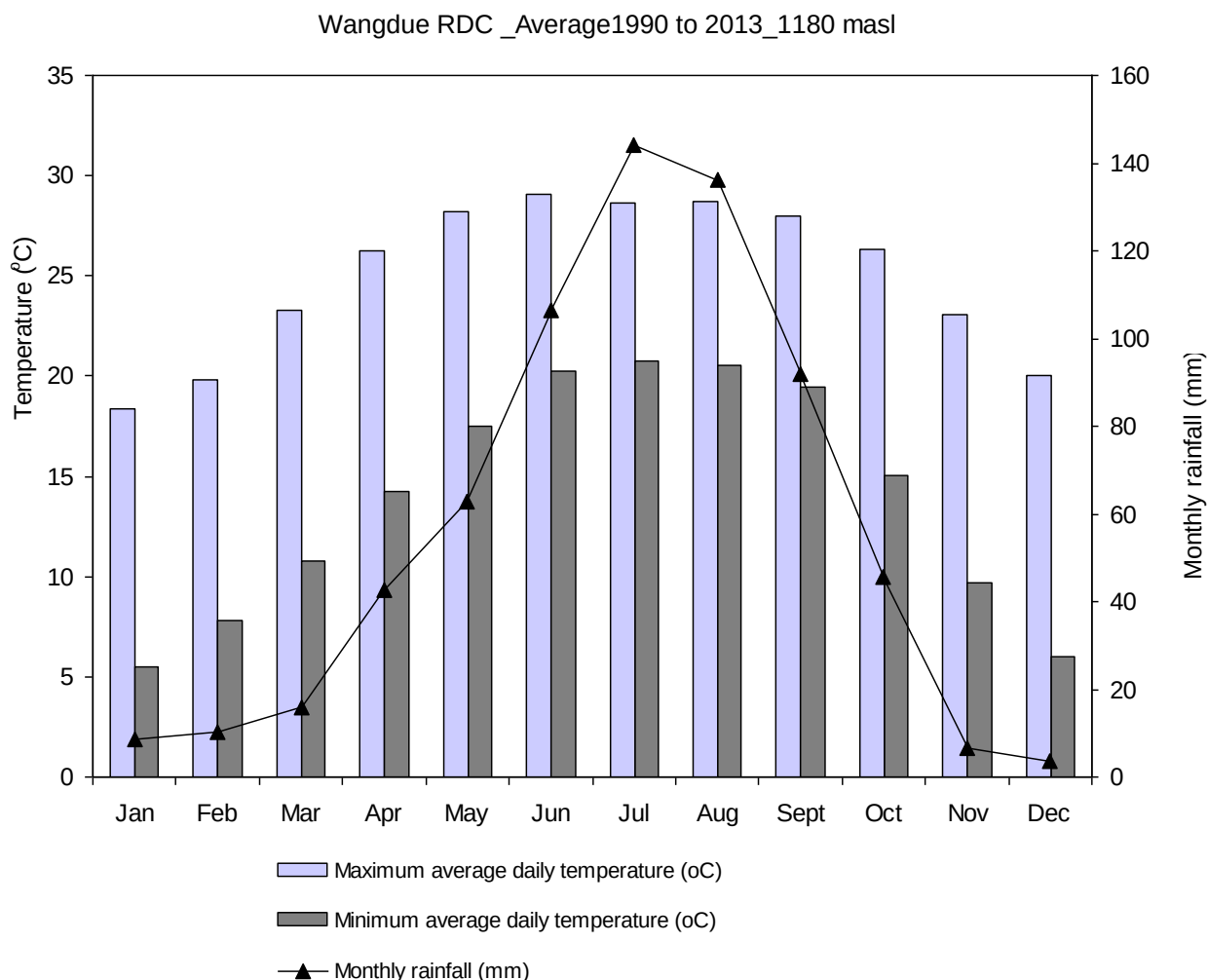


Figure 8-3: Climate information for proposed Damchen Farm under Bjena Geog, Wangdue

8.3 Proposed Crops

The land is feasible for both summer and winter vegetable crops. Among the vegetables, the following crops are selected based on climatic suitability, production, market demand and income from their sale.

Summer crop: Onion, chili, tomato, cabbage, ginger

Winter: Broccoli, cauliflower, garlic, peas, beans

Perennial crops like Asparagus, passion fruits and cardamom can be successfully grown. In addition, fruit crops such as Citrus, Avocado, Litchi and Mango can be cultivated. However, we recommend the following vegetable crops for immediate production and income generation, dividing the 5.6 acre land for various crops as shown in the table.

Table 8-2: Proposed crops for summer and winter season at Damchen, Bjena.

Summer		Winter	
Crop	Area (ac)	Crop	Area (ac)
Chili	1.00	Broccoli	1.00
Tomato	2.00	Garlic	1.00
Onion	2.00	Pea	1.00
Beans	1.00	Cabbage	0.25
Ginger	0.50	Cauliflower	1.00
Cucumber	0.25	Leafy green	0.20
Total	6.75	Total	4.45

8.4 Cropping calendar

Different crops can be grown following the cropping calendar as presented in the Table below.

Table 8-3: Proposed cropping calendar for summer and winter season at Damchen, Bjena.

Vegetable	Growing season												
	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	
Cabbage		SOWING											
						HARVESTING							
Cauliflower		S											
						H							
Broccoli		S											
						H							
Tomato		S					H				S		
		H					H						
Egg plant			S										
						H							
Chili			S										
						H							
Onion (Bulb)								S					
			H										
Pea		S											
				H									
Beans			S			S							
						H				H			
Ginger			S										
	H										H		
Garlic									S				
		H											
Asparagus				S									
				H from third year									

8.5 Inputs required

The most basic inputs required for cultivation include: seeds or seedlings, manures, fertilizers and labor days. The table below provides information on inputs.

Table 8-4: Production inputs and expected crop yield at Damchen, Bjena in per unit area (acre).

Crop	Seed rate	FYM (MT)	Fertilizer rate (kg)				Labour (day)	Yield (kg/ac)
			Urea	SSP	MoP	Suphala		
Chili	300 gm	8.0	100.0	150.0	25.0	0.0	84	2364.0
Tomato	160 gm	8.0	77.0	125.0	17.0	0.0	108	2629.0
Beans	20 kg	2.6	22.0	187.5	0.0	0.0	59	2176.3
Broccoli	180 gm	7.9	75.0	150.0	25.0	0.0	70	980.0
Garlic	175.7 kg	4.8	65.0	100.0	0	0.0	59	724.0
Pea	40 kg	5.2	44.0	187.5	50.0	0.0	51	1400.0
Cabbage	300 gm	7.4	75.0	150.0	25.0	0.0	68	2858.0
Cauliflower	180 gm	5.5	75.0	150.0	25.0	0.0	74	1600.0
Onion	1.6 kg	4.3	88.0	187.5	50.0	0.0	82	1296.5
Leafy Greens	1.0 kg	8	44 kg	0	0	0	47	2106.1
Cucumber	1.2 kg	8	0	0	0	0	58	5000.0
Ginger	554.1 kg	5.6	65.0	100.0	0.0	0.0	60	2772.9

8.6 Long term investment plan (Capital investment)

Capital investment is required for fencing, land development, irrigation, approach road, internal farm road, and infrastructure (office, huts, store, and processing shed).

Table 8-5: Summary of capital investment required for Damchen, Bjena Geog, Wangdue.

SN	Farm infrastructure	Qty/unit	Rate	Amount	Remark
1	Electric fencing	970 m	56.18	54,497	From detail estimate
2	Irrigation- Intake	1 No	10,000.00	10,000	Lump sum
3	Irrigation- Conveyance (50mm HDPE pipe)	500 m	235.21	117,605	BSR item code PO0018
4	Irrigation- Storage	10 cu.m	11,300.00	113,000	Based on RDC Bajo tank
5	Irrigation- Application (sprinkler)	5.90 acre	100,000.00	590,000	
6	Road- Approach (5m wide)	50 m	425.72	21,286	Formation cutting- earth
7	Road- Internal farm road (4m wide)	300 m	222.10	66,630	Formation cutting- earth
8	Land Development	2 acre	20,000.00	40,000	
9	Infrastructure- Office	1 Block	200,000.00	200,000	
10	Infrastructure- Huts	5 Block	50,000.00	250,000	
11	Infrastructure- Store	1 Block	100,000.00	100,000	
12	Infrastructure- Processing shed	1 Block	150,000.00	150,000	
13	Green house	2 Block	70,000.00	140,000	
A	Total			1,853,018	
B	Unit cost (Nu per acre)			289,082	

8.7 Economics of the farm

Basic crop production economics and farm profitability are calculated and shown in the table below.

Table 8-6: Annual crop production economics for Damchen, Bjena Geog, Wangdue.

Crop	Yield (kg/ac)	Cost of production		Proposed area (acre)	Production (kg)	Production cost (Nu)	Market price (Nu/kg)	Annual income (Nu)	Net Profit (Nu)
		(Nu/kg)	(kg/ac)						
Onion	1296	30.7	39802.6	2.0	2593.0	79605.1	40.0	103720.0	24114.9
Chili	2364	15.1	35649.1	1	2364.0	35649.1	50.0	118200.0	82550.9
Tomato	2629	16.7	43904.3	2.0	5258.0	87808.6	30.0	157740.0	69931.4
Beans	2176	15.6	34037.2	1.0	2176.3	34037.2	35.7	77758.8	43721.7
Ginger	2772	17.7	48941.2	0.5	1386.4	24470.6	80.0	110914.8	86444.2
Garlic	724	46.7	33810.8	1.0	724.0	33810.8	86.0	62264.0	28453.2
Broccoli	980	34.6	33908.0	1.0	980.0	33908.0	88.0	86240.0	52332.0
Cauliflower	1600	20.3	32496.0	1.0	1600.0	32496.0	45.0	72000.0	39504.0
Cabbage	2858	9.8	27894.1	0.3	714.5	6973.5	20.7	14775.9	7802.3
Pea	1400	18.8	26334.0	1.0	1400.0	26334.0	48.0	67200.0	40866.0
Leafy Greens	2106	10.2	21376.8	0.2	421.2	4275.4	16.3	6882.702	2607.339
Cucumber	5000	6.2	31000.0	0.25	1250.0	7750.0	20.0	25000.0	17250.0
Total						407118.3		902696.2	495577.9

The cost of production calculation is based on the Vegetable Production Economics conducted by Horticulture Division, DoA, MoAF. For land preparation, power tillers to be used and hiring rates are prescribed as per existing government rates. The prevailing wholesale market rates are used as selling price. Labour is costed at Nu 340 per day which includes meals and refreshment. The gross value of production is calculated based on the average yield of vegetables in Bhutan (Agriculture Statistics, 2014). The production costs involved are materials inputs like seeds, manures, chemical fertilizers, plant protection and labour inputs for production of the crop in each season.

Based on the analysis, the total cost incurred for production of the selected crops per year is computed at Nu. **407118** for 5.6 acres area or Nu 72,699 per acre. The total income that will be generated from the farm is estimated at Nu. **902696** per year (Nu 161,195 per acre). The net profit is from the farm will be Nu. **495577** per year.

9 Site Profile 3: Daga, Wangdue

9.1 Site Information

Table 9-1: Site information for Umakhamey under Daga Geog, Wangdue

Name of land owner	<i>Nala</i>
Total area	<i>5.5 acres</i>
Dzongkhag	<i>Wangdue</i>
Geog	<i>Daga</i>
Chewog	<i>Uma</i>
Location	<i>Umakhamey/Dorjipokto</i>
Altitude	<i>1130 m</i>
Land aspect	<i>East facing, Upper plot 24.4⁰ lower plot 19.1⁰</i>
Land type	<i>Dry land</i>
Land status	<i>Fallow</i>
Land Tenancy	<i>Own/private</i>
Soil type	<i>Loamy clay</i>
Distance from highway	<i>2.5 km</i>
Distance from town	<i>36.0 km (Bajo Town)</i>
Natural Vegetation	<i>Broad leaves</i>
Cropping system	<i>Summer: Rice, vegetables, Winter : vegetable, wheat, mustard</i>
Climatic information	
Existing Infrastructure	<i>Farm road cutting across the farm, farm house, electricity connected, drinking water tap, land with gentle slope but not terraced (dry land)</i>
Distance from irrigation water	<i>3.5km</i>
Irrigation water source type	<i>Stream</i>
Problem and constraints	<i>Wild animals (deer, wild boar, porcupine), irrigation</i>

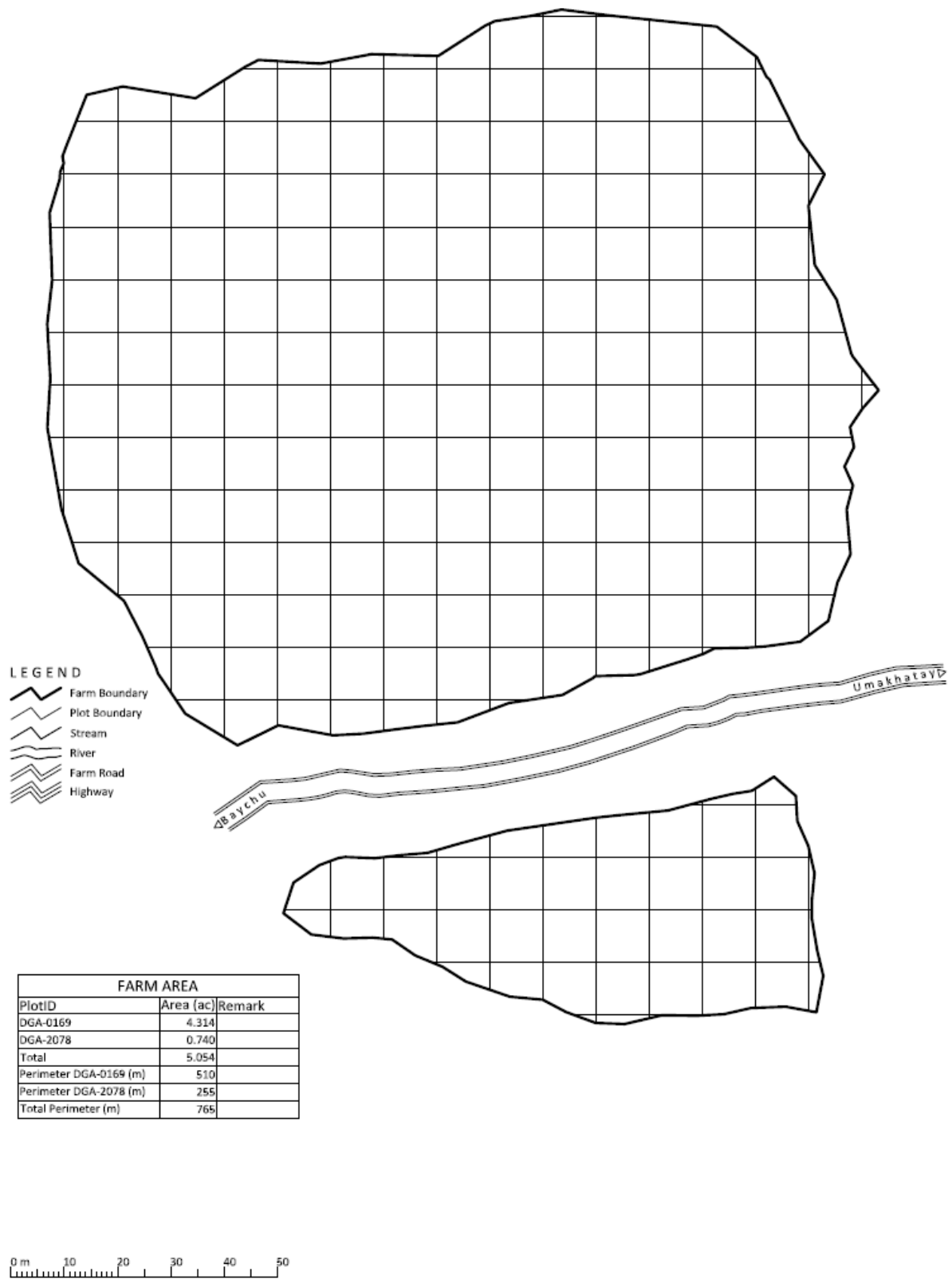


Figure 9-1: A map of proposed Umakhatey Farm under Daga Geog, Wangdue

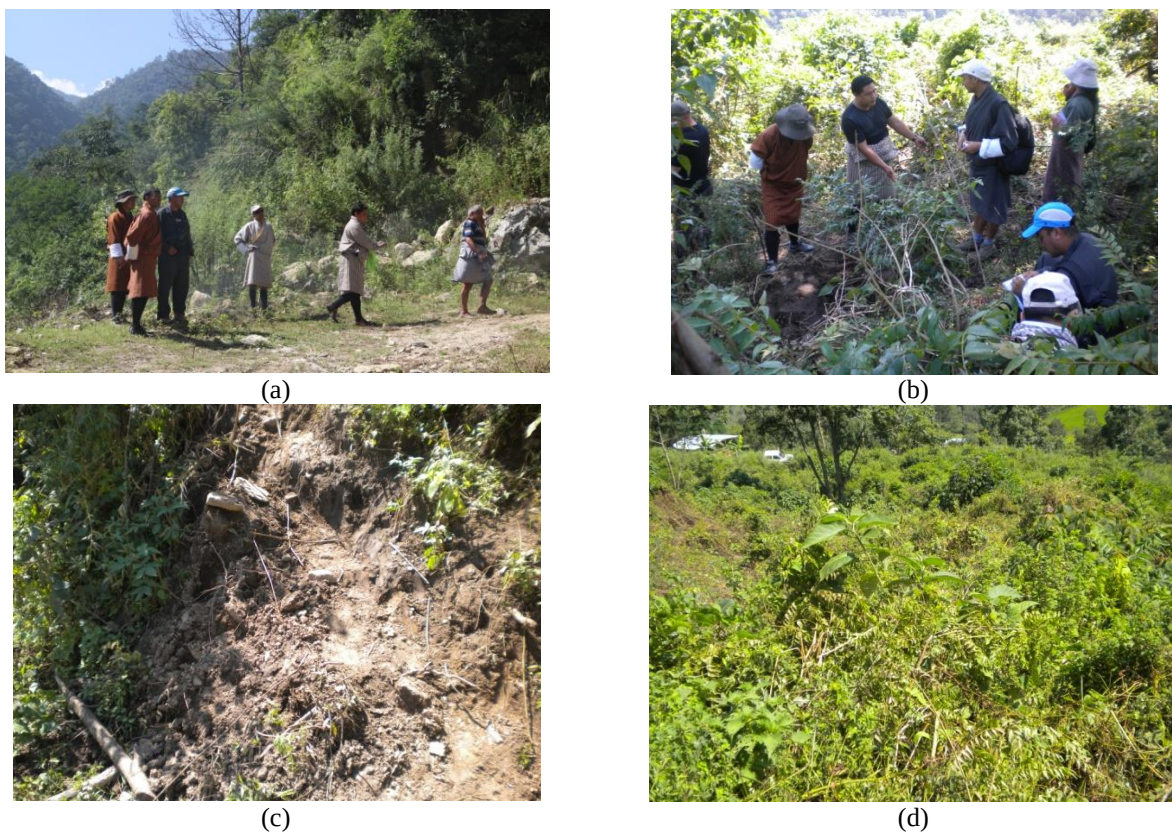


Figure 9-2: Pictorial views of proposed Umakhatey Farm under Daga Geog, Wangdue:

(a) Identified site is being assessed by team members, (b) Land owner explains the potentialities of his farm, (c) Surface view of the soil (top-soil), and (d) A views of the identified fallow land.

9.2 Climatic conditions

Meteorological data was collected Gaselo weather station which is the nearest weather station from the identified fallow land for commercial agriculture. The rainfall pattern is monomodal with maximum rainfall occurring from the months of April to October, whilst the least quantity of rainfall occurs in months of January, February, November and December. The annual total rainfall is estimated for the site to be 583 mm. The Maximum and minimum temperatures are most favourable for growing crops from the month of March to November, however temperatures are colder in January, February and December.

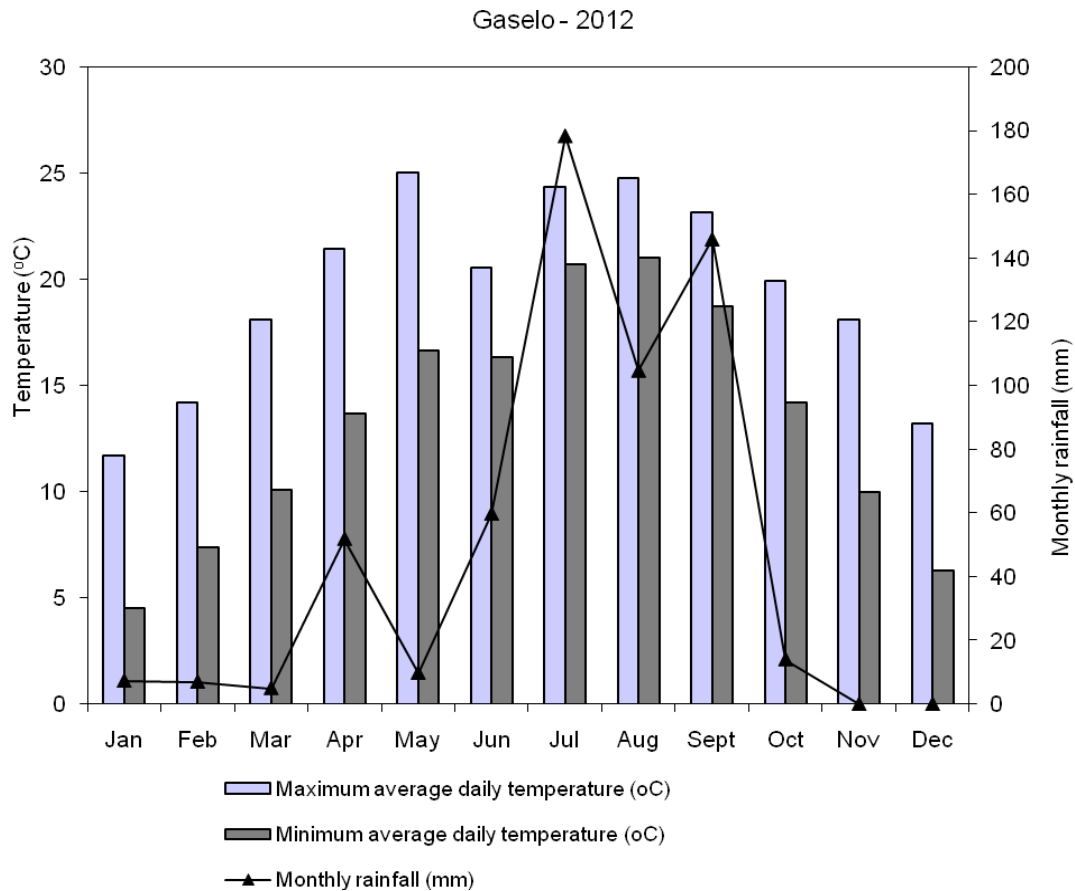


Figure 9-3: Climate information for Umakhatey Farm under Daga Geog, Wangdue

9.3 Proposed Crops

The area has a mild sub-tropical climate that supports cultivation of several different crops. Both summer and winter vegetable crops can be successfully grown. Among the vegetables, the following crops are selected based on climatic suitability, production, market demand and income from their sale.

Summer crop: Onion, green vegetables, chili (dalley), tomato, okra, beans, ginger

Winter: Pea, beans, garlic, radish, coriander, cauliflower

In addition, the farm can also be grown with fruit plants. The following fruit plants are feasible:

- Citrus
- Passion fruits
- Cardamom
- Avocado
- Litchi

- Mango

However, to get the farm started we recommend to go for vegetable production. The farm has a total area of 5.5 acre. It can be divided to grow the following crops:

Table 9-2: Proposed crops for Umakhatey Farm under Daga Geog, Wangdue

Summer		Winter	
Crop	Area (ac)	Crop	Area (ac)
Tomato	1.00	Cabbage	1.00
Onion	1.00	Cauliflower	1.00
Ginger	1.00	Garlic	1.00
Beans	0.50	Pea	1.00
Chili	0.50	Radish	1.00
Okra	0.50	Beans	0.50
Bitter guard	0.50	Leafy green	0.50
Egg plant	0.25	Carrot	0.25
Spinach	0.25		
Total	5.50	Total	6.25

9.4 Cropping calendar

The following cropping calendar for different vegetables (Table) should be followed.

Table 9-3: Proposed cropping calendar for Umakhatey Farm under Daga Geog, Wangdue

Vegetable	Growing season												
	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	
Cabbage								SOWING					
	HARVESTING												
Cauliflower									H				
		S											
Broccoli									H				
		S											
Tomato										H			
		S											
Egg plant			H										
						S							
Chili		H											
						S							
Onion									H				
			S										
Pea		H											
				S									
Beans			H			H							
						S				S			
Radish			H										
				S									
Carrot			H										
							S						

Cucumber			H							
						S				
Mustard green								H		
									S	
Garlic										
			S							
Okra						H				
								S		
Ginger			H							
	S								S	
Coriander							H			
								S		
Spinach								H		
		S								S

9.5 Inputs required

The most basic inputs required for cultivation include: seeds or seedlings, manures, fertilizers and labor days. The table below provides information on inputs.

Table 9-4: Farm inputs and expected yield per acre for Umakhatey Farm under Daga Geog, Wangdue.

Crop	Seed rate	FYM (MT)	Fertilizer rate (kg)				Labour (day)	Yield (kg/ac)
			Urea	SSP	MoP	Suphala		
Chili	300.0 gm	8.0	100.0	150.0	25.0	0.0	84.4	2364.0
Tomato	160.0 gm	8.0	77.0	125.0	17.0	0.0	108.6	2629.0
Carrot	600.0 gm	5.9	15.0	25.0	40.0	0.0	54.3	2600.0
Egg plant	300 gm	8.0	70.0	175.0	20.0	0.0	80.0	1200.0
Radish	4.0 kg	5.0	44.0	125.0	34.0	0.0	57.4	3143.0
Beans	20.0 kg	2.6	22.0	187.5	0.0	0.0	59.6	1700.0
Garlic	175.7 kg	4.8	65.0	100.0	0	0.0	59.1	724.0
Pea	40.0 kg	5.2	44.0	187.5	50.0	0.0	51.8	1400.0
Cabbage	300 gm	7.4	75.0	150.0	25.0	0.0	68.3	2858.0
Cauliflower	180 gm	5.5	75.0	150.0	25.0	0.0	74.6	1600.0
Onion	1.6 kg	4.3	88.0	187.5	50.0	0.0	82.7	2772.9
Leafy Greens	1.0 kg	8	44 kg	0	0	0	47.2	2106.1
Bitter gourd	2.5 kg	5	108	150	40	0	49.33	1785.8
Okra	8.0 kg	6	87	120	0	0	53.4	1007.7
Ginger	554.1 kg	5.6	65.0	100.0	0.0	0.0	60.9	2772.9

9.6 Long term investment plan (capital investment)

Capital investment is required for fencing, land development, irrigation, approach road, internal farm road, and infrastructure (office, huts, store, processing shed).

Table 9-5: Summary of Capital Investment for Umakhatey Farm under Daga Geog, Wangdue.

SN	Farm infrastructure	Qty/unit	Rate	Amount	Remark
1	Electric fencing	765 m	67.24	51,437	From detail estimate
2	Irrigation- Intake	1 No	10,000.00	10,000	Lump sum
3	Irrigation- Conveyance (50mm HDPE pipe)	2,950 m	235.21	693,867	BSR item code PO0018
4	Irrigation- Storage	10 cu.m	11,300.00	113,000	Based on RDC Bajo tank
5	Irrigation- Application (sprinkler)	5.90 acre	100,000.00	590,000	
6	Road- Approach (5m wide)	0 m	425.72	0	Formation cutting- earth
7	Road- Internal farm road (4m wide)	200 m	222.10	44,420	Formation cutting- earth
8	Land Development	6 acre	20,000.00	118,000	
9	Infrastructure- Office	1 Block	200,000.00	200,000	
10	Infrastructure- Huts	5 Block	50,000.00	250,000	
11	Infrastructure- Store	1 Block	100,000.00	100,000	
12	Infrastructure- Processing shed	1 Block	150,000.00	150,000	
13	Green house	2 Block	70,000.00	140,000	
A	Total			2,460,724	
B	Unit cost (Nu per acre)			487,755	

9.7 Economics of the farm

Basic crop production economics and farm profitability are calculated and shown in the table below.

Table 9-6: Annual crop production economics for Umakhatey Farm under Daga Geog, Wangdue.

Crop	Yield (kg/ac)	Cost of production (Nu/kg)	Proposed area (acre)	Cost of production (Nu/ac)	Total production (kg)	Production cost (Nu/year)	Market price (Nu/kg)	Total income (Nu)	Net Profit (Nu)
Chili	2364.0	15.1	0.5	35649.1	1182.0	17824.6	50.0	59100.0	41275.4
Tomato	2629.0	16.7	1.0	43904.3	2629.0	43904.3	30.0	78870.0	34965.7
Carrot	2600.0	9.8	0.3	25376.0	650.0	6344.0	32.0	20800.0	14456.0
Egg plant	1200.0	13.7	0.3	16380.0	300.0	4095.0	32.0	9600.0	5505.0
Radish	3143.0	8.3	0.5	26212.6	1571.5	13106.3	15.1	23682.5	10576.2
Beans	1700.0	16.9	1.0	28662.0	1700.0	28662.0	35.7	60741.0	32079.0
Garlic	724.0	46.7	1.0	33810.8	724.0	33810.8	86.0	62264.0	28453.2
Pea	1400.0	18.8	1.0	26334.0	1400.0	26334.0	39.6	55482.0	29148.0
Cabbage	2858.0	9.8	1.0	27894.1	2858.0	27894.1	20.7	59103.4	31209.4
Cauliflower	1600.0	20.3	1.0	32496.0	1600.0	32496.0	45.0	72000.0	39504.0
Onion	1100.0	31.5	1.0	34650.0	1100.0	34650.0	40.0	44000.0	9350.0
Ginger	2772.9	17.7	1.0	48941.2	2772.9	48941.2	80.0	221829.6	172888.4
Bitter guard	1785.8	13.3	0.5	23787.0	892.9	11893.5	31.1	27742.5	15849.0
Okra	1007.7	24.0	0.5	24154.3	503.8	12077.2	40.0	20153.8	8076.6
Leafy greens	2106.1	10.2	0.5	21376.8	1053.0	10688.4	16.3	17206.8	6518.3
Total						352721.3		832575.6	479854.4

The estimation of costs and profits and evaluation of the economic feasibility of production techniques are aspects of the management of a farm as a business enterprise. The production economics of the selected crops are computed for both season summer and winter seasons. The cost of production is based on the Vegetable Production Economics conducted by Horticulture Division,

DoA, MoAF. For land preparation, the prevailing AMC hiring rates for power tiller are used in the calculations. Market price is taken at prevailing wholesale market rates. Labour cost is averaged at Nu 340 per day which includes meals and refreshment. The gross value of production is calculated based on the average yield of vegetables in Bhutan (Agriculture Statistics, 2014). The production costs include materials inputs like seeds, manures, chemical fertilizers, plant protection and labour inputs needed for production of the crop in each season.

The total production cost incurred for production of the selected crops per year is computed at Nu**352,721** for 5.5 acres area. The total income that will be generated from the farm is computed at Nu**832,575** per year and the net profit is Nu**479,854** per year from the 5.5 acre farm.

10 Site Profile 4: Rubesa, Wangdue

10.1 Site Information

Table 10-1: Site information for proposed Jazheepang Farm under Ruepisa Geog, Wangdue

Name of land owner	<i>Phub Zam (Thram#89, House# TSHA-13-102)</i>
Total area	<i>1.72 (dry land) + 2.918 (wet land)</i>
Dzongkhag	<i>Wangdue</i>
Geog	<i>Ruepisa</i>
Chewog	<i>Ruepisa, Village: Lumena</i>
Location	<i>Jazheepang</i>
Altitude	<i>1350 m</i>
Land aspect	<i>south facing</i>
Land type	<i>Dry land and wet land</i>
Land status	<i>Fallow for 16 years</i>
Land Tenancy	<i>Own/private</i>
Soil type	<i>Red soil</i>
Distance from highway	<i>1.0 km</i>
Distance from town	<i>4.0 km</i>
Natural Vegetation	<i>Pine</i>
Cropping system	<i>Summer (vegetable), Winter (vegetable)</i>
Climatic information	<i>-</i>
Existing Infrastructure	<i>Farm road (20 minutes walk from the land)</i>
Distance from irrigation water	
Irrigation water source type	<i>Steam water</i>
Problem and constraints	<i>Wild animals (deer, wild boar, porcupine), irrigation, approach road.</i>

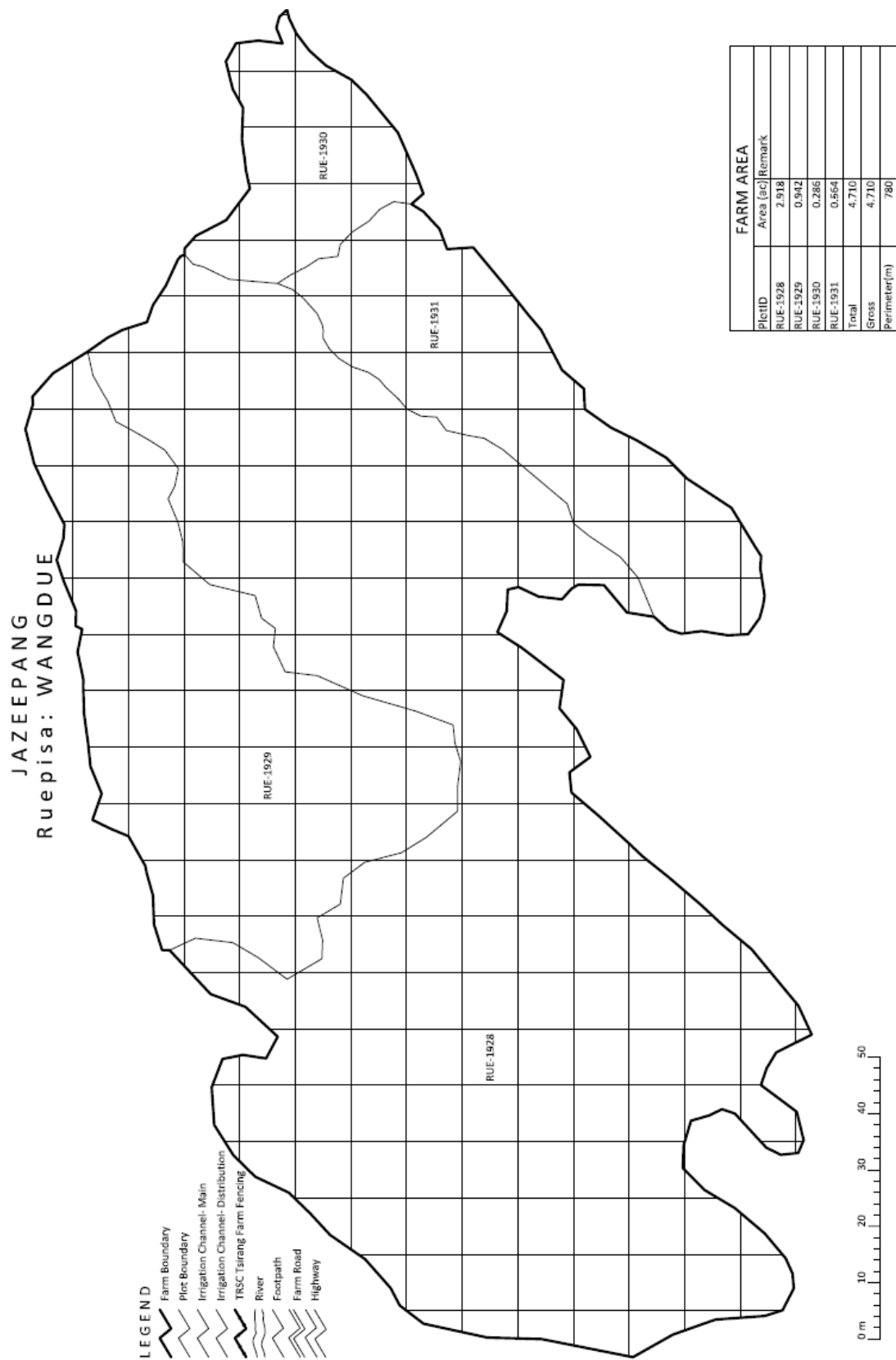


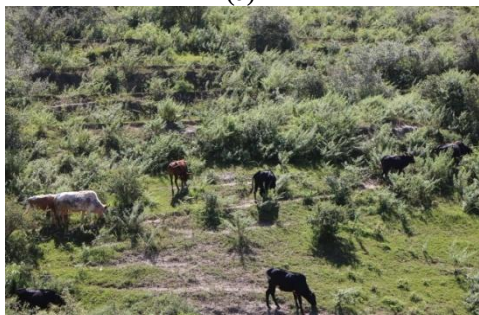
Figure 10-1: Map of proposed Jazeepang Farm under Ruepisa, Wangdue



(a)



(b)



(c)



(d)

Figure 10-2: Pictorial view of proposed Jazeepang Farm under Ruepisa, Wangdue:

(a) Preliminary discussion on site identification with geog Mangmi, Tshogpa, DAO, Agriculture EA, (b) Land owner explains the potentialities of his farm, (c) The fallow land is used for cattle grazing, and (d) A views of the identified fallow land.

10.2 Climatic conditions

Meteorological data was collected for nearest weather station (RDC Wangdue) from the identified fallow land for commercial agriculture. The rainfall pattern is monomodal with maximum rainfall occurring from the month of May to September, whilst the least quantity of rainfall occurs in months of January, February, November and December. The annual total rainfall is estimated for the site to be 675 mm. The Maximum and minimum temperatures are most favourable for growing crops from the month of April to October, however temperatures are colder in January, February and December.

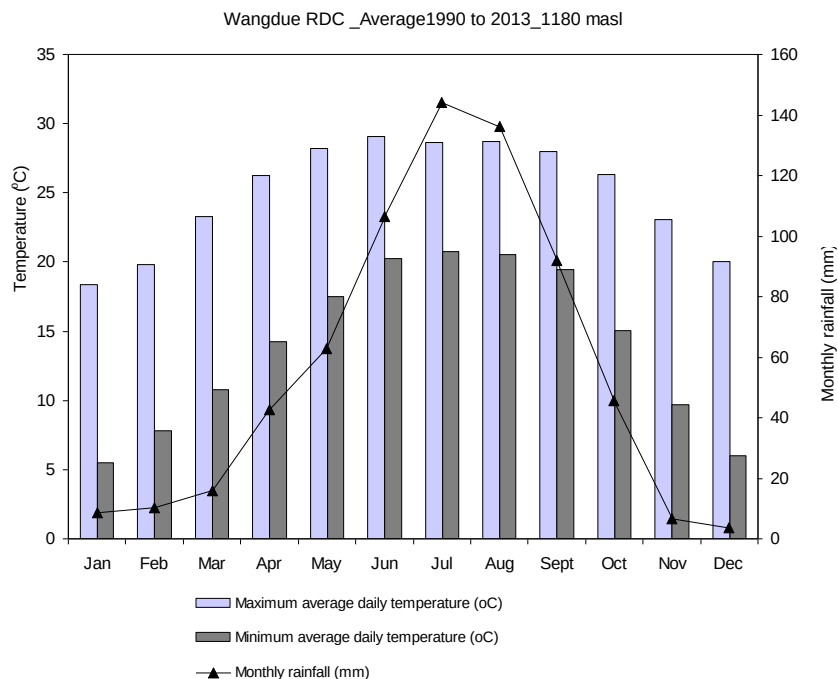


Figure 10-3: Climatic information of proposed Jazeepang Farm under Ruepisa, Wangdue.

10.3 Proposed Crops

The land is feasible for both summer and winter vegetable crops. Among the vegetables, the following crops are selected based on climatic suitability, production, market demand and income from their sale.

Summer crop: Onion, green chili, chili (dolly), beans, bitter guard, tomato

Winter: Cabbage, broccoli, cauliflower, garlic, carrot, pea, bean

Long term vegetable: Asparagus, Squash

Feasible Fruit crops in the sloppy area: Citrus, Passion fruits, Cardamom, Avocado, Litchi, Mango

However, for immediate economic gain, we propose cultivation of seasonal vegetables. Of the total farm area, the land can be divided to grow the summer and winter vegetables as follows:

Table 10-2: Proposed crops for Jazeepang Farm under Ruepisa, Wangdue.

Summer		Winter	
Crop	Area (ac)	Crop	Area (ac)
Onion	1.00	Carrot	1.00
Beans	0.50	Garlic	1.00
Tomato	0.50	Pea	1.00
Chili	0.50	Broccoli	0.50
Chili (dolly)	0.25	Cabbage	0.50
Bitter guard	0.25	Cauliflower	0.50
Total	3.00	Total	4.50

10.4 Cropping calendar

The cropping calendar for different vegetables is presented in the Table below.

Table 10-3: Proposed cropping calendar for Jazeepang Farm under Ruepisa, Wangdue.

Vegetable	Growing season												
	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	
Cabbage		SOWING											
		HARVESTING											
Cauliflower		S											
		H											
Broccoli		S											
		H											
Tomato		S				H				S			
		H		S				H					
Egg plant		S				H							
		S				H							
Chili		S				H							
		S				H							
Onion		H				S							
		H				S							
Pea		S					H						
		H					S						
Beans		S			S			H					
		H			H			H					
Radish		S											
		H											
Carrot		S											
		H											
Garlic		H			S			S					
		H			S			S					

10.5 Inputs required

The most basic inputs required for cultivation include: seeds or seedlings, manures, fertilizers and labor days. The table below provides information on inputs.

Table 10-4: Farm inputs and yield per acre for Jazeepang Farm under Ruepisa, Wangdue.

Crop	Seed rate	FYM (MT)	Fertilizer rate (kg)				Labour (day)	Yield (kg)
			Urea	SSP	MoP	Suphala		
Chili	300 gm	8.0	100.0	150.0	25.0	0.0	84.4	2364.0
Tomato	160 gm	8.0	77.0	125.0	17.0	0.0	108.6	2629.0
Carrot	600 gm	5.9	15.0	25.0	40.0	0.0	54.3	2600.0
Egg plant	300 gm	8.0	70.0	175.0	20.0	0.0	80.0	1200.0
Radish	4.0 kg	5.0	44.0	125.0	34.0	0.0	57.4	3143.0
Beans	20.0 kg	2.6	22.0	187.5	0.0	0.0	59.6	1700.0
Broccoli	180 gm	7.9	75.0	150.0	25.0	0.0	70.9	1906.8
Garlic	175.7 kg	4.8	65.0	100.0	0	0.0	59.1	724.0
Pea	40.0 kg	5.2	44.0	187.5	50.0	0.0	51.8	1400.0
Cabbage	300 gm	7.4	75.0	150.0	25.0	0.0	68.3	2858.0
Cauliflower	180 gm	5.5	75.0	150.0	25.0	0.0	74.6	1600.0
Onion	1.6 kg	4.3	88.0	187.5	50.0	0.0	82.7	2772.9
Leafy Greens	1.0 kg	8	44 kg	0	0	0	47.2	2106.1
Bitter gourd	2.5 kg	5	108	150	40	0	49.33	1785.8
Okra	8.0 kg	6	87	120	0	0	53.4	1007.7
Ginger	554.1 kg	5.6	65.0	100.0	0.0	0.0	60.9	2772.9

10.6 Long term investment plan (Capital investment)

Investment will be needed for farm fencing, land development, irrigation, access road, green houses and farm infrastructure (hut, store, office, processing shed).

Table 10-5: Summary of Capital Investment for for Jazeepang Farm under Ruepisa, Wangdue.

SN	Farm infrastructure	Qty/unit	Rate	Amount	Remark
1	Electric fencing	780 m	65.06	50,748	From detail estimate
2	Irrigation- Intake	1 No	10,000.00	10,000	Lump sum
3	Irrigation- Conveyance (50mm HDPE pipe)	100 m	235.21	23,521	BSR item code PO0018
4	Irrigation- Storage	50 cu.m	11,300.00	565,000	Based on RDC Bajo tank
5	Irrigation- Application (sprinkler)	4 acre	100,000.00	400,000	
6	Road- Approach (5m wide)	630 m	425.72	268,204	Formation cutting- earth
7	Road- Internal farm road (4m wide)	400 m	222.10	88,840	Formation cutting- earth
8	Land Development	4 acre	20,000.00	80,000	
9	Infrastructure- Office	1 Block	200,000.00	200,000	
10	Infrastructure- Huts	5 Block	50,000.00	250,000	
11	Infrastructure- Store	1 Block	100,000.00	100,000	
12	Infrastructure- Processing shed	1 Block	150,000.00	150,000	
13	Green house	1 Block	70,000.00	70,000	
A	Total			2,256,313	
B	Unit cost (Nu per acre)			478,844	

10.7 Economics of the farm

Basic crop production economics and farm profitability are calculated and shown in the table below.

Table 10-6: Annual crop production economics for Jazeepang Farm under Ruepisa, Wangdue.

Crop	Yield (kg/ac)	Cost of production		Area (acre)	Production (kg/yr)	Cost (Nu/yr)	M-price (Nu/kg)	Income (Nu)	Net Profit (Nu)
		(Nu/kg)	(Nu/ac)						
Chili	2364.0	15.1	35649.1	0.6	1418.4	21389.5	50.0	70920.0	49530.5
Tomato	2629.0	16.7	43904.3	0.5	1314.5	21952.2	30.0	39435.0	17482.9
Carrot	2600.0	9.8	25376.0	0.3	650.0	6344.0	29.2	19006.0	12662.0
Egg plant	1200.0	13.7	16380.0	0.3	300.0	4095.0	32.0	9600.0	5505.0
Radish	3143.0	8.3	26212.6	0.3	785.8	6553.2	15.1	11841.3	5288.1
Beans	1700.0	16.9	28662.0	0.5	850.0	14331.0	35.7	30370.5	16039.5
Broccoli	1906.8	20.3	38688.8	0.5	953.4	19344.4	100.0	95339.5	75995.1
Bitter gourd	1785.8	13.3	23787.0	0.3	446.5	5946.7	31.1	13871.3	7924.5
Garlic	724.0	46.7	33810.8	0.6	434.4	20286.5	86.0	37358.4	17071.9
Okra	1007.7	24.0	24154.3	0.5	503.8	12077.2	40.0	20153.8	8076.6
Pea	1400.0	18.8	26334.0	1.0	1400.0	26334.0	48.0	67200.0	40866.0
Leafy Greens	2106.1	10.2	21376.8	0.5	1053.0	10688.4	16.3	17206.8	6518.3
Cauliflower	1600.0	20.3	32496.0	0.5	800.0	16248.0	45.0	36000.0	19752.0
Cabbage	2858.0	9.8	27894.1	0.3	714.5	6973.5	20.7	14775.9	7802.3
Ginger	2772.9	17.7	48941.2	0.5	1386.4	24470.6	80.0	110914.8	86444.2
Onion	1100.0	31.5	34650.0	1.0	1100.0	34650.0	40.0	44000.0	9350.0
Total				8.0		251684.1		637993.1	386309.1

- Estimation of costs and profits and evaluation of the economic feasibility of production techniques are aspects of the management of a farm as a business enterprise.
- Production economics of the selected crops are computed for two season summer and winter.
- Cost of production calculation is based on Vegetable Production Economics conducted by Horticulture Division, DoA, MoAF. For land preparation, ploughing power tiller present government rate is use for the farm machineries rate. Market price is taken at prevailing market wholesale rate. Labours cost is kept at Nu 340 per day which includes meals and refreshment.
- The gross value of production is calculated based on the average yield of vegetables in Bhutan (Agriculture Statistics, 2014).
- The production cost involve materials inputs like seeds, manures, chemical fertilizers, plant protection and tools and labour inputs involved for production of the crop in each season.
- The total production cost incurred for production of the selected crops per year is computed at Nu. **251684.1** for 4.63 acres area per year . The total income that will be generated from the farm is computed at Nu. **637993.1** per year and the net profit is Nu. **386309.1** per year from the 4.63 acre farm.

11 Site Profile 5: Toewang, Punakha

11.1 Site Information

Table 11-1: Site information for proposed Tshetaykha Farm under Toewang Geog, Punakha.

Name of land owner	<i>HRH Ashi Dechen Wangmo Wangchuk</i>
Total area	<i>5.0 acre</i>
Dzongkhag	<i>Punakha</i>
Geog	<i>Teowang</i>
Chewog	<i>Jibjokha</i>
Location	<i>Tsheteykha</i>
Altitude	<i>1667 m</i>
Land aspect	<i>North West, Slope 8-90</i>
Land type	<i>Wet land</i>
Land status	<i>Cultivated (Plot-A, Plot-B, Plot-C), Fallow (Plot-D, Plot-E, Plot-F)</i>
Land Tenancy	<i>Private</i>
Soil type	<i>Sandy clay</i>
Distance from highway	<i>25 km</i>
Distance from town	<i>25 km</i>
Natural Vegetation	<i>Broad leave forest</i>
Cropping system	<i>Paddy – vegetable</i>
Climatic information	<i>NA</i>
Existing Infrastructure	<i>Access to farm road, irrigation channel, electricity, terraced land.</i>
Distance from irrigation water	<i>Irrigation channel connected</i>
Irrigation water source type	<i>7 km</i>
Problem and constraints	<i>NA</i>

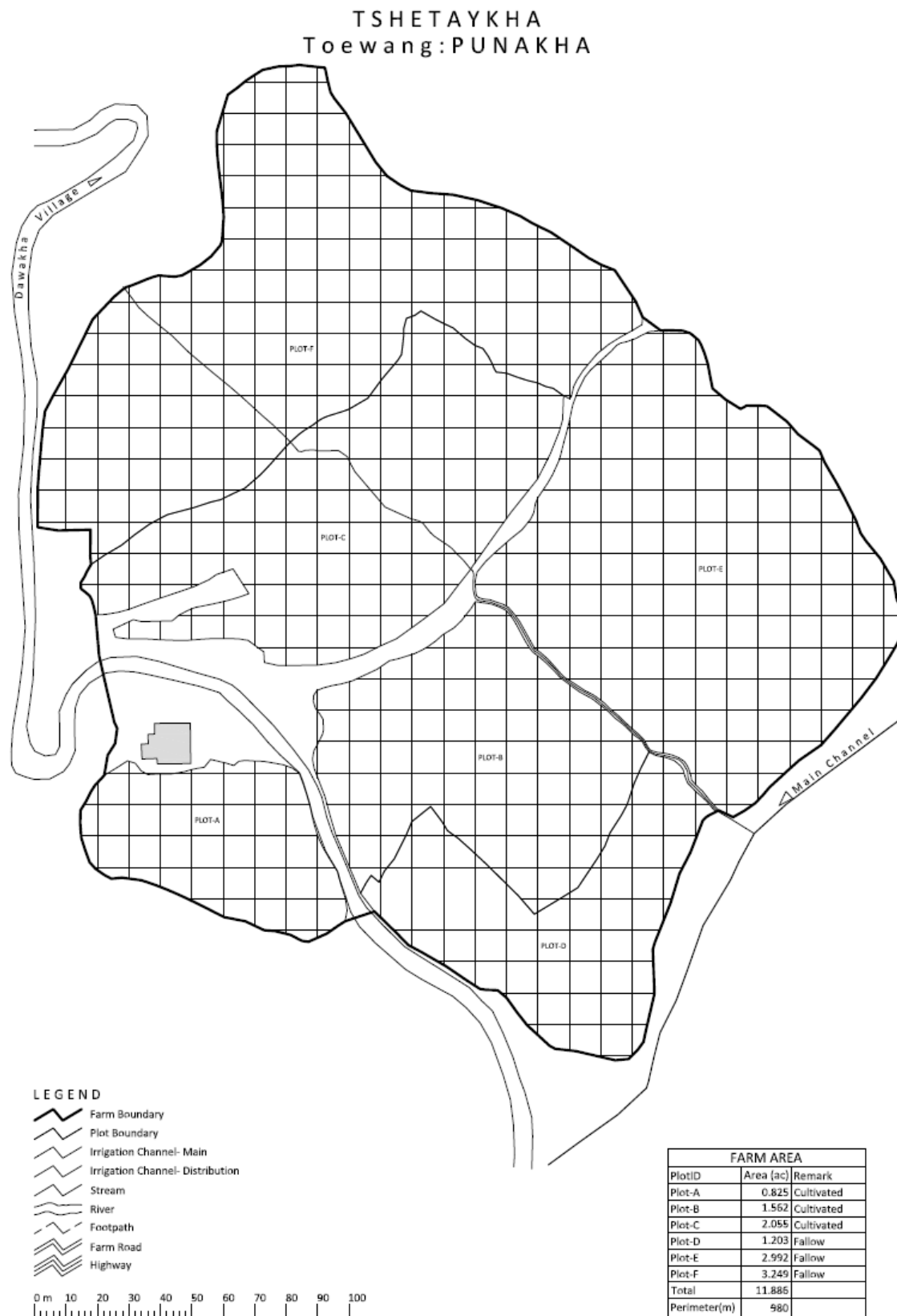


Figure 11-1: Proposed Tshetaykha Farm map under Toewang Geog, Punakha.



(a)



(b)



(c)



(d)

Figure 11-2: Pictorial view of Tshetaykha Farm map under Toewang Geog, Punakha.

(a) Discussion with care-taker, Mangmi, land tshogpa, DAO and Agriculture EA at the farm, (b) A view in the upper side of the farm, (c) The fallow land is used for cattle grazing, and (d) A closer view of the lower side of the fallow land.

11.2 Climatic conditions

Meteorological data was collected from Shengana, the closest weather station from the identified fallow land for commercial agriculture. The rainfall pattern is monomodal with maximum rainfall occurring from the month of May to September, whilst the least quantity of rainfall occurs in months of January, February, November and December. The annual total rainfall is estimated for the site to be 308 mm. The Maximum and minimum temperatures are most favourable for growing crops from the month of April to October, however temperatures are colder in January, February, November and December.

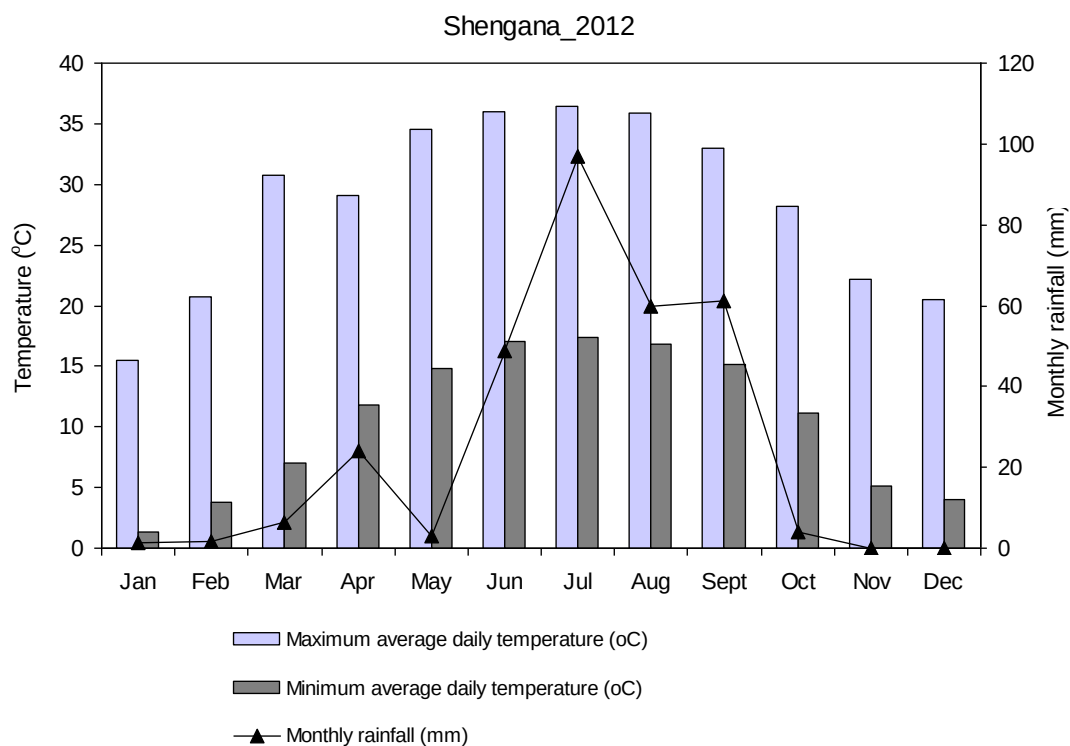


Figure 11-3: Climatic information for Tshetaykha Farm Toewang Geog, Punakha.

11.3 Proposed Crops

The land is feasible for both summer and winter vegetable crops. Among the vegetables, the following crops are selected based on climatic suitability, production, market demand and income from their sale.

Summer crop: Chili, Brinjal, tomato, carrot, radish, potato, beans

Winter: Cabbage, broccoli, cauliflower, mustard green, garlic, radish, carrot, onion,

Long term vegetable: Asparagus and potato

Feasible Fruit crops: Cardamom, Avocado, Melon, Pear, Persimmon, Kiwi, Grapes

However, for immediate economic gain, we propose cultivation of seasonal vegetables. Of the total farm area, the land can be divided to grow the summer and winter vegetables as follows:

Table 11-2: Proposed crops for Tshetaykha Farm Toewang Geog, Punakha.

Summer		Winter	
Crop	Area (ac)	Crop	Area (ac)
Beans	1.00	Cauliflower	1.00
Onion	1.00	Garlic	1.00
Chili	1.00	Pea	1.00
Carrot	0.50	Broccoli	0.50
Egg plant	0.50	Cabbage	0.50
Tomato	0.50	Onion	0.50
Radish	0.25	Leafy green	0.25
Leafy green	0.25	Radish	0.25
Total	5.00	Total	5.00

11.4 Cropping calendar

The cropping calendar for different vegetables is presented in the Table below.

Table 11-3: Proposed cropping calendar for Tshetaykha Farm Toewang Geog, Punakha.

Vegetable	Growing season												
	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	
Cabbage			SOWING								HARVESTING		
Cauliflower			S										
Broccoli			S										
Tomato		S									S		
Egg plant				S									
Chili			S										
Onion									S				
Pea		S											
Beans			S			S							
Radish			S										
Carrot			S										
Mustard green									S				
Garlic									S				

11.5 Inputs required

The most basic inputs required for cultivation include: seeds or seedlings, manures, fertilizers and labor days. The table below provides information on inputs.

Table 11-4: Farm inputs and expected yield in per acre for Tshetaykha Farm Toewang Geog, Punakha.

Crop	Seed rate	FYM (MT)	Fertilizer rate (kg)				Labour (day)	Yield (kg)
			Urea	SSP	MoP	Suphala		
Chili	300 gm	8.0	100.0	150.0	25.0	0.0	84.4	2381.0
Tomato	160 gm	8.0	77.0	125.0	17.0	0.0	108.6	1963.0
Carrot	600 gm	5.9	15.0	25.0	40.0	0.0	54.3	1700.0
Egg plant	300 gm	8.0	70.0	175.0	20.0	0.0	80.0	1350.0
Radish	4.0 kg	5.0	44.0	125.0	34.0	0.0	57.4	2015.0
Beans	20.0 kg	2.6	22.0	187.5	0.0	0.0	59.6	2072.0
Broccoli	180 gm	7.9	75.0	150.0	25.0	0.0	70.9	1154.0
Garlic	175.7 kg	4.8	65.0	100.0	0	0.0	59.1	660.0
Pea	40.0 kg	5.2	44.0	187.5	50.0	0.0	51.8	943.0
Cabbage	300 gm	7.4	75.0	150.0	25.0	0.0	68.3	2224.0
Cauliflower	180 gm	5.5	75.0	150.0	25.0	0.0	74.6	1530.0
Onion	1.6 kg	4.3	88.0	187.5	50.0	0.0	82.7	1181.0
Leafy Greens	1.0 kg	8	44	0	0	0	47.2	2106.1

11.6 Long term investment plan (Capital investment)

Table 11-5: Summary of capital investment for Tshetaykha Farm Toewang Geog, Punakha.

SN	Farm infrastructure	Qty/unit	Rate	Amount	Remark
1	Electric fencing	980 m	57.10	55,956	From detail estimate
2	Irrigation- Intake	1 No	10,000.00	10,000	Lump sum
3	Irrigation- Conveyance (50mm HDPE pipe)	50 m	235.21	11,760	BSR item code PO0018
4	Irrigation- Storage	5 cu.m	11,300.00	56,500	Based on RDC Bajo tank
5	Irrigation- Application (sprinkler)	7.44 acre	100,000.00	744,000	
6	Road- Approach (5m wide)	0 m	425.72	0	Formation cutting- earth
7	Road- Internal farm road (4m wide)	500 m	222.10	111,050	Formation cutting- earth
8	Land Development	5.00 acre	20,000.00	100,000	
9	Infrastructure- Office	1 Block	200,000.00	200,000	
10	Infrastructure- Huts	5 Block	50,000.00	250,000	
11	Infrastructure- Store	1 Block	100,000.00	100,000	
12	Infrastructure- Processing shed	1 Block	150,000.00	150,000	
13	Green house	2 Block	70,000.00	140,000	
A	Total			1,929,266	
B	Unit cost (Nu per acre)			259,310	

11.7 Economics of the farm

Basic crop production economics and farm profitability are calculated and shown in the table below.

Table 11-6: Annual farm production economic for Tshetaykha Farm Toewang Geog, Punakha.

Crop	Yield (kg/ac)	Cost of production		Area (ac)	Production (kg/yr)	Cost (Nu/yr)	M-price (Nu/kg)	Income (Nu)	Net Profit (Nu)
		(Nu/kg)	(Nu/ac)						
Chili	2381.0	15.0	35643.6	1.0	2381.0	35643.6	50.0	119050.0	83406.4
Tomato	1963.0	22.4	43892.7	0.5	981.5	21946.3	30.0	29445.0	7498.7
Carrot	1700.0	14.9	25381.0	0.5	850.0	12690.5	29.2	24854.0	12163.5
Egg plant	1350.0	20.0	27000.0	0.5	675.0	13500.0	32.0	21600.0	8100.0
Beans	2072.0	15.6	32406.1	1.0	2072.0	32406.1	35.7	74032.6	41626.5
Broccoli	1154.0	29.4	33904.5	0.5	577.0	16952.3	88.0	50776.0	33823.7
Garlic	660.0	51.2	33792.0	1.0	660.0	33792.0	86.0	56760.0	22968.0
Pea	943.0	27.9	26328.6	1.0	943.0	26328.6	39.6	37371.1	11042.5
Leafy greens	2106.1	10.2	21376.8	0.5	1053.0	10688.4	16.3	17206.8	6518.3
Cauliflower	1530.0	21.2	32497.2	1.0	1530.0	32497.2	45.0	68850.0	36352.8
Cabbage	2224.0	12.6	27911.2	0.5	1112.0	13955.6	20.7	22996.2	9040.6
Onion	1181.0	29.4	34721.4	1.5	1771.5	52082.1	40.0	70860.0	18777.9
Radish	2015.0	13.0	26195.0	0.5	1007.5	13097.5	15.1	15183.0	2085.5
Total						302482.6		593801.6	293404.5

The estimation of costs and profits and evaluation of the economic feasibility of production techniques are aspects of the management of a farm as a business enterprise. The production economics of the selected crops are computed for both season summer and winter seasons. The cost of production is based on the Vegetable Production Economics conducted by Horticulture Division, DoA, MoAF. For land preparation, the prevailing AMC hiring rates for power tiller are used in the calculations. Market price is taken at prevailing wholesale market rates. Labour cost is averaged at Nu 340 per day which includes meals and refreshment. The gross value of production is calculated based on the average yield of vegetables in Bhutan (Agriculture Statistics, 2014). The production costs include materials inputs like seeds, manures, chemical fertilizers, plant protection and labour inputs needed for production of the crop in each season.

The total cost incurred for production of the selected crops per year is computed at Nu. **302482** for 5.0 acres area. The total income that will be generated from the farm is computed at Nu. **593801** per year. Excluding input costs, the net profit will be Nu. **293404** per year.

12 Site Profile 6: Dawakha, Punakha

12.1 Site Information

Table 12-1: Site information for proposed Bamjee Farm under Toewang Geog, Punakha.

Name of land owner	<i>Tobgay Sonam Namgey</i>
Total area	<i>2.54 acre</i>
Dzongkhag	<i>Punakha</i>
Geog	<i>Teowang</i>
Chewog	<i>Dawakha</i>
Location	<i>Bamji</i>
Altitude	<i>1736 m</i>
Land aspect	<i>North West, Slope 8-90</i>
Land type	<i>Wet land</i>
Land status	<i>Fallow</i>
Land Tenancy	<i>Private</i>
Soil type	<i>Sandy clay</i>
Distance from highway	<i>25 km</i>
Distance from town	<i>25 km</i>
Natural Vegetation	<i>Broad leave forest</i>
Cropping system	<i>Paddy – vegetable</i>
Climatic information	<i>NA</i>
Existing Infrastructure	<i>Access to farm road, irrigation channel, electricity, terraced land.</i>
Distance from irrigation water	<i>Just below irrigation channel</i>
Irrigation water source type	<i>NA</i>
Problem and constraints	<i>Fencing, wild animal</i>

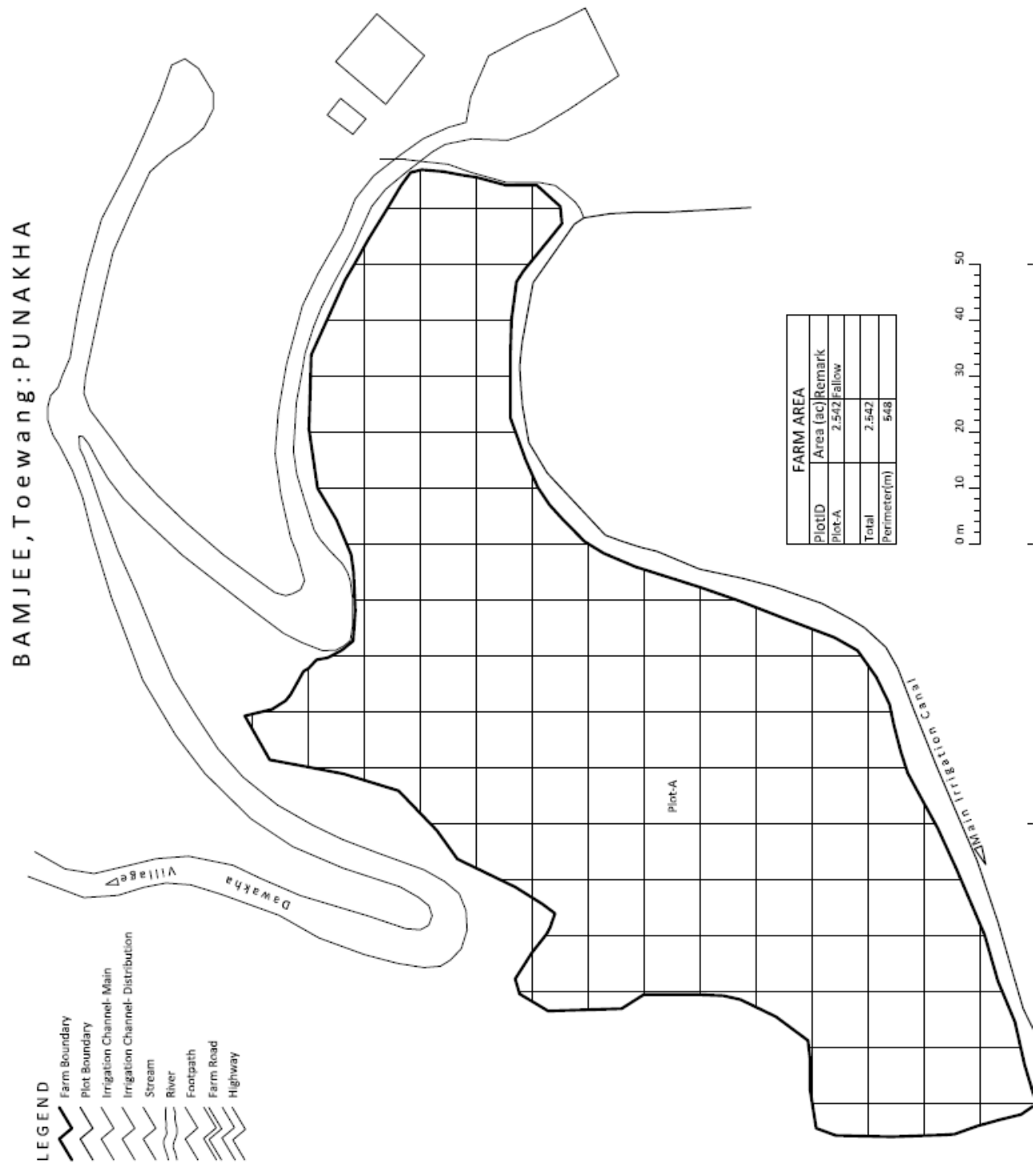


Figure 12-1: Proposed Bamjee Farm map under Toewang Geog, Punakha.

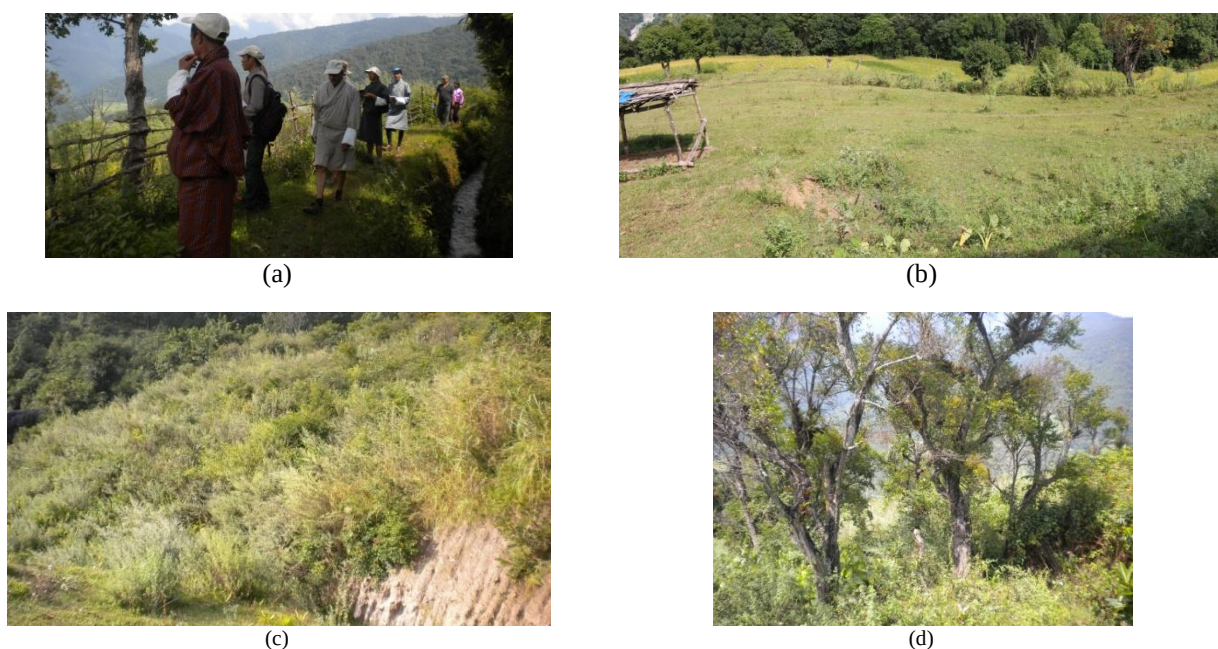


Figure 12-2: Pictorial view of proposed Bamjee Farm map under Toewang Geog, Punakha.

(a) A field inspection of the fallow with Mangmi, DAO, Land tshogpa, Agriculture EA. Also in picture is the irrigation channel location above the land, (b) A view of the fallow land, (c) The other view of the farm with farm road connection, and (d) A few pangsthe trees were on the boundary/edges of terraces.

12.2 Climatic conditions

Meteorological data was collected from Shengana, the closest weather station from the identified fallow land for commercial agriculture.

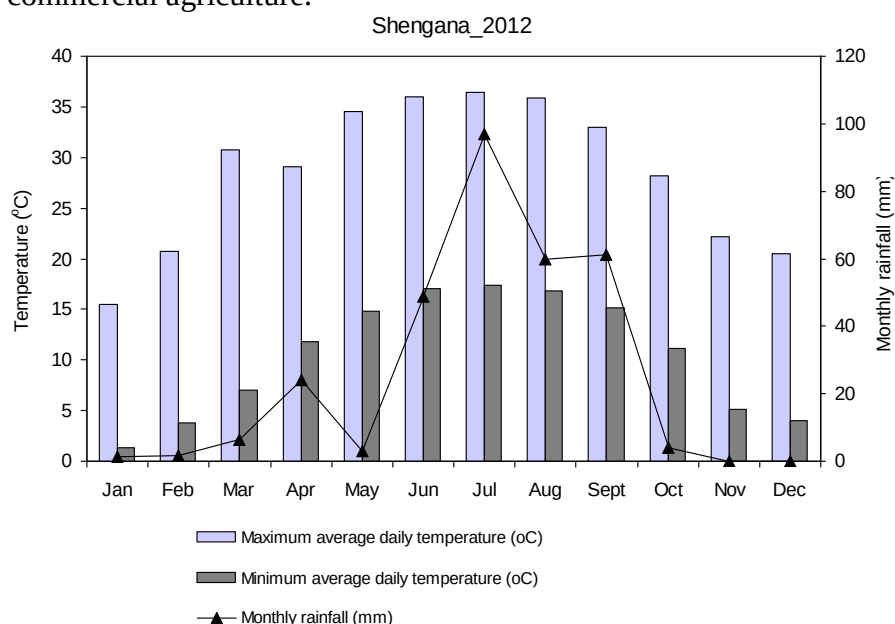


Figure 12-3: Climatic information for proposed Bamjee Farm under Toewang Geog, Punakha.

The rainfall pattern is monomodal with maximum rainfall occurring from the month of May to September, whilst the least quantity of rainfall occurs in months of January, February, November and December. The annual total rainfall is estimated for the site to be 308 mm. The Maximum and minimum temperatures are most favourable for growing crops from the month of April to October, however temperatures are colder in January, February, November and December.

12.3 Proposed Crops

The land is feasible for both summer and winter vegetable crops. Among the vegetables, the following crops are selected based on climatic suitability, production, market demand and income from their sale.

Summer crop: Chili, ginger, Brinjal, tomato, pumpkin, carrot, radish, cucumber, ladies finger, guards, potato, soyabean, legumes (mung bean)

Winter: cabbage, broccoli, cauliflower, coriander, mustard green, garlic, radish, lettuce, carrot, turnip, onion,

Long term vegetables: Asparagus, Potato

Feasible Fruit crops: Cardamom, Avocado, Mellon, Pear, Persimmon, Kiwi, Grapes

Table 12-2: Proposed crops for Bamjee Farm under Toewang Geog, Punakha.

Summer		Winter	
Crop	Area (ac)	Crop	Area (ac)
Chili	1.0	Cauliflower	1.0
Ginger	1.0	Garlic	1.0
Tomato	0.5	Cabbage	0.5
Total	2.5	Total	2.5

12.4 Cropping calendar

The cropping calendar for different vegetables is presented in the Table below.

Table 12-3: Proposed cropping calendar for Bamjee Farm under Toewang Geog, Punakha.

Vegetable	Growing season											
	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Cabbage			SOWING									
						HARVESTING						
Cauliflower			S									
						H						
Tomato		S								S		
		H					H					
Chili			S									
						H						
Garlic									S			
		H										
Ginger			S									
		H									H	

12.5 Inputs required

The most basic inputs required for cultivation include: seeds or seedlings, manures, fertilizers and labor days. The table below provides information on inputs.

Table 12-4: Farm production inputs and expected yield for Bamjee Farm, Toewang Geog, Punakha.

Crop	Seed rate (per ac)	FYM (MT/ac)	Fertilizer rate (kg/ac)				Labour (day/ac)	Yield (kg/ac)
			Urea	SSP	MoP	Suphala		
Chili	300 gm	8.0	100.0	150.0	25.0	0.0	84.4	2381.0
Tomato	160 gm	8.0	77.0	125.0	17.0	0.0	108.6	1963.0
Garlic	175.7 kg	4.8	65.0	100.0	0	0.0	59.1	660.0
Cabbage	300 gm	7.4	75.0	150.0	25.0	0.0	68.3	2224.0
Cauliflower	180 gm	5.5	75.0	150.0	25.0	0.0	74.6	1530.0
Ginger	554.1 kg	5.6	65.0	100.0	0.0	0.0	60.9	1880.0

12.6 Long term investment plan (Capital investment)

Table 12-5: Summary of capital investment required for Bamjee Farm under Toewang Geog, Punakha.

SN	Farm infrastructure	Qty/unit	Rate	Amount	Remark
1	Electric fencing	550 m	23.94	13,167	From detail estimate
2	Irrigation- Intake	1 No	10,000.00	10,000	Lump sum
3	Irrigation- Conveyance (50mm HDPE pipe)	40 m	235.21	9,408	BSR item code PO0018
4	Irrigation- Storage	5 cu.m	11,300.00	56,500	Based on RDC Bajo tank
5	Irrigation- Application (sprinkler)	2.54 acre	100,000.00	254,000	
6	Road- Approach (5m wide)	0 m	425.72	0	Formation cutting- earth
7	Road- Internal farm road (4m wide)	100 m	222.10	22,210	Formation cutting- earth
8	Land Development	2.54 acre	20,000.00	50,800	
9	Infrastructure- Office	1 Block	200,000.00	200,000	
10	Infrastructure- Huts	5 Block	50,000.00	250,000	
11	Infrastructure- Store	1 Block	100,000.00	100,000	
12	Infrastructure- Processing shed	1 Block	150,000.00	150,000	
13	Green house	1 Block	70,000.00	70,000	
A	Total			1,186,085	
B	Unit cost (Nu per acre)			466,963	

Economics of the farm

Basic crop production economics and farm profitability are calculated and shown in the table below.

Table 12-6: Annual crop production economics for Bamjee Farm under Toewang Geog, Punakha.

Crop	Yield (kg/ac)	Production cost		Area (acre)	Production (kg)	Production cost (Nu/yr)	M-price (Nu/kg)	Income (Nu)	Net Profit (Nu)
		(Nu/kg)	(Nu/ac)						
Chili	2381.0	15.0	35643.6	1.0	2381.0	35643.6	50.0	119050.0	83406.4
Tomato	1963.0	22.4	43892.7	0.5	981.5	21946.3	30.0	29445.0	7498.7
Garlic	660.0	51.2	33792.0	1.0	660.0	33792.0	86.0	56760.0	22968.0
Cauliflower	1530.0	21.2	32497.2	1.0	1530.0	32497.2	45.0	68850.0	36352.8
Cabbage	2224.0	12.6	27911.2	0.5	1112.0	13955.6	20.7	22996.2	9040.6
Ginger	1880.0	22.0	41322.4	1.0	1880.0	41322.4	80.0	150400.0	109077.6
Total				5.0		137834.7		297101.2	268344.1

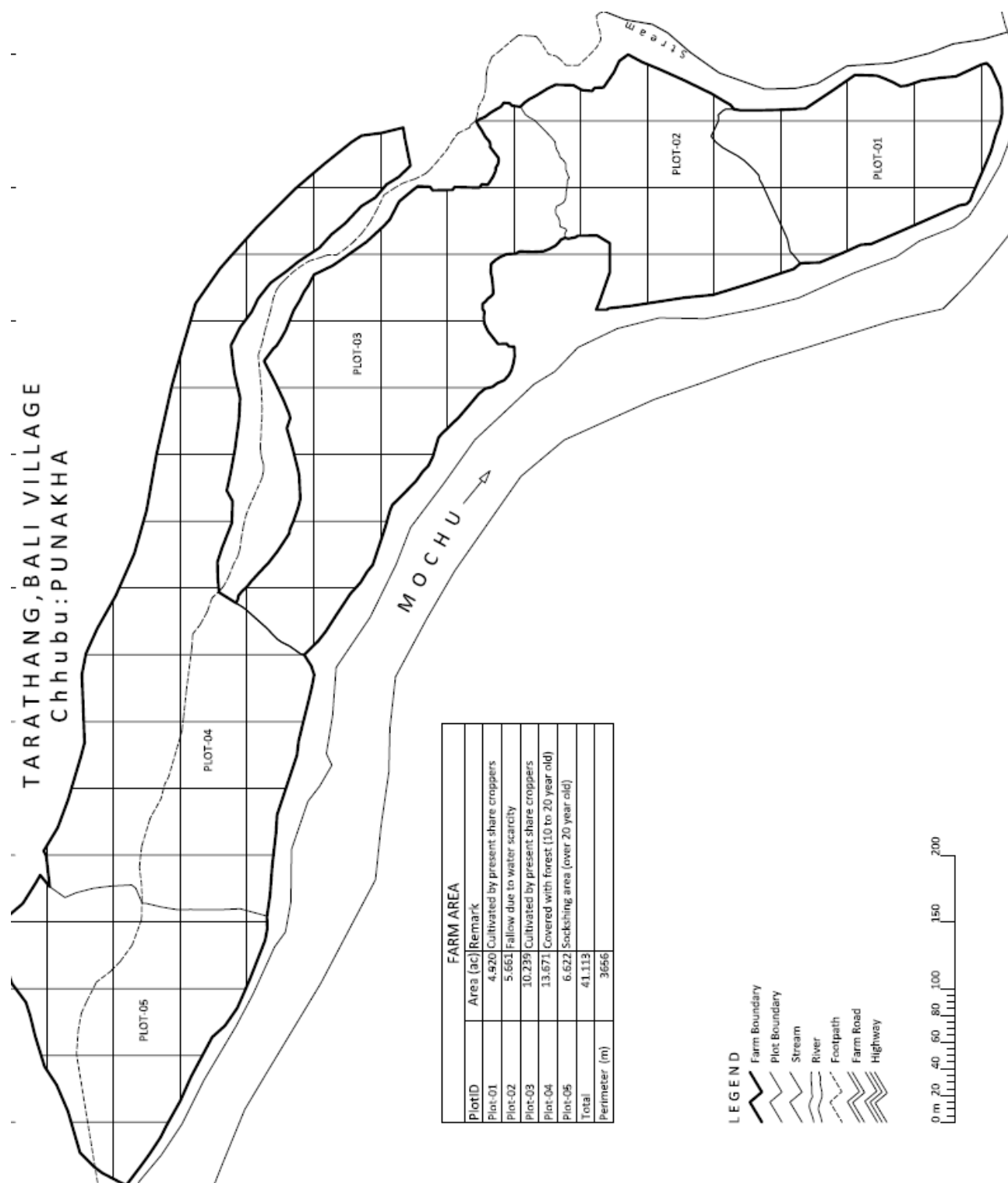
- Estimation of costs and profits and evaluation of the economic feasibility of production techniques are aspects of the management of a farm as a business enterprise.
- Production economics of the selected crops are computed for two season summer and winter.
- Cost of production calculation is based on Vegetable Production Economics conducted by Horticulture Division, DoA, MoAF. For land preparation, ploughing power tiller present government rate is use for the farm machineries rate. Market price is taken at prevailing market wholesale rate. Labours cost is kept at Nu 340 per day which includes meals and refreshment.
- The gross value of production is calculated based on the average yield of vegetables in Bhutan (Agriculture Statistics, 2014).
- The production cost involve materials inputs like seeds, manures, chemical fertilizers, plant protection and tools and labour inputs involved for production of the crop in each season.
- The total production cost incurred for production of the selected crops per year is computed at Nu**137,834.70** The total income that will be generated from the farm is computed at Nu**297,101.20** per year and the net profit is Nu**268,344**per year from the farm.

13 Site Profile 6: Chubu, Punakha

13.1 Site Information

Table 13-1: Site information for proposed Taraythang Farm under Chhubu Geog, Punakha.

Name of land owner	<i>Dratsang</i>
Total area	<i>5 acres</i>
Dzongkhag	<i>Punakha</i>
Geog	<i>Chubhu</i>
Chewog	<i>Bali</i>
Location	<i>Taringpang</i>
Altitude	<i>1330 m</i>
Land aspect	<i>South-West, Slope 5.11°</i>
Land type	<i>Wetland and dryland</i>
Land status	<i>Cultivated: 15 acre (Plot-03), Fallow: (a) Plot-01 and Plot-02 fallow wetland, (b) Plot-04 & Plot-05 dryland covered with forested</i>
Land Tenancy	<i>Leased in by communities (20 acres- Plot-03, Plot-04, and Plot-05)</i>
Soil type	<i>Sandy loam</i>
Distance from highway	<i>1.5 hours walk</i>
Distance from town	<i>30 km Kuruthang Town</i>
Natural Vegetation	<i>Broad leaf forest</i>
Cropping system	<i>Summer (Paddy), Winter (vegetable)</i>
Climatic information	<i>NA</i>
Existing Infrastructure	<i>NA</i>
Distance from irrigation water	<i>1 km</i>
Irrigation water source type	<i>Perennial stream Menchu Ding</i>
Problem and constraints	<i>Shortage of irrigation water, however there is proposal to construct new irrigation in the 11FYP.</i>



Source: Demarcation based on the information gathered from existing share cropper and google map.

Figure 13-1: Map for proposed Taraythang Farm under Chhubu Geog, Punakha.

13.2 Climatic conditions

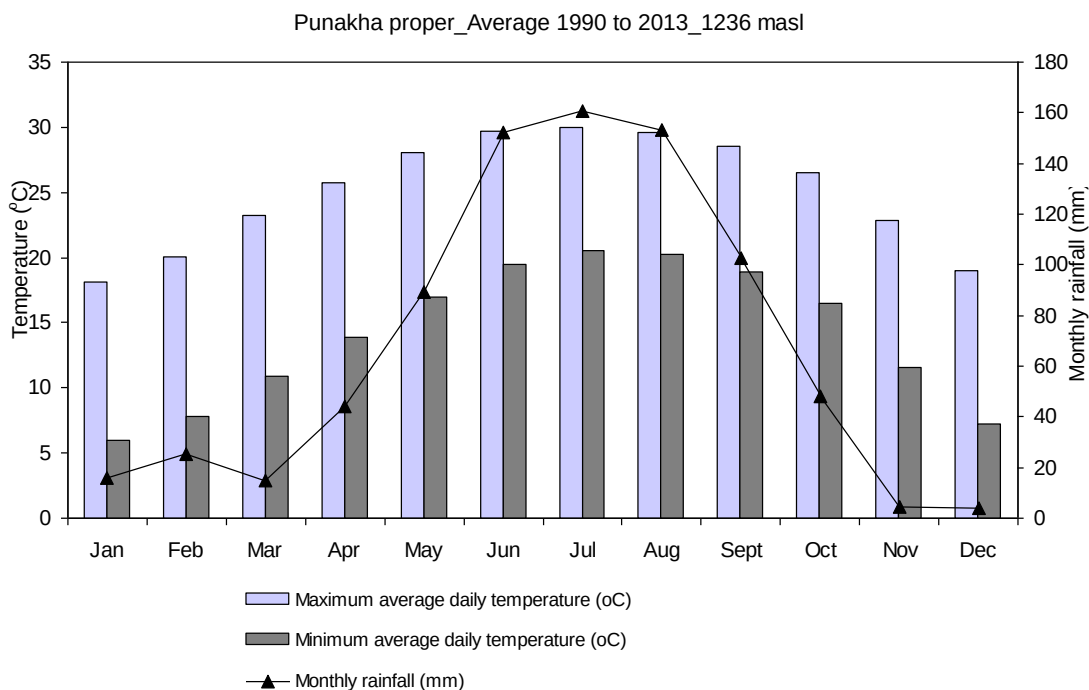


Figure 13-2: Climate information for proposed Taraythang Farm under Chhubu Geog, Punakha.

Meteorological data was collected from Punakha proper, the closest weather station from the identified fallow land for commercial agriculture. The rainfall pattern is monomodal with maximum rainfall occurring from the month of April to October, whilst the least quantity of rainfall occurs in months of January, February, March, November and December. The annual total rainfall is estimated for the site to be 815 mm. The maximum and minimum temperatures are most favourable for growing crops from the month of April to October; however temperatures are colder in January, February and December.

13.3 Proposed Crops

The following listed vegetable crops can be grown in the currently cultivated land by farmers but it will be very difficult to grow crops in the forested and long fallowed land. However, with the existing vegetation cover, plantations crops such as ginger, turmeric and cardamom can be grown. These crops need shady and moist soils.

Summer crop: Chili, ginger, Brinjal, carrot, ladies finger

Winter: Cabbage, broccoli, cauliflower, mustard green, garlic, legumes (mung bean)

Feasible Fruit crops: Avocado, Melon, Persimmon, Grapes, Cardamom

The farm can be apportioned vegetable cultivation in the following manner.

Table 13-2: Proposed crops for proposed Taraythang Farm under Chhubu Geog, Punakha.

Summer		Winter	
Crop	Area (ac)	Crop	Area (ac)
Beans	0.25	Broccoli	0.25
Chili (dolly)	0.25	Cabbage	0.25
Carrot	0.25	Cauliflower	0.25
Egg plant	0.25	Garlic	0.50
Ginger	0.25	Mustard green	0.50
Okra	0.25	Pea	1.00
Total	1.50	Total	2.75

13.4 Cropping calendar

The cropping calendar for different vegetables is presented in the Table below.

Table 13-3: Proposed cropping calendar for proposed Taraythang Farm under Chhubu Geog, Punakha.

Vegetable	Growing season												
	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	
Cabbage			SOWING										
						HARVESTING							
Cauliflower		S											
						H							
Broccoli		S											
						H							
Egg plant			S				H						
						H							
Chili		S											
						H							
Pea		S											
				H									
Beans			S			S							
						H				H			
Carrot				S									
							H						
Mustard green									S				
										H			
Garlic									S				
		H											

13.5 Inputs required

The most basic inputs required for cultivation include: seeds or seedlings, manures, fertilizers and labor days. The table below provides information on inputs.

Table 13-4: Farm production inputs and expected yield for Taraythang under Chhubu Geog, Punakha.

Crop	Seed rate (per ac)	FYM (MT/ac)	Fertilizer rate (kg/ac)				Labour (day/ac)	Yield (kg/ac)
			Urea	SSP	MoP	Suphala		
Chili	300 gm	8.0	100.0	150.0	25.0	0.0	84.4	2381.0
Tomato	160 gm	8.0	77.0	125.0	17.0	0.0	108.6	1963.0
Carrot	600 gm	5.9	15.0	25.0	40.0	0.0	54.3	1700.0
Egg plant	300 gm	8.0	70.0	175.0	20.0	0.0	80.0	1200.0
Radish	4.0 kg	5.0	44.0	125.0	34.0	0.0	57.4	2015.0
Beans	20.0 kg	2.6	22.0	187.5	0.0	0.0	59.6	2072.0
Broccoli	180 gm	7.9	75.0	150.0	25.0	0.0	70.9	1154.0
Garlic	175.7 kg	4.8	65.0	100.0	0	0.0	59.1	660.0
Pea	40.0 kg	5.2	44.0	187.5	50.0	0.0	51.8	943.0
Cabbage	300 gm	7.4	75.0	150.0	25.0	0.0	68.3	2224.0
Cauliflower	180 gm	5.5	75.0	150.0	25.0	0.0	74.6	1530.0
Onion	1.6 kg	4.3	88.0	187.5	50.0	0.0	82.7	1181.0
Leafy Greens	1.0 kg	8.0	44.0	0	0	0	47.2	2106.1
Bitter gourd	2.5 kg	5.0	108.0	150.0	40.0	0	49.3	1785.8
Okra	8.0 kg	6.0	87.0	120.0	0	0	53.4	1007.7

13.6 Long term investment plan (Capital investment)

Table 13-5: Capital investment required for proposed Taraythang Farm under Chhubu Geog, Punakha.

SN	Farm infrastructure	Qty/unit	Rate	Amount	Remark
1	Electric fencing	630 m	24.32	15,320	From detail estimate
2	Irrigation- Intake	1 No	10,000.00	10,000	Lump sum
3	Irrigation- Conveyance (50mm HDPE pipe)	500 m	235.21	117,605	BSR item code PO0018
4	Irrigation- Storage	50 cu.m	11,300.00	565,000	Based on RDC Bajo tank
5	Irrigation- Application (sprinkler)	4.98 acre	100,000.00	498,000	
6	Road- Approach (5m wide)	3,620 m	425.72	1,541,106	Formation cutting- earth
7	Road- Internal farm road (4m wide)	200 m	222.10	44,420	Formation cutting- earth
8	Land Development	5 acre	20,000.00	99,600	
9	Infrastructure- Office	1 Block	200,000.00	200,000	
10	Infrastructure- Huts	5 Block	50,000.00	250,000	
11	Infrastructure- Store	1 Block	100,000.00	100,000	
12	Infrastructure- Processing shed	1 Block	150,000.00	150,000	
13	Green house	1 Block	70,000.00	70,000	
A	Total			3,661,051	
B	Unit cost (Nu per acre)			735,151	

13.7 Economics of the farm

Basic crop production economics and farm profitability are calculated and shown in the table below.

Table 13-6: Annual crop production economics for Taraythang Farm under Chhubu Geog, Punakha.

Crop	Yield (kg/ac)	Production cost		Area (ac)	Production (kg/yr)	Cost (Nu/yr)	M-price (Nu/kg)	Income (Nu/yr)	Net Profit (Nu/yr)
		(Nu/kg)	(Nu/ac)						
Chili	2381	14.97		1	2381	35643.6	50	119050	83406
Tomato	1963	22.36		0.5	981.5	21946.3	30	29445	7498.7
Carrot	1700	14.93		0.5	850	12690.5	29.2	24854	12164
Egg plant	1200	20.0		1	1200	24000	32	38400	14400
Beans	2072	15.64		0.5	1036	16203	35.7	37016	20813
Garlic	660	51.2		1	660	33792	86	56760	22968
Pea	943	27.92		0.5	471.5	13164.3	45	21218	8053.2
Cabbage	2224	12.55		0.5	1112	13955.6	20.7	22996	9040.6
Cauliflower	1530	21.24		0.5	765	16248.6	45	34425	18176
Onion	1181	29.4		1	1181	34721.4	40	47240	12519
Broccoli	1154	29.38		1	1154	33904.5	88	101552	67647
Bitter guard	1785.81	13.32		0.5	892.9	11893.5	31.1	27743	15849
Okra	1007.69	23.97		0.5	503.85	12077.2	40	20154	8076.6
Leafy vegetable	2106.09	10.15		1	2106.1	21376.8	16.3	34414	13037
Total				10.0		301617		615266	313648

- Estimation of costs and profits and evaluation of the economic feasibility of production techniques are aspects of the management of a farm as a business enterprise.
- Cost of production calculation is based on Vegetable Production Economics conducted by Horticulture Division, DoA, MoAF. For land preparation, ploughing power tiller present government rate is use for the farm machineries rate. Market price is taken at prevailing market wholesale rate. Labour cost is kept at Nu 340 per day which includes meals.
- The production cost involve materials inputs like seeds, manures, chemical fertilizers, plant protection and tools and labour inputs involved for production of the crop in each season.
- The total production cost incurred for production of the selected crops per year is computed at Nu. **301617**. The total income that will be generated from the farm is computed at Nu. **615266** per year and the net profit is Nu. **313648** per year from the farm.

Remarks:

The proposed site is not feasible for commercial farming considering the following points

- Long walking distance from the town
- No approach road
- Too many share cropper

14 Site Profile 8: Tebesa, Punakha

14.1 Site Information

Table 14-1: Site information for proposed Siluna(Upper) Farm under Toepisa Geog, Punakha.

Name of land owner	<i>Chimi Yuden/Aum Sangay/Dasho Tshering, House#329, Thram#??</i>
Total area	<i>7.37 acre</i>
Dzongkhag	<i>Punakha</i>
Geog	<i>Tebesa</i>
Chewog	<i>Tokha</i>
Location	<i>Lamtekha</i>
Altitude	<i>1713 m</i>
Land aspect	<i>North East, Slop: Gentle to very sloppy land</i>
Land type	<i>Wetland (4.36 ac) and Dry land (3.01ac)</i>
Land status	<i>1.0 acre walnut, 0.5 acre passion fruit (Only the structure remains), 0.5 acre vegetables, rest fallow</i>
Land Tenancy	<i>Private</i>
Soil type	<i>Sandy clay</i>
Distance from highway	<i>Below the highway</i>
Distance from town	<i>15 km from Lobesa Town</i>
Natural Vegetation	<i>Broad leave forest</i>
Cropping system	<i>Paddy – vegetable, Fruit crops with vegetable</i>
Climatic information	
Existing Infrastructure	<i>Access to farm road, irrigation channel, electricity, terraced land.</i>
Distance from irrigation water	<i>Just below irrigation channel</i>
Irrigation water source type	<i>Stream connected with irrigation channel</i>
Problem and constraints	<i>Fencing, wild animal</i>

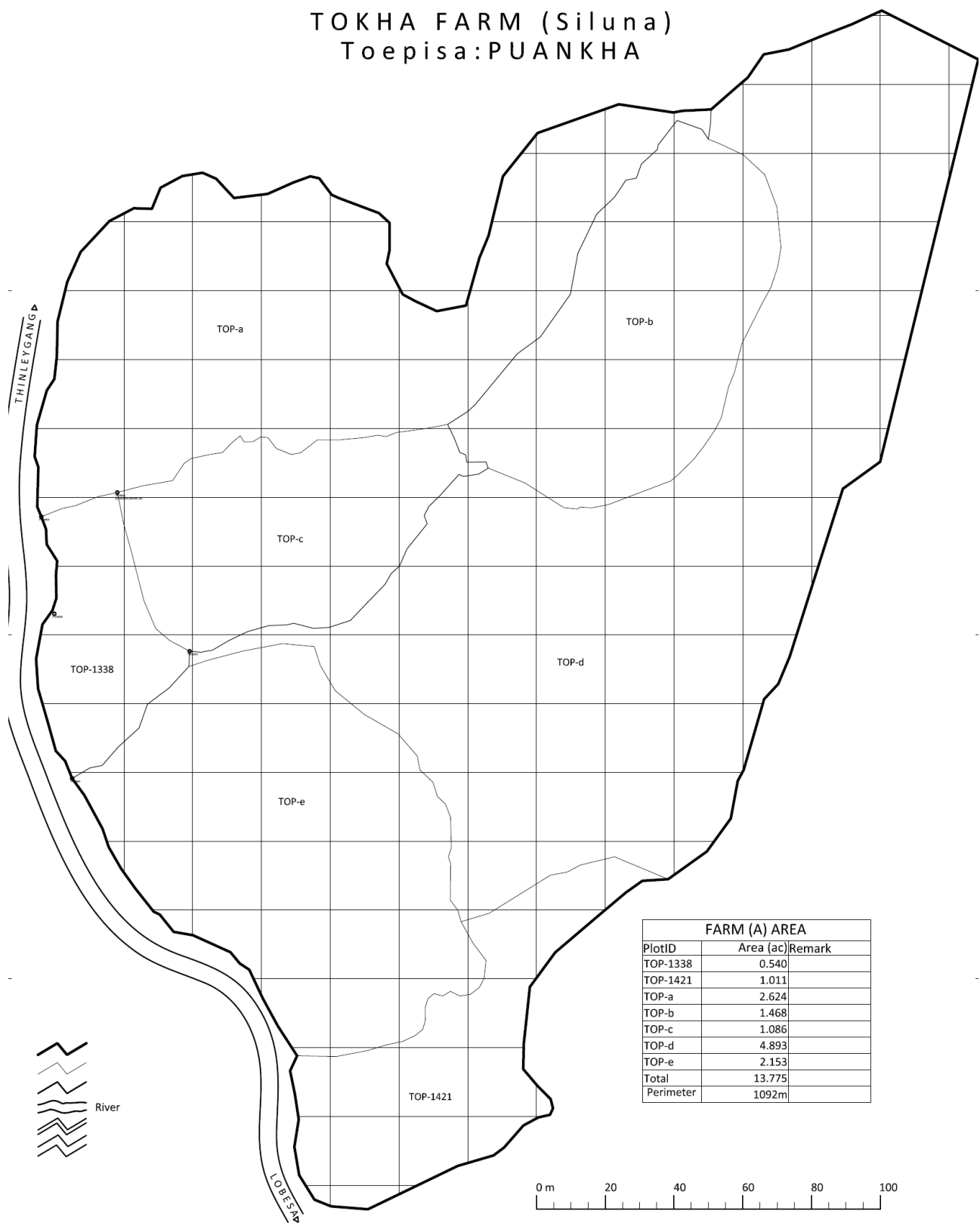


Figure 14-1: Farm map for proposed Siluna (Upper) Farm under Toepisa Geog, Punakha.

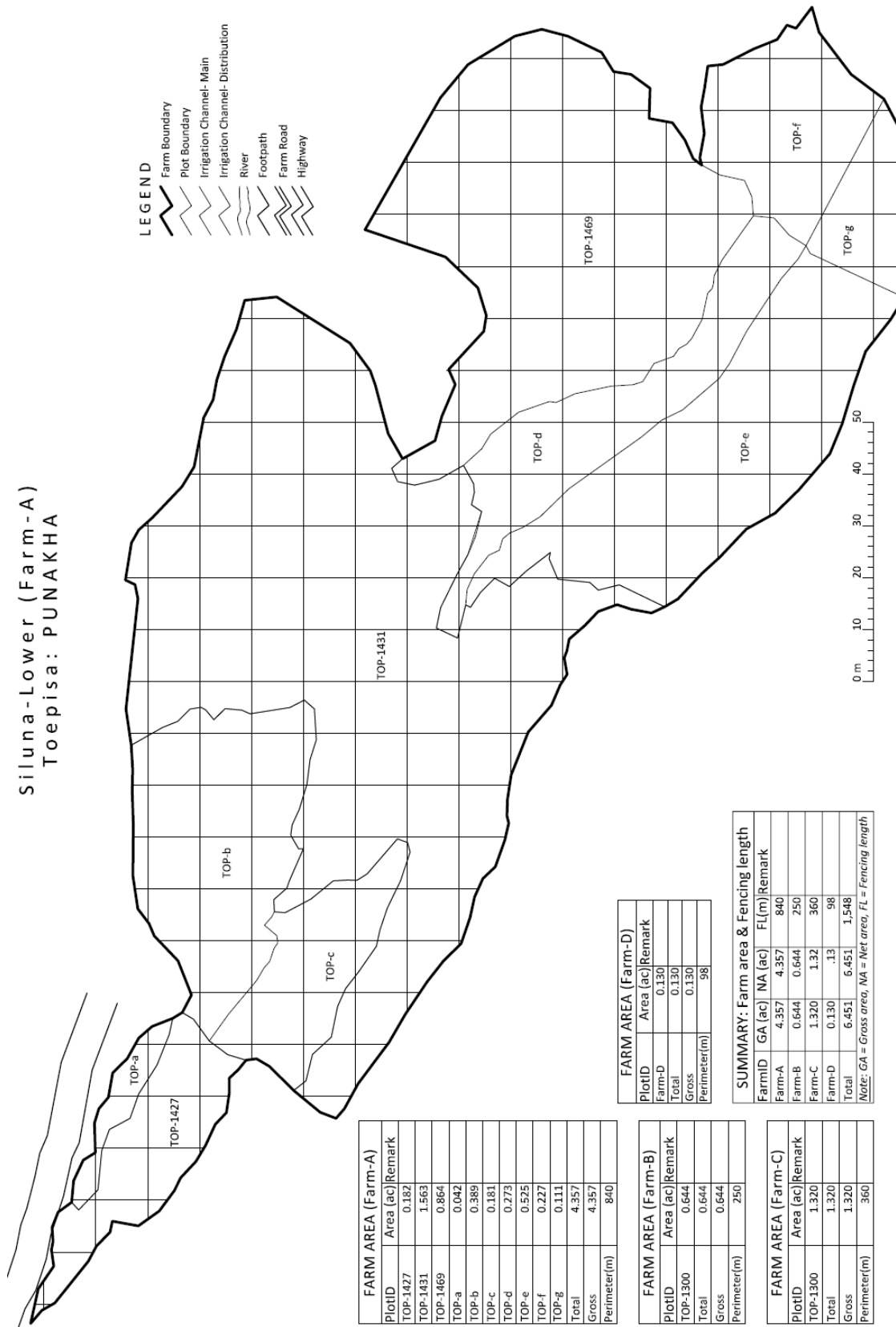


Figure 14-2: Farm map for proposed Siluna (Lower) Farm under Toepisa Geog, Punakha.



(a)



(b)



(c)



(d)

Figure 14-3: Pictorial view of Siluna Farm under Toepisa Geog, Punakha.

(a) A field inspection of the fallow with DAO, Land land owner, Agriculture EA. Also in picture is the existing walnut plants, (b) A view of the fallow land which is below the Thimphu-Wandue highway, (c) The view of lower farm near Drupchu processing factory, and (d) The other view of the lower Siluna farm near Drupchu processing factory).

14.2 Climatic conditions

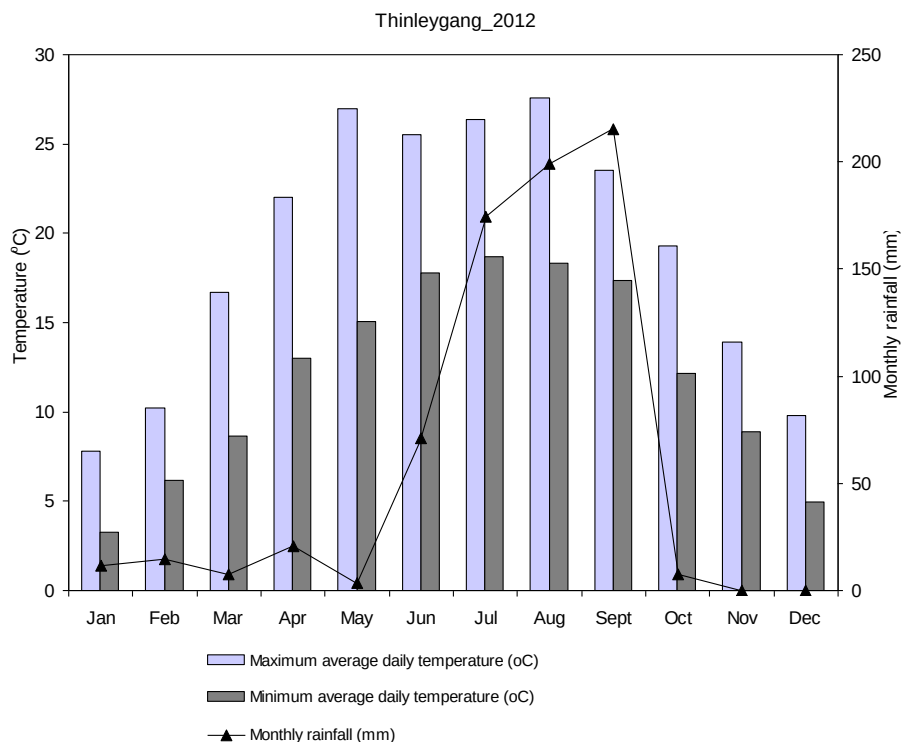


Figure 14-4: Climatic information for Siluna (upper and lower) Farm under Toepisa Geog, Punakha.

Meteorological data was collected from Thinleygang, the closest weather station from the identified fallow land for commercial agriculture. The rainfall pattern is monomodal with maximum rainfall occurring from the month of April to October, whilst the least quantity of rainfall occurs in months of January, February, March, November and December. The annual total rainfall is estimated for the site to be 725 mm. The maximum and minimum temperatures are most favourable for growing crops from the month of April to October; however temperatures are colder in January, February and December.

14.3 Proposed Crops

The land is feasible for both summer and winter vegetable crops. Among the vegetables, the following crops are selected based on climatic suitability, production, market demand and income from their sale.

Summer crop: Chili, Brinjal, tomato, carrot, radish, ladies finger, guards, potato

Winter: Cabbage, broccoli, cauliflower, coriander, mustard green, garlic, radish, lettuce, carrot, onion

Long term vegetable: Asparagus, Potato

Feasible Fruit crops: Cardamom, Avocado, Melon, Pear, Persimmon, Kiwi, Grapes

For immediate economic gain, we propose cultivation of seasonal vegetables. Of the total farm area, the land can be divided to grow the summer and winter vegetables as follows:

Table 14-2: Recommended crops for proposed Siluna Farms under Toepisa Geog, Punakha.

Summer		Winter	
Crop	Area (ac)	Crop	Area (ac)
Beans	1.12	Broccoli	1.00
Bitter gourd	0.50	Cabbage	1.00
Carrot	1.00	Carrot	0.37
Chili	1.00	Cauliflower	1.00
Egg plant	1.00	Garlic	1.00
Okra	0.50	Pea	1.00
Potato	1.00	Radish	0.50
Radish	0.25	Leafy greens	1.50
Tomato	1.00		
Total	7.37	Total	7.37

14.4 Cropping calendar

The cropping calendar for different vegetables is presented in the Table below.

Table 14-3: Proposed cropping calendar for Siluna Farms under Toepisa Geog, Punakha.

Vegetable	Growing season												
	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Cabbage			SOWING										
						HARVESTING							
Cauliflower			S										
							H						
Broccoli			S										
							H						
Tomato		S						H					
		H					H						
Egg plant			S					H					
						H							
Chili			S										
						H							
Pea		S											
				H									
Beans			S			S							
						H				H			
Radish			S										
					H								
Carrot				S									
							H						
Mustard green									S				
										H			

Garlic									S		
		H									
Okra						S					
									H		
Ginger			S								
	H									H	
Coriander							S				
									H		
Cucumber			S								
						H					
Potato			S								
						H					

14.5 Inputs required

The most basic inputs required for cultivation include: seeds or seedlings, manures, fertilizers and labor days. The table below provides information on inputs.

Table 14-4: Farm production inputs and expected yields for Siluna Farms under Toepisa Geog, Punakha.

Crop	Seed rate (per ac)	FYM (MT/ac)	Fertilizer (kg/ac) rate				Labour (day/ac)	Yield (kg/ac)
			Urea	SSP	MoP	Suphala		
Chili	300 gm	8.0	100.0	150.0	25.0	0.0	84.4	2381.0
Tomato	160 gm	8.0	77.0	125.0	17.0	0.0	108.6	1963.0
Carrot	600 gm	5.9	15.0	25.0	40.0	0.0	54.3	1700.0
Egg plant	300 gm	8.0	70.0	175.0	20.0	0.0	80.0	1200.0
Radish	4.0 kg	5.0	44.0	125.0	34.0	0.0	57.4	2015.0
Beans	20.0 kg	2.6	22.0	187.5	0.0	0.0	59.6	2072.0
Broccoli	180 gm	7.9	75.0	150.0	25.0	0.0	70.9	1154.0
Garlic	175.7 kg	4.8	65.0	100.0	0	0.0	59.1	660.0
Pea	40.0 kg	5.2	44.0	187.5	50.0	0.0	51.8	943.0
Cabbage	300 gm	7.4	75.0	150.0	25.0	0.0	68.3	2224.0
Cauliflower	180 gm	5.5	75.0	150.0	25.0	0.0	74.6	1530.0
Onion	1.6 kg	4.3	88.0	187.5	50.0	0.0	82.7	1181.0
Leafy Greens	1.0 kg	8.0	44.0	0	0	0	47.2	2106.1
Bitter gourd	2.5 kg	5.0	108.0	150.0	40.0	0	49.33	1785.8
Okra	8.0 kg	6.0	87.0	120.0	0	0	53.4	1007.7

14.6 Long term investment plan (Capital investment)

Table 14-5: Capital investment required for proposed Siluna (Upper) Farm under Toepisa Geog, Punakha.

SN	Farm infrastructure	Qty/unit	Rate	Amount	Remark
1	Electric fencing	1,100 m	53.87	59,258	From detail estimate
2	Irrigation- Intake	1 No	10,000.00	10,000	Lump sum
3	Irrigation- Conveyance (50mm HDPE pipe)	50 m	235.21	11,760	BSR item code PO0018
4	Irrigation- Storage	10 cu.m	11,300.00	113,000	Based on RDC Bajo tank
5	Irrigation- Application (sprinkler)	13.78 acre	100,000.00	1,378,000	
6	Road- Approach (5m wide)	50 m	425.72	21,286	Formation cutting- earth
7	Road- Internal farm road (4m wide)	500 m	222.10	111,050	Formation cutting- earth
8	Land Development	13.78 acre	20,000.00	275,600	
9	Infrastructure- Office	1 Block	200,000.00	200,000	
10	Infrastructure- Huts	10 Block	50,000.00	500,000	
11	Infrastructure- Store	2 Block	100,000.00	200,000	
12	Infrastructure- Processing shed	2 Block	150,000.00	300,000	
13	Green house	3 Block	70,000.00	210,000	
A	Total			3,389,954	
B	Unit cost (Nu per acre)			246,005	

Table 14-6: Capital investment required for Siluna (Lower) Farm-A under Toepisa Geog, Punakha.

SN	Farm infrastructure	Qty/unit	Rate	Amount	Remark
1	Electric fencing	840 m	61.82	51,932	From detail estimate
2	Irrigation- Intake	1 No	10,000.00	10,000	Lump sum
3	Irrigation- Conveyance (50mm HDPE pipe)	20 m	235.21	4,704	BSR item code PO0018
4	Irrigation- Storage	10 cu.m	11,300.00	113,000	Based on RDC Bajo tank
5	Irrigation- Application (sprinkler)	4.36 acre	100,000.00	436,000	
6	Road- Approach (5m wide)	50 m	425.72	21,286	Formation cutting- earth
7	Road- Internal farm road (4m wide)	100 m	222.10	22,210	Formation cutting- earth
8	Land Development	4 acre	20,000.00	87,200	
9	Infrastructure- Office	1 Block	200,000.00	200,000	
10	Infrastructure- Huts	5 Block	50,000.00	250,000	
11	Infrastructure- Store	1 Block	100,000.00	100,000	
12	Infrastructure- Processing shed	1 Block	150,000.00	150,000	
13	Green house	1 Block	70,000.00	70,000	
A	Total			1,516,332	
B	Unit cost (Nu per acre)			347,783	

Table 14-7: Capital investment required for Siluna (Lower) Farm-B under Toepisa Geog, Punakha.

SN	Farm infrastructure	Qty/unit	Rate	Amount	Remark
1	Electric fencing	250 m	24.93	6,232	From detail estimate
2	Irrigation- Intake	1 No	10,000.00	10,000	Lump sum
3	Irrigation- Conveyance (50mm HDPE pipe)	500 m	235.21	117,605	BSR item code PO0018
4	Irrigation- Storage	10 cu.m	11,300.00	113,000	Based on RDC Bajo tank
5	Irrigation- Application (sprinkler)	0.64 acre	100,000.00	64,400	
6	Road- Approach (5m wide)	400 m	425.72	170,288	Formation cutting- earth
7	Road- Internal farm road (4m wide)	100 m	222.10	22,210	Formation cutting- earth
8	Land Development	0.6 acre	20,000.00	12,880	
9	Infrastructure- Office	1 Block	200,000.00	200,000	
10	Infrastructure- Huts	5 Block	50,000.00	250,000	
11	Infrastructure- Store	1 Block	100,000.00	100,000	
12	Infrastructure- Processing shed	1 Block	150,000.00	150,000	
13	Green house	1 Block	70,000.00	70,000	
A	Total			1,286,615	
B	Unit cost (Nu per acre)			1,997,849	

Table 14-8: Capital investment required for Siluna (Lower) Farm-C under Toepisa Geog, Punakha.

SN	Farm infrastructure	Qty/unit	Rate	Amount	Remark
1	Electric fencing	360 m	25.51	9,182	From detail estimate
2	Irrigation- Intake	1 No	10,000.00	10,000	Lump sum
3	Irrigation- Conveyance (50mm HDPE pipe)	320 m	235.21	75,267	BSR item code PO0018
4	Irrigation- Storage	10 cu.m	11,300.00	113,000	Based on RDC Bajo tank
5	Irrigation- Application (sprinkler)	1.32 acre	100,000.00	132,000	
6	Road- Approach (5m wide)	100 m	425.72	42,572	Formation cutting- earth
7	Road- Internal farm road (4m wide)	200 m	222.10	44,420	Formation cutting- earth
8	Land Development	0.00 acre	20,000.00	0	
9	Infrastructure- Office	0 Block	200,000.00	0	
10	Infrastructure- Huts	2 Block	50,000.00	100,000	
11	Infrastructure- Store	0 Block	100,000.00	0	
12	Infrastructure- Processing shed	0 Block	150,000.00	0	
13	Green house	0 Block	70,000.00	0	
A	Total			526,441	
B	Unit cost (Nu per acre)			398,819	

Table 14-9: Capital investment required for Siluna (Lower) Farm-D under Toepisa Geog, Punakha.

SN	Farm infrastructure	Qty/unit	Rate	Amount	Remark
1	Electric fencing	100 m	381.13	38,113	From detail estimate
2	Irrigation- Intake	1 No	10,000.00	10,000	Lump sum
3	Irrigation- Conveyance (50mm HDPE pipe)	320 m	235.21	75,267	BSR item code PO0018
4	Irrigation- Storage	5 cu.m	11,300.00	56,500	Based on RDC Bajo tank
5	Irrigation- Application (sprinkler)	0.13 acre	100,000.00	13,000	
6	Road- Approach (5m wide)	0 m	425.72	0	Formation cutting- earth
7	Road- Internal farm road (4m wide)	0 m	222.10	0	Formation cutting- earth
8	Land Development	0.00 acre	20,000.00	0	
9	Infrastructure- Office	0 Block	200,000.00	0	
10	Infrastructure- Huts	0 Block	50,000.00	0	
11	Infrastructure- Store	0 Block	100,000.00	0	
12	Infrastructure- Processing shed	0 Block	150,000.00	0	
13	Green house	0 Block	70,000.00	0	
A	Total			192,880	
B	Unit cost (Nu per acre)			1,483,692	

14.7 Economics of the farm

Basic crop production economics and farm profitability are calculated and shown in the table below.

Table 14-10: Annual crop production economics for Siluna (Upper) Farm under Toepisa Geog, Punakha.

Crop	Yield (kg/ac)	Production cost		Area (ac)	Production (kg/yr)	Cost (Nu/yr)	M-price (Nu/kg)	Income (Nu/yr)	Net Profit (Nu/yr)
		(Nu/kg)	(Nu/ac)						
Chili	2381.0	15.0	35643.6	1.0	2381.0	35643.6	50.0	119050.0	83406.4
Tomato	1963.0	22.4	43892.7	1.0	1963.0	43892.7	30.0	58890.0	14997.3
Carrot	1700.0	14.9	25381.0	1.4	2329.0	34772.0	29.2	68100.0	33328.0
Egg plant	1200.0	20.0	24000.0	1.0	1200.0	24000.0	32.0	38400.0	14400.0
Radish	2015.0	13.0	26195.0	0.8	1511.3	19646.3	15.1	22774.5	3128.3
Beans	2072.0	15.6	32406.1	1.1	2320.6	36294.8	35.7	82916.5	46621.7
Garlic	660.0	51.2	33792.0	1.0	660.0	33792.0	86.0	56760.0	22968.0
Pea	943.0	27.9	26328.6	1.0	943.0	26328.6	45.0	42435.0	16106.4
Cabbage	2224.0	12.6	27911.2	1.0	2224.0	27911.2	20.7	45992.3	18081.1
Cauliflower	1530.0	21.2	32497.2	1.0	1530.0	32497.2	45.0	68850.0	36352.8
Onion	1181.0	29.4	34721.4	1.0	1181.0	34721.4	40.0	47240.0	12518.6
Broccoli	1154.0	29.4	33904.5	1.0	1154.0	33904.5	88.0	101552.0	67647.5
Bitter guard	1785.8	13.3	23787.0	0.5	892.9	11893.5	31.1	27742.5	15849.0
Okra	1007.7	24.0	24154.3	0.5	503.8	12077.2	40.0	20153.8	8076.6
Leafy vegetable	2106.1	10.2	21376.8	1.5	3159.1	32065.2	16.3	51620.3	19555.0
Total						439440.0		852476.9	413036.9

The estimation of costs and profits and evaluation of the economic feasibility of production techniques are aspects of the management of a farm as a business enterprise. The production economics of the selected crops are computed for both season summer and winter seasons. The cost of production is based on the Vegetable Production Economics conducted by Horticulture Division, DoA, MoAF. For land preparation, the prevailing AMC hiring rates for power tiller are used in the calculations. Market price is taken at prevailing wholesale market rates. Labour cost is averaged at Nu 340 per day which includes meals and refreshment. The gross value of production is calculated based on the average yield of vegetables in Bhutan (Agriculture Statistics, 2014). The production costs include materials inputs like seeds, manures, chemical fertilizers, plant protection and labour inputs needed for production of the crop in each season.

The total production cost incurred for production of the selected crops per year is computed at Nu. 439440.0 for 7.37 acres area per year . The total income that will be generated from the farm is computed at Nu. 852476.9 per year and the net profit is Nu. 413036.9 per year from the 7.37 acre farm.

15 Site Profile 9: Sunkosh, Tsirang

15.1 Site Information

Table 15-1: Site information for proposed Sunkosh Farm under Tsholingkhar Geog, Tsirang.

Name of land owner	<i>Mindu Tshering</i>
Total area	<i>4.33 acre</i>
Dzongkhag	<i>Tsirang</i>
Geog	<i>Tsholingkhar</i>
Chewog	
Location	<i>Sunkosh</i>
Altitude	<i>320-360 m</i>
Land aspect	
Land type	<i>Fallow</i>
Land status	<i>Fallow</i>
Land Tenancy	<i>Private</i>
Soil type	<i>Silty clay loam</i>
Distance from highway	<i>1.0 km</i>
Distance from town	<i>20.0 km from Tsirang town</i>
Natural Vegetation	<i>Broad leaf forest</i>
Cropping system	<i>Paddy vegetable</i>
Climatic information	<i>Warm subtropical</i>
Existing Infrastructure	<i>No farm road, BPC power line passes through the farm, no fencing, no irrigation, Un-terraced land.</i>
Distance from irrigation water	<i>100m</i>
Irrigation water source type	<i>Irrigation water source within the land proposed</i>
Problem and constraints	<i>No farm road, no fencing.</i>

SUNKOSH, Tsholingkhar: TSIRANG

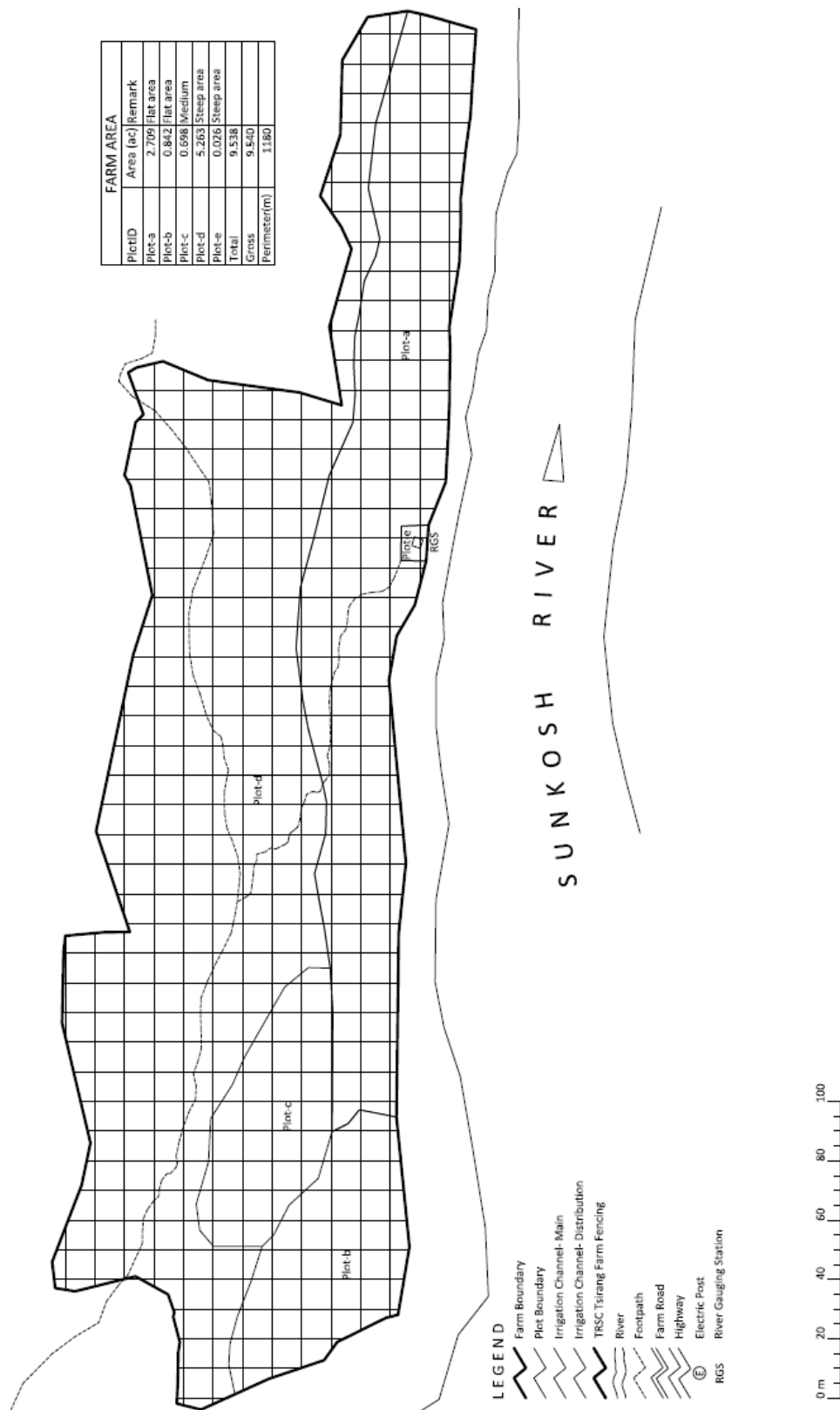


Figure 15-1: Farm map for proposed Sunkosh Farm under Tsholingkhar Geog, Tsirang.

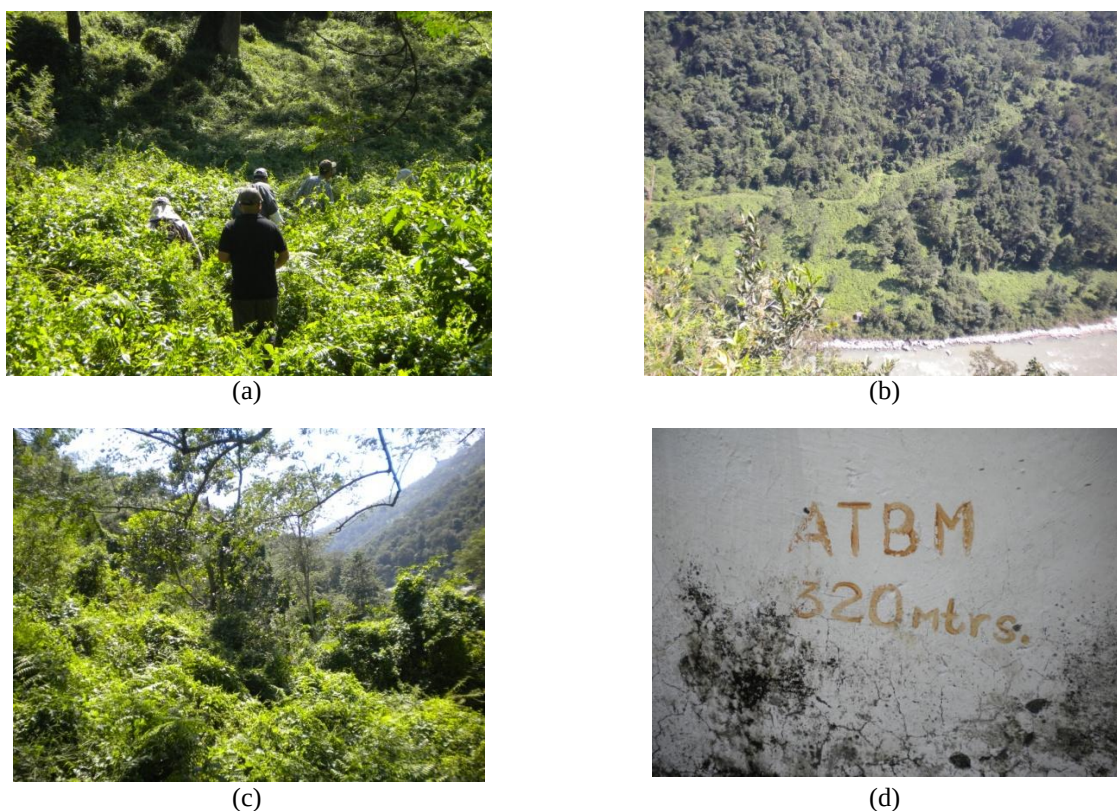


Figure 15-2: Pictorial view of proposed Sunkosh Farm under Tsholingkhar Geog, Tsirang.

(a) A field inspection of the fallow land by the team, (b) A view of the fallow land from other side of the river. The land is between the river and the footpath, (c) The other view of the fallow land at Sunkosh, and (d) The wall of weather station located adjacent to the fallow indicated the altitude of 320 masl.

15.2 Climatic conditions

Meteorological data was collected from Sunkosh weather station and the climate data for this site is perfectly reliable as the indentified fallow farm is on or adjacent to the weather station. The rainfall pattern is monomodal with maximum rainfall occurring from the month of April to October, whilst the least quantity of rainfall occurs in months of January, February, March, November and December. The annual total rainfall for the site is 1195 mm. The maximum and minimum temperatures are favourable for growing crops throughout the year.

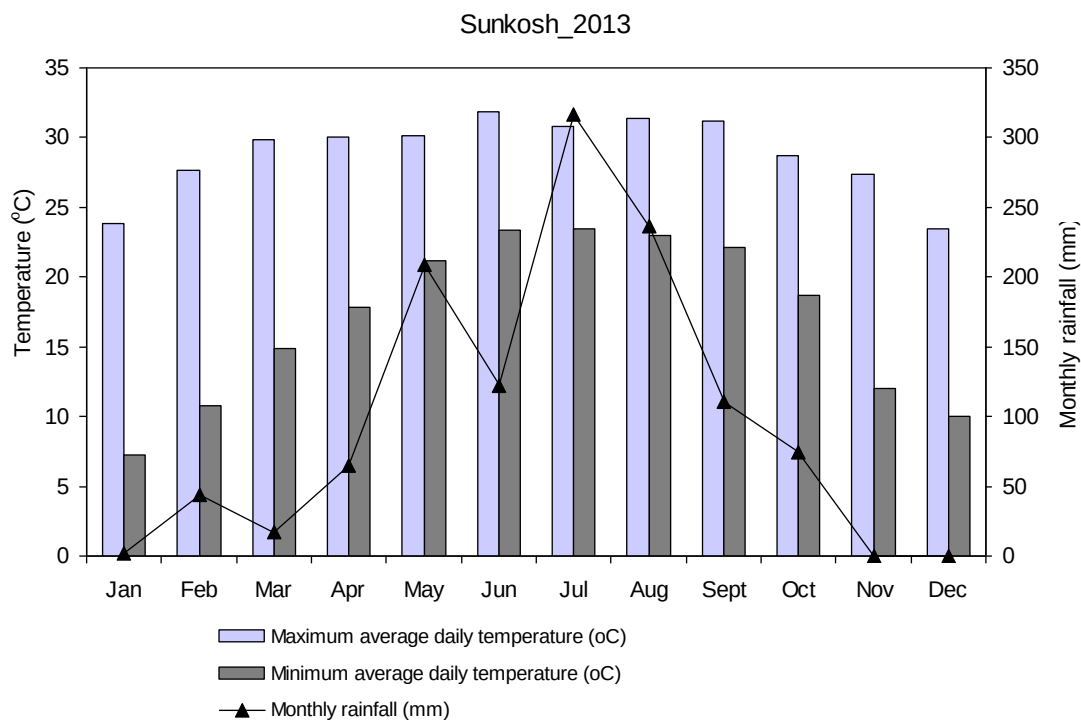


Figure 15-3: Climatic information of Sunkosh Farm under Tsholingkhar Geog, Tsirang.

15.3 Proposed Crops

The land is feasible for both summer and winter vegetable crops. Among the vegetables, the following crops are selected based on climatic suitability, production, market demand and income from their sale.

Summer crop: Indian chili, ginger, onion, Brinjal, ladies finger, guards

Winter: cabbage, broccoli, cauliflower, garlic, pea, legumes (mung bean), tomato

Long term vegetables: Cassava and yam

Feasible Fruit crops: Cardamom, Avocado, Banana, Litchi, Mango, Guava, Papaya, Jack fruit, Areca nut, Melon

For vegetable cultivation the farm can be apportioned as below.

Table 15-2: Recommended crops for Sunkosh Farm under Tsholingkhar Geog, Tsirang.

Summer		Winter	
Crop	Area (ac)	Crop	Area (ac)
Bitter gourd	0.30	Carrot	0.50
Chili- dolly	0.50	Cabbage	0.25
Chili- Indian	0.50	Cauliflower	0.50
Egg plant	0.50	Garlic	0.50
Ginger	1.00	Onion	1.00
Mung bean	1.50	Pea	1.00
		Tomato	0.50
Total	4.30	Total	4.25

15.4 Cropping calendar

The cropping calendar for different vegetables is presented in the Table below.

Table 15-3: Cropping calendar for Sunkosh Farm under Tsholingkhar Geog, Tsirang.

Vegetable	Growing season											
	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Cabbage												
Cauliflower												
Tomato												
Chili												
Onion												
Pea												
Beans												
Garlic												
Ginger												
Okra												
Egg plant												
Carrot												

15.5 Inputs required

The most basic inputs required for cultivation include: seeds or seedlings, manures, fertilizers and labor days. The table below provides information on inputs.

Table 15-4: Farm production inputs and expected yields for Sunkosh Tsholingkhar Geog, Tsirang.

Crop	Seed rate (per ac)	FYM (MT/ac)	Fertilizer rate (kg/ac)				Labour (day/ac)	Yield (kg/ac)
			Urea	SSP	MoP	Suphala		
Chili	300 gm	8.0	100.0	150.0	25.0	0.0	84.4	1038.9
Tomato	160 gm	8.0	77.0	125.0	17.0	0.0	108.6	1570.0
Carrot	600 gm	5.9	15.0	25.0	40.0	0.0	54.3	1679.0
Egg plant	300 gm	8.0	70.0	175.0	20.0	0.0	80.0	1200.0
Garlic	175.7 kg	4.8	65.0	100.0	0	0.0	59.1	660.0
Pea	40.0 kg	5.2	44.0	187.5	50.0	0.0	51.8	1362.0
Cabbage	300 gm	7.4	75.0	150.0	25.0	0.0	68.3	2790.0
Cauliflower	180 gm	5.5	75.0	150.0	25.0	0.0	74.6	1350.0
Onion	1.6 kg	4.3	88.0	187.5	50.0	0.0	82.7	1800.0
Bitter gourd	2.5 kg	5.0	108	150.0	40.0	0	49.3	1785.8
Mung bean								651.0
Ginger	554.1 kg	5.6	65.0	100.0	0.0	0.0	60.9	2724.4

15.6 Long term investment plan (Capital investment)

Table 15-5: Capital Investment required for proposed Sunkosh Farm under Tsholingkhar Geog, Tsirang.

SN	Farm infrastructure	Qty/unit	Rate	Amount	Remark
1	Electric fencing	1,180 m	50.36	59,419	From detail estimate
2	Irrigation- Intake	3 No	10,000.00	30,000	Lump sum
3	Irrigation- Conveyance (50mm HDPE pipe)	300 m	235.21	70,563	BSR item code PO0018
4	Irrigation- Storage	20 cu.m	11,300.00	226,000	Based on RDC Bajo tank
5	Irrigation- Application (sprinkler)	4.25 acre	100,000.00	425,000	
6	Road- Approach (5m wide)	510 m	425.72	217,117	Formation cutting- earth
7	Road- Internal farm road (4m wide)	500 m	222.10	111,050	Formation cutting- earth
8	Land Development	4.25 acre	20,000.00	85,000	
9	Infrastructure- Office	1 Block	200,000.00	200,000	
10	Infrastructure- Huts	5 Block	50,000.00	250,000	
11	Infrastructure- Store	1 Block	100,000.00	100,000	
12	Infrastructure- Processing shed	1 Block	150,000.00	150,000	
13	Green house	1 Block	70,000.00	70,000	
A	Total			1,994,149	
B	Unit cost (Nu per acre)			469,212	

15.7 Economics of the farm

Basic crop production economics and farm profitability are calculated and shown in the table below.

Table 15-6: Crop production economics for Sunkosh Farm under Tsholingkhar Geog, Tsirang.

Crop	Yield (kg/ac)	Production cost		Area (acre)	Production (kg/yr)	Cost (Nu/yr)	M-price (Nu/kg)	Income (Nu)	Net Profit (Nu)
		(Nu/kg)	(Nu/ac)						
Chili	1038.9	34.3	35645.0	1.0	1038.9	35645.0	80.0	83112.8	47467.8
Tomato	1570.0	28.0	43897.2	0.5	785.0	21948.6	30.0	23550.0	1601.4
Carrot	1679.0	15.1	25369.7	0.5	839.5	12684.8	29.2	24547.0	11862.1
Egg plant	1200.0	20.0	24000.0	0.5	600.0	12000.0	32.0	19200.0	7200.0
Garlic	660.0	44.3	29205.0	0.5	330.0	14602.5	86.0	28380.0	13777.5
Pea	1362.0	19.3	26327.5	1.0	1362.0	26327.5	45.0	61290.0	34962.5
Cabbage	2790.0	10.0	27900.0	0.3	697.5	6975.0	20.7	14424.3	7449.3
Cauliflower	1350.0	24.1	32494.5	0.5	675.0	16247.3	45.0	30375.0	14127.8
Onion	1800.0	19.3	34740.0	1.0	1800.0	34740.0	40.0	72000.0	37260.0
Ginger	2724.4	15.2	41328.8	1.0	2724.4	41328.8	50.0	136219.0	94890.2
Bitter guard	1785.8	16.0	28501.5	0.3	535.7	8550.4	31.1	16645.5	8095.1
Mung bean	651.0	48.6	31638.6	1.5	976.5	47457.9	80.0	78120.0	30662.1
Total				8.6		278507.9		587863.6	309355.7

- Estimation of costs and profits and evaluation of the economic feasibility of production techniques are aspects of the management of a farm as a business enterprise.
- Production economics of the selected crops are computed for two season summer and winter.
- Cost of production calculation is based on Vegetable Production Economics conducted by Horticulture Division, DoA, MoAF. For land preparation, ploughing power tiller present government rate is use for the farm machineries rate. Market price is taken at prevailing market wholesale rate. Labours cost is kept at Nu 340 per day which includes meals and refreshment.
- The gross value of production is calculated based on the average yield of vegetables in Bhutan (Agriculture Statistics, 2014).
- The production cost involve materials inputs like seeds, manures, chemical fertilizers, plant protection and tools and labour inputs involved for production of the crop in each season.
- The total production cost incurred for production of the selected crops per year is computed at Nu. **278507.9** for 4.33 acres area per year . The total income that will be generated from the farm is computed at Nu. **587863.6** per year and the net profit is Nu. **309355.7** per year from the 4.33 acre farm.

16 Site Profile 10: Mithun, Tsirang

16.1 Site Information

Table 16-1: Site information for proposed Minchuna Farm under Kilkhorthang Geog, Tsirang.

Name of land owner	<i>Kelzang Namgyel House#BA-6-454, Thram#454</i>
Total area	<i>2.83 acres</i>
Dzongkhag	<i>Tsirang</i>
Geog	<i>Kilkhorthang</i>
Chewog	<i>Minchuna</i>
Location	<i>Mithun</i>
Altitude	<i>1536 m</i>
Land aspect	<i>North-west, Slope: 7.20°</i>
Land type	<i>Wetland</i>
Land status	<i>Fallow</i>
Land Tenancy	<i>Private</i>
Soil type	<i>Clay silt</i>
Distance from highway	<i>0.80 km</i>
Distance from town	<i>1.0 km</i>
Natural Vegetation	<i>Broad leaf forest</i>
Cropping system	<i>Summer (Paddy), Winter (vegetable)</i>
Climatic information	<i>NA</i>
Existing Infrastructure	<i>Approach road, irrigation, electricity, terraced land, nearby RNR RDSC-Tsirang.</i>
Distance from irrigation water	<i>500 m</i>
Irrigation water source type	<i>Perennial stream</i>
Problem and constraints	

MINCHUNA, Kilkhorthang: TSIRANG

FARM AREA		
PlotID	Area (ac)	Remark
Plot-A	2.830	Fallow
Total	2.830	
Perimeter(m)	460	

RDSC
Tsirang
Farm
Plots

Plot-a

RDSC
Tsirang
Farm
Plots

RDSC
Tsirang
Farm
Plots

LEGEND

- Farm Boundary
- Plot Boundary
- Irrigation Channel- Main
- Irrigation Channel- Distribution
- TRSC Tsirang Farm Fencing
- River
- Footpath
- Farm Road
- Highway
- Electric Post

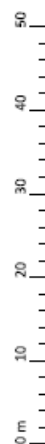


Figure 16-1: Farm map for proposed Minchuna Farm under Kilkhorthang Geog, Tsirang.

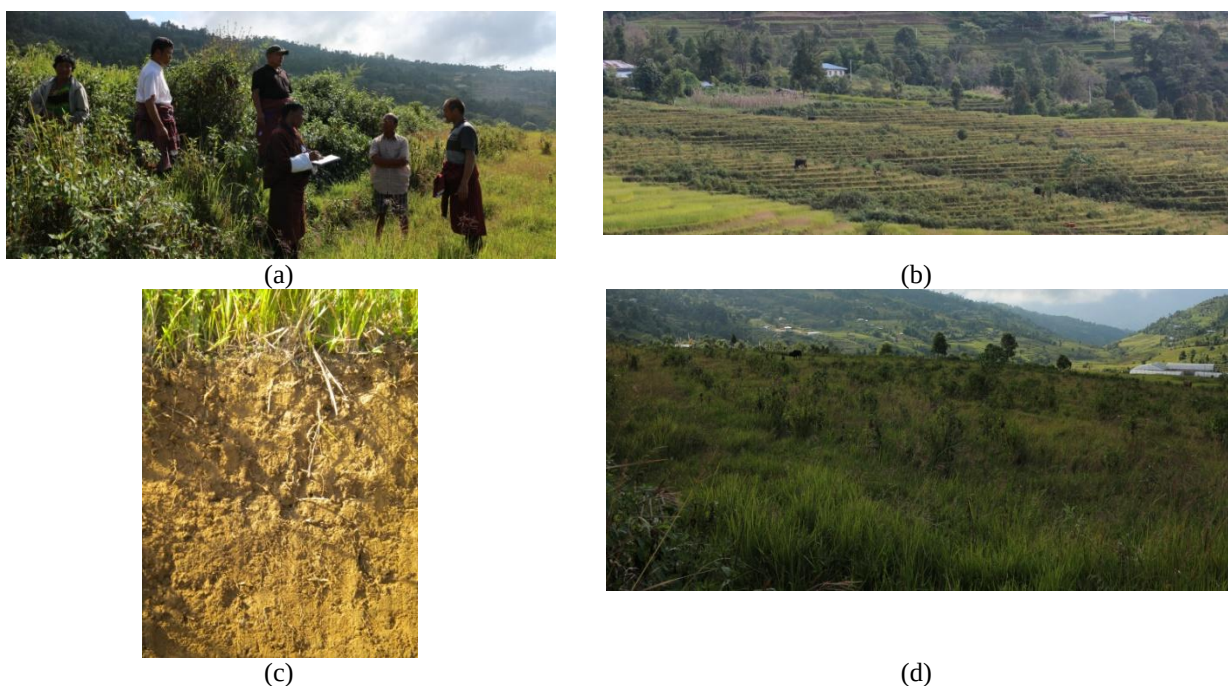


Figure 16-2: Farm map for proposed Minchuna Farm under Kilkhorthang Geog, Tsirang.

(a) A field interview with the owner of the fallow land by the team, (b) A view of the fallow land from RDSC Mithum The land is spotted with some cattle grazing; (c) The soil profile is deep at site, and (d) The other view of the fallow land. National Citrus repository is also captured in the picture.

16.2 Climatic conditions

Meteorological data was collected from Damphu weather station and the climate data for this site is very reliable as the indentified fallow farm is reasonably to the weather station. The rainfall pattern is monomodal with maximum rainfall occurring from the month of April to October, whilst the least quantity of rainfall occurs in months of January, February, March, November and December. The annual total rainfall is estimated for the site to be 1467 mm. The maximum and minimum temperatures are most favourable for growing crops from the month of March to November; however temperatures are colder in January, February and December.

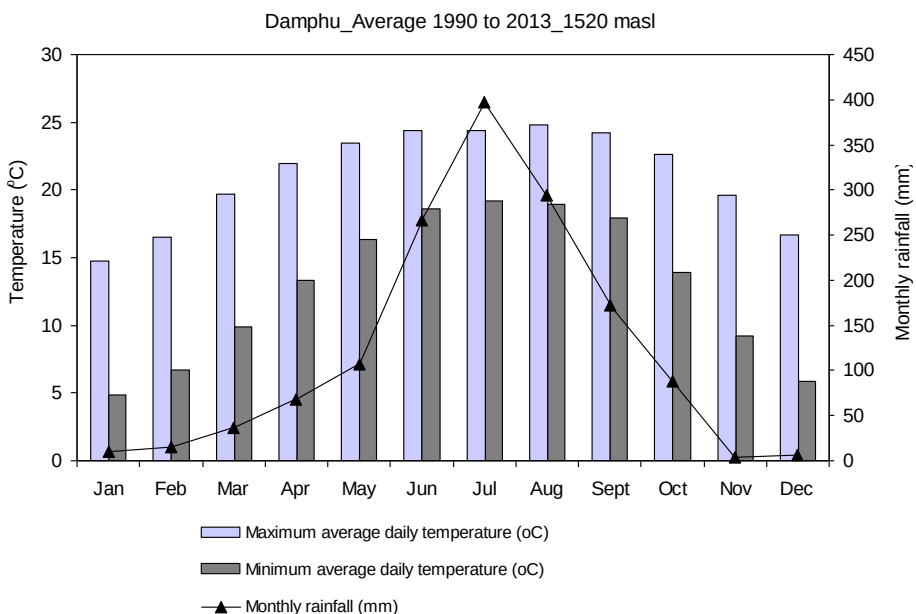


Figure 16-3: Climatic information for proposed Minchuna Farm under Kilkhorthang Geog, Tsirang.

16.3 Proposed Crops

The land is feasible for both summer and winter vegetable crops. Among the vegetables, the following crops are selected based on climatic suitability, production, market demand and income from their sale.

Summer crop: Chili, ginger, Brinjal, carrot, ladies finger, legumes (mung bean)

Winter: cabbage, broccoli, cauliflower, mustard green, garlic, radish, lettuce, carrot, onion,

Feasible Fruit crops: Cardamom, Avocado, Melon, Pear, Persimmon, Kiwi, and Grapes

However, for immediate economic gain, we propose cultivation of seasonal vegetables. Of the total farm area, the land can be divided to grow the summer and winter vegetables as follows:

Table 16-2: Recommended crops for Minchuna Farm under Kilkhorthang Geog, Tsirang.

Summer		Winter	
Crop	Area (ac)	Crop	Area (ac)
Beans	0.50	Broccoli	0.25
Chili- dolly	0.50	Cabbage	0.20
Carrot	0.50	Cauliflower	0.25
Egg plant	0.25	Garlic	0.50
Ginger	0.50	Mustard green	0.50
Okra	0.25	Pea	1.00
Tomato	0.30	Tomato	0.10
Total	2.80	Total	2.80

16.4 Cropping calendar

The cropping calendar for different vegetables is presented in the Table below.

Table 16-3: Cropping calendar for Minchuna Farm under Kilkhorthang Geog, Tsirang.

Vegetable	Growing season													
	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec		
Cabbage			SOWING											
						HARVESTING								
Cauliflower			S											
Broccoli			S											
Tomato		S								S				
Egg plant			S											
Chili			S											
Onion									S					
Pea		S												
Beans			S			S								
Radish			S											
Carrot				S										
Cucumber			S											
Mustard green									S					
Garlic									S					
Okra						S								
Ginger			S											
Coriander								S						
Cucumber			S											

16.5 Inputs required

The most basic inputs required for cultivation include: seeds or seedlings, manures, fertilizers and labor days. The table below provides information on inputs.

Table 16-4: Farm production inputs and expected yields for Minchuna Farm, Kilkhorthang Geog, Tsirang.

Crop	Seed rate (per ac)	FYM (MT/ac)	Fertilizer rate (kg/ac)				Labour (day/ac)	Yield (kg/ac)
			Urea	SSP	MoP	Suphala		
Chili	300 gm	8.0	100.0	150.0	25.0	0.0	84.4	1038.9
Tomato	160 gm	8.0	77.0	125.0	17.0	0.0	108.6	1570.0
Beans	20.0 kg	2.6	22.0	187.5	0.0	0.0	59.6	1184.0
Egg plant	300 gm	8.0	70.0	175.0	20.0	0.0	80.0	1200.0
Garlic	175.7 kg	4.8	65.0	100.0	0	0.0	59.1	660.0
Pea	40.0 kg	5.2	44.0	187.5	50.0	0.0	51.8	1362.0
Cabbage	300 gm	7.4	75.0	150.0	25.0	0.0	68.3	2790.0
Cauliflower	180 gm	5.5	75.0	150.0	25.0	0.0	74.6	1350.0
Broccoli	180 gm	7.9	75.0	150.0	25.0	0.0	70.9	817.5
Leafy Greens	1.0 kg	8.0	44.0	0	0	0	47.2	2106.1
Okra	8.0 kg	6.0	87.0	120.0	0	0	53.4	1007.7
Ginger	554.1 kg	5.6	65.0	100.0	0.0	0.0	60.9	2724.4

16.6 Long term investment plan (Capital investment)

Table 16-5: Capital investment required for Minchuna Farm under Kilkhorthang Geog, Tsirang.

SN	Farm infrastructure	Qty/unit	Rate	Amount	Remark
1	Electric fencing	460 m	23.82	10,958	From detail estimate
2	Irrigation- Intake	1 No	10,000.00	10,000	Lump sum
3	Irrigation- Conveyance (50mm HDPE pipe)	693 m	235.21	163,000	BSR item code PO0018
4	Irrigation- Storage	50 cu.m	11,300.00	565,000	Based on RDC Bajo tank
5	Irrigation- Application (sprinkler)	2.83 acre	100,000.00	283,000	
6	Road- Approach (5m wide)	210 m	425.72	89,401	Formation cutting- earth
7	Road- Internal farm road (4m wide)	300 m	222.10	66,630	Formation cutting- earth
8	Land Development	2.83 acre	20,000.00	56,600	
9	Infrastructure- Office	1 Block	200,000.00	200,000	
10	Infrastructure- Huts	5 Block	50,000.00	250,000	
11	Infrastructure- Store	1 Block	100,000.00	100,000	
12	Infrastructure- Processing shed	1 Block	150,000.00	150,000	
13	Green house	1 Block	70,000.00	70,000	
A	Total			2,014,589	
B	Unit cost (Nu per acre)			711,869	

16.7 Economics of the farm

Basic crop production economics and farm profitability are calculated and shown in the table below.

Table 16-6: Farm production economics for Minchuna Farm under Kilkhorthang Geog, Tsirang.

Crop	Yield (kg/ac)	Production cost		Area (ac)	Production (kg/yr)	Cost (Nu/yr)	M-price (Nu/kg)	Income (Nu/yr)	Net Profit (Nu/yr)
		(Nu/kg)	(Nu/ac)						
Chili	1038.9	34.3	35645.0	0.5	519.5	17822.5	80.0	41556.4	23733.9
Carrot	1679.0	15.1	25369.7	0.5	839.5	12684.8	29.2	24547.0	11862.1
Egg plant	1200.0	20.0	24000.0	0.3	300.0	6000.0	32.0	9600.0	3600.0
Beans	1184.0	24.2	28664.6	0.5	592.0	14332.3	35.7	21152.2	6819.8
Broccoli	817.5	41.5	33909.9	0.3	204.4	8477.5	60.0	12262.5	3785.0
Garlic	660.0	44.3	29205.0	0.5	330.0	14602.5	86.0	28380.0	13777.5
Pea	1362.0	19.3	26327.5	1.0	1362.0	26327.5	45.0	61290.0	34962.5
Cabbage	2790.0	10.0	27900.0	0.2	558.0	5580.0	20.7	11539.4	5959.4
Cauliflower	1350.0	24.1	32494.5	0.5	675.0	16247.3	45.0	30375.0	14127.8
Okra	1007.7	26.0	26169.7	0.3	251.9	6542.4	40.0	10076.9	3534.5
Ginger	2724.4	15.2	41328.8	0.9	2315.7	35129.5	50.0	115786.2	80656.6
Leafy green	2106.1	11.9	25041.4	0.5	1053.0	12520.7	16.3	17206.8	4686.1
Total				6.0		176267.0		383772.3	207505.3

- Estimation of costs and profits and evaluation of the economic feasibility of production techniques are aspects of the management of a farm as a business enterprise.
- Production economics of the selected crops are computed for two season summer and winter.
- Cost of production calculation is based on Vegetable Production Economics conducted by Horticulture Division, DoA, MoAF. For land preparation, ploughing power tiller present government rate is use for the farm machineries rate. Market price is taken at prevailing market wholesale rate. Labours cost is kept at Nu 340 per day which includes meals and refreshment.
- The gross value of production is calculated based on the average yield of vegetables in Bhutan (Agriculture Statistics, 2014).
- The production cost involve materials inputs like seeds, manures, chemical fertilizers, plant protection and tools and labour inputs involved for production of the crop in each season.
- The total production cost incurred for production of the selected crops per year is computed at Nu. **176267.0**. The total income that will be generated from the farm is computed at Nu. **383772.3** per year and the net profit is Nu. **207505.3** per year from farm.

17 Site Profile 11: Hebesa, Wangdue

17.1 Site Information

Table 17-1: Site information for proposed Hebesa Farm under Gasetsho-om Geog, Wangdue.

Name of land owner	<i>Singay Dorji, Kinley Om and Namgay Wangchuk (Dratsang Thram#309,310 and 311)</i>
Total area	<i>25.0 acres</i>
Dzongkhag	<i>Wangdue</i>
Geog	<i>Gasestho-om</i>
Chewog	<i>Hebesa</i>
Location	<i>Hebesa</i>
Altitude	<i>1650 m</i>
Land aspect	<i>South East facing, Slope 10% average</i>
Land type	<i>Fallow</i>
Land status	<i>Dratshang, leased in</i>
Land Tenancy	<i>Leased in</i>
Soil type	<i>Silty loam</i>
Distance from highway	<i>7.0 km</i>
Distance from town	<i>27.0 km Bajo Town</i>
Natural Vegetation	<i>Broad leaf (deciduous)</i>
Cropping system	<i>Paddy-fallow, Potato-Paddy, Paddy –Wheat, Paddy – Mustard, vegetable</i>
Climatic information	<i>5-25 °C. High humidity in summer, frost free in winter, high rainfall in summer.</i>
Existing Infrastructure	<i>Farm road connected, fenced, land development needs to be done, irrigation existing but needs renovation, temporarily connected with electricity. Majority of the area is plane.</i>
Distance from irrigation water	<i>15.0 km</i>
Irrigation water source type	<i>Stream</i>
Problem and constraints	<i>Capital, Wild animal and labor shortage</i>

A total area of 44 acres had been leased in for commercial agriculture. However the BoIC did not fund as promised and hence the whole of the area cannot be taken up by the group of three people due to capital constraint. Thus it had been decided to seek support for the 25 acres out of the total of 44 acres.

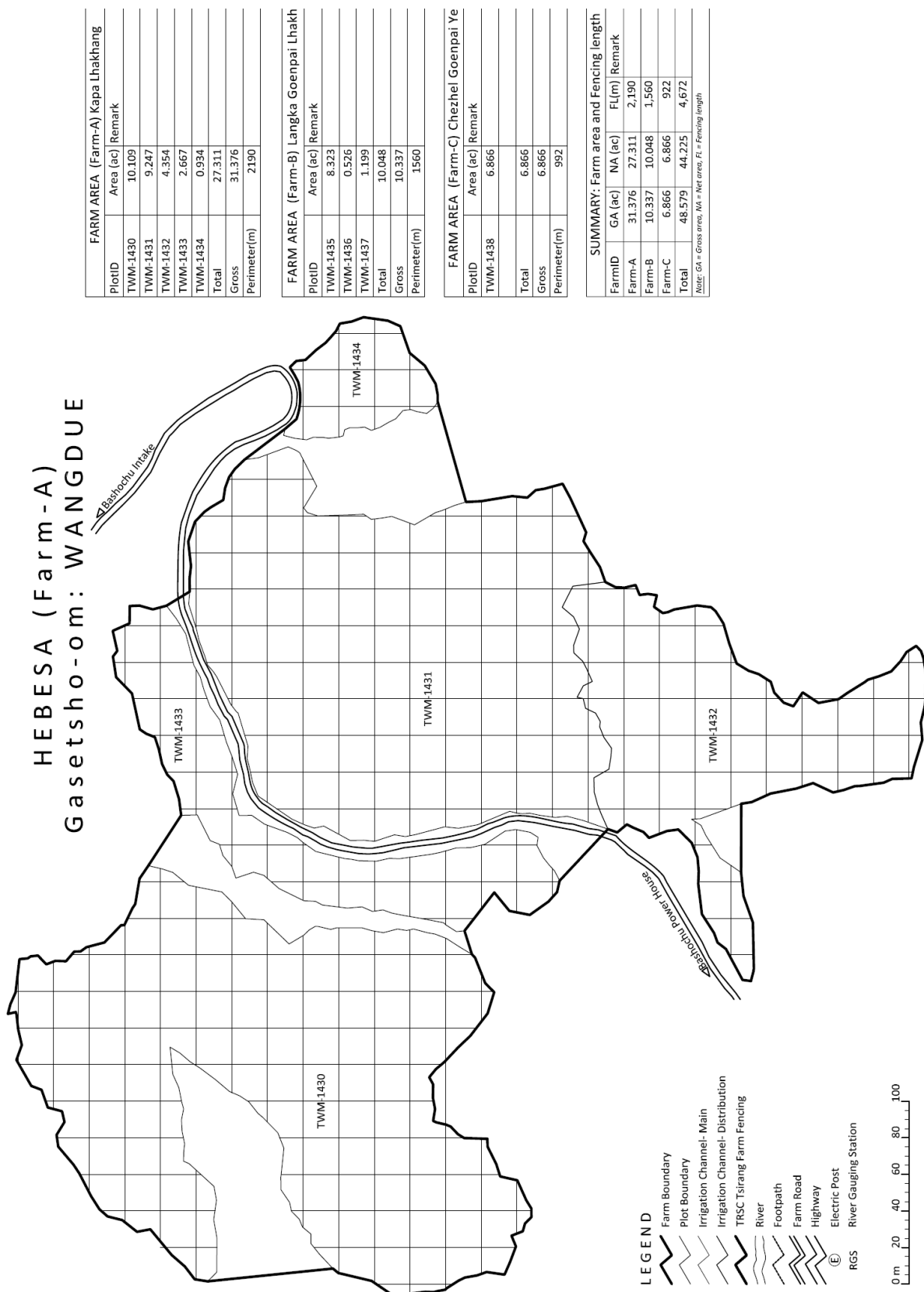


Figure 17-1: Hebesa Farm map- Farm-A under Gasetsho-om Geog, Wangdue.

HEBESA (Farm-B) Gasetsho-om: WANGDUE

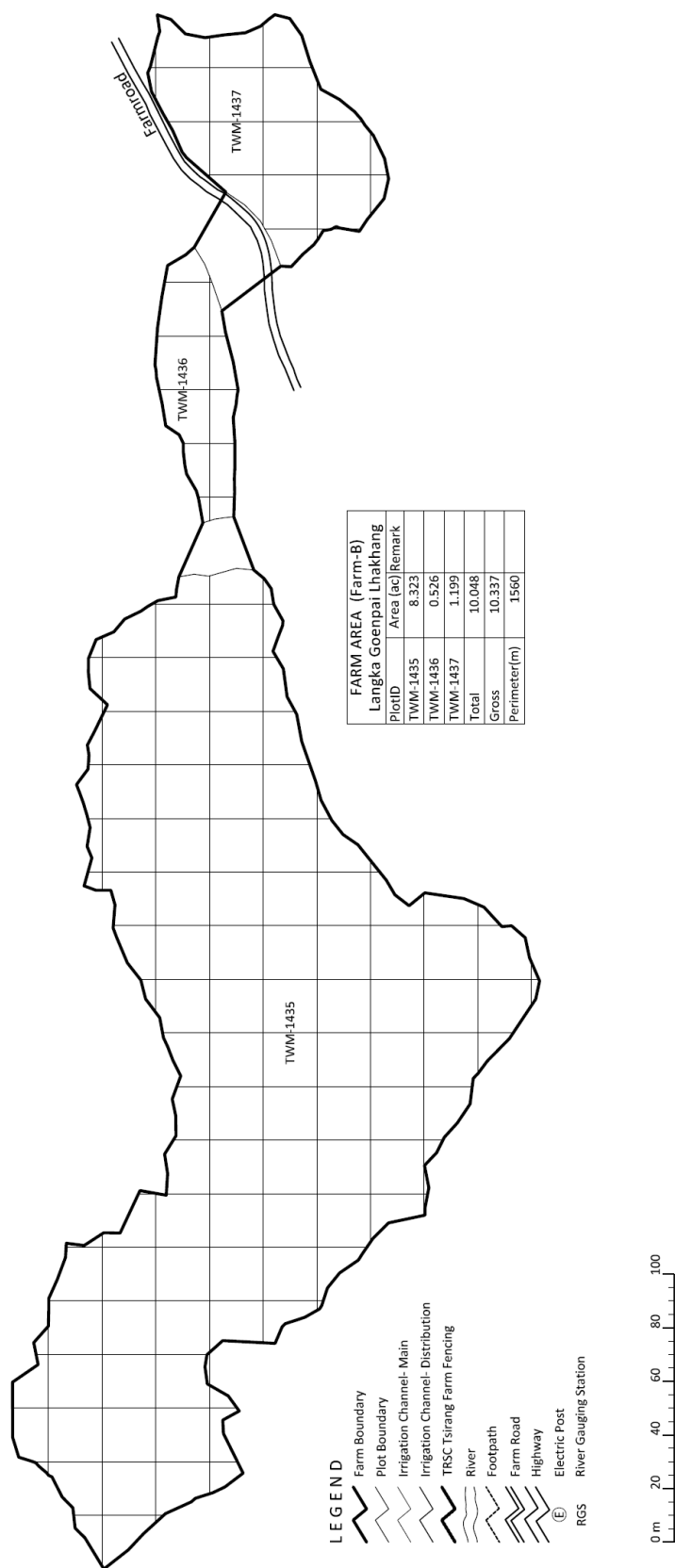


Figure 17-2: Hebesa Farm map- Farm-B under Gasetsho-om Geog, Wangdue.

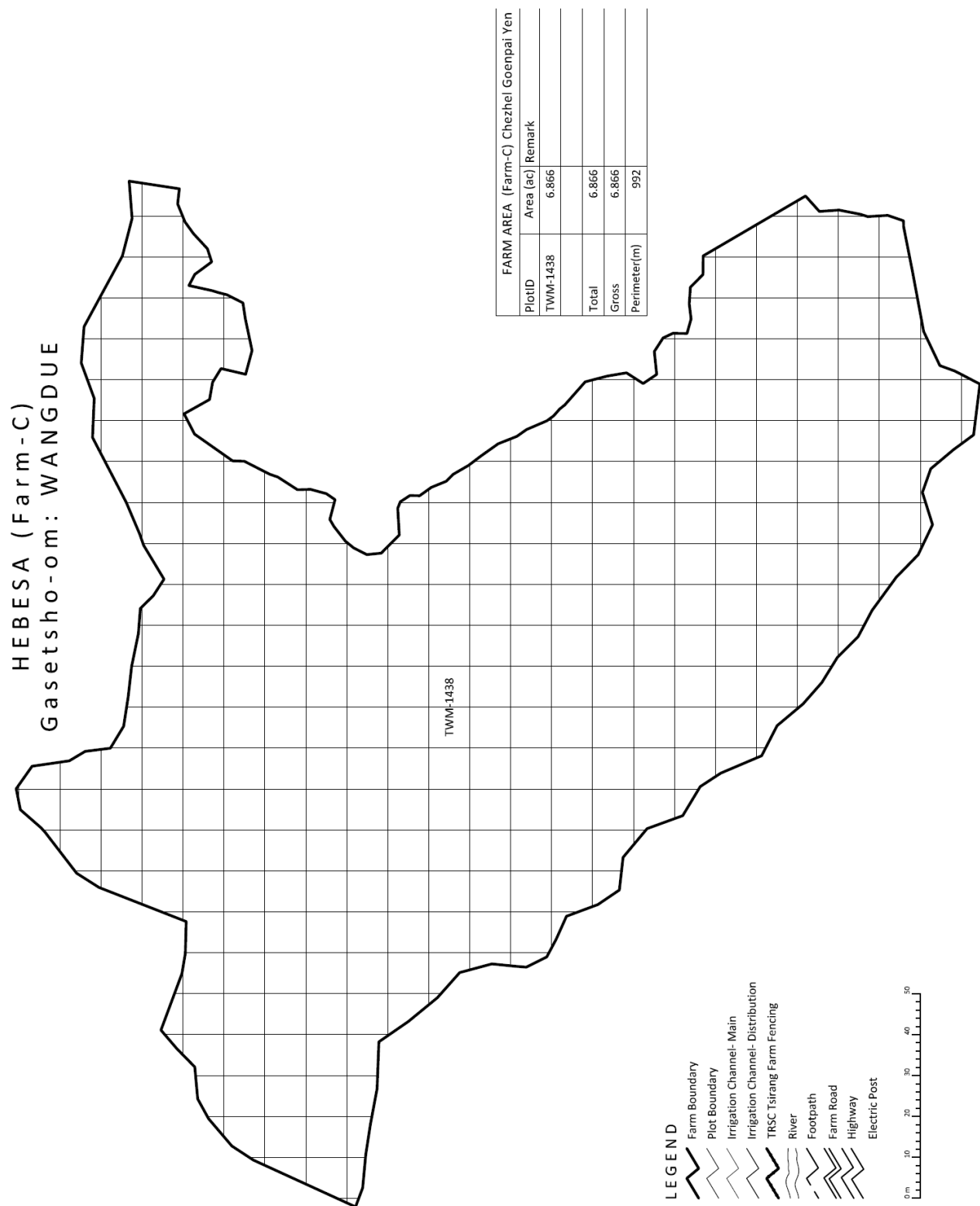


Figure 17-3: Hebesa Farm map- Farm-C under Gasetsho-om Geog, Wangdue.

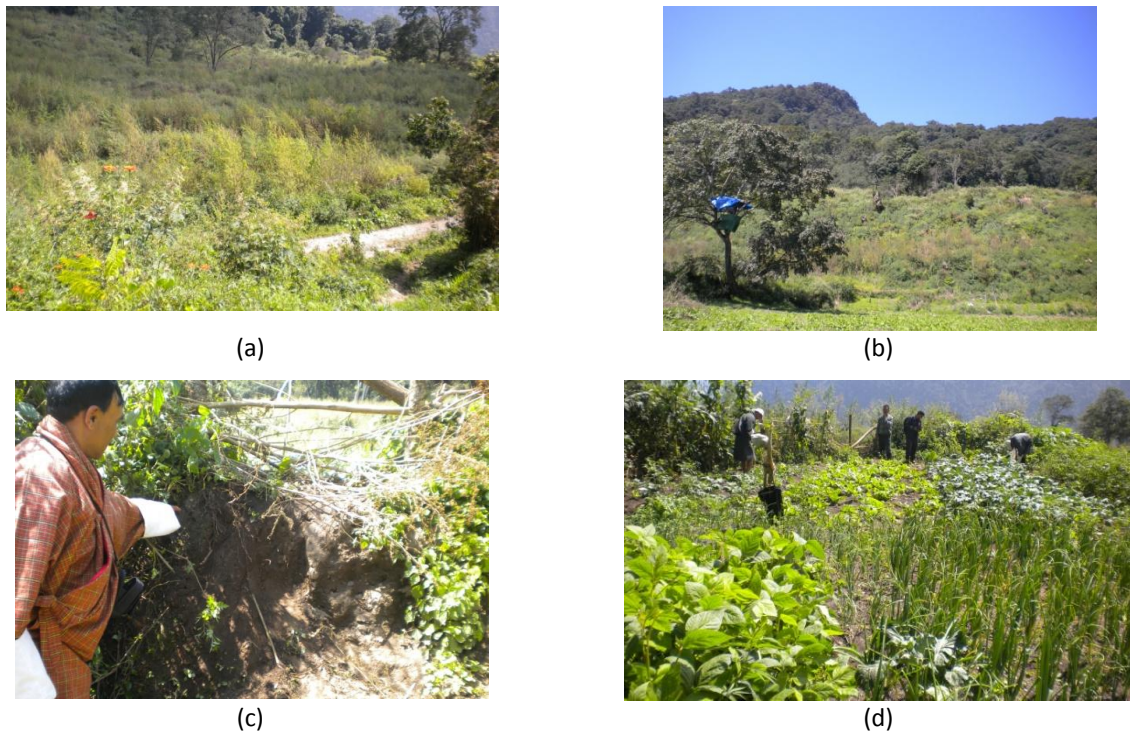


Figure 17-4: Pictorial view of Hebesa farm.

(a) A farm view of the lower site of the fallow land. The motorable runs through the farm, (b) A view in the upper side of the farm. A tree house to guard wild animals is also seen, (c) A deep soil profile is observed and (d) Team members inspect the assorted vegetables grown

17.2 Climatic conditions

Meteorological data was collected Gaselo weather station which is the nearest weather station from the identified fallow land for commercial agriculture. The rainfall pattern is monomodal with

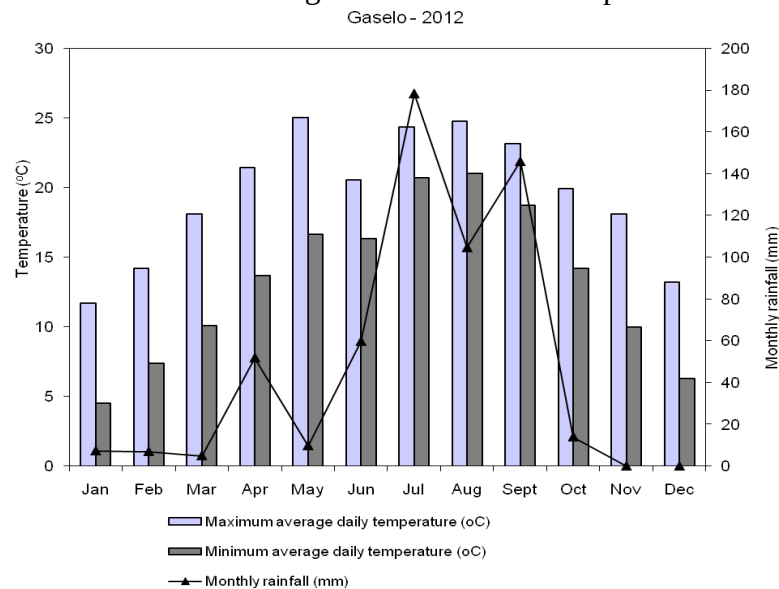


Figure 17-5: Climate information for Hebesa Farm, Gasetsho-om Geog Wangdue

maximum rainfall occurring from the months of April to October, whilst the least quantity of rainfall occurs in months of January, February, November and December. The annual total rainfall is estimated for the site to be 583 mm. The Maximum and minimum temperatures are most favourable for growing crops from the month of March to November, however temperatures are colder in January, February and December.

17.3 Long term investment plan (Capital investment)

Table 17-2: Capital investment required for Hebesa Farm-A under Gasetsho-om Geog, Wangdue.

SN	Farm infrastructure	Qty/unit	Rate	Amount	Remark
1	Electric fencing	2,190 m	36.59	80,125	From detail estimate
2	Irrigation- Intake	1 No	10,000.00	10,000	Lump sum
3	Irrigation- Conveyance (50mm HDPE pipe)	10 m	235.21	2,352	BSR item code PO0018
4	Irrigation- Storage	100 cu.m	11,300.00	1,130,000	Based on RDC Bajo tank
5	Irrigation- Application (sprinkler)	27.00 acre	100,000.00	2,700,000	
6	Road- Approach (5m wide)	0 m	425.72	0	Formation cutting- earth
7	Road- Internal farm road (4m wide)	100 m	222.10	22,210	Formation cutting- earth
8	Land Development	10 acre	20,000.00	200,000	
9	Infrastructure- Office	1 Block	200,000.00	200,000	
10	Infrastructure- Huts	10 Block	50,000.00	500,000	
11	Infrastructure- Store	4 Block	100,000.00	400,000	
12	Infrastructure- Processing shed	4 Block	150,000.00	600,000	
13	Green house	6 Block	70,000.00	420,000	
A	Total			6,264,687	
B	Unit cost (Nu per acre)			232,025	

Table 17-3: Capital investment required for Hebesa Farm-B under Gasetsho-om Geog, Wangdue.

SN	Farm infrastructure	Qty/unit	Rate	Amount	Remark
1	Electric fencing	1,560 m	42.90	66,916	From detail estimate
2	Irrigation- Intake	1 No	10,000.00	10,000	Lump sum
3	Irrigation- Conveyance (50mm HDPE pipe)	10 m	235.21	2,352	BSR item code PO0018
4	Irrigation- Storage	20 cu.m	11,300.00	226,000	Based on RDC Bajo tank
5	Irrigation- Application (sprinkler)	10.00 acre	100,000.00	1,000,000	
6	Road- Approach (5m wide)	50 m	425.72	21,286	Formation cutting- earth
7	Road- Internal farm road (4m wide)	200 m	222.10	44,420	Formation cutting- earth
8	Land Development	10 acre	20,000.00	200,000	
9	Infrastructure- Office	0 Block	200,000.00	0	
10	Infrastructure- Huts	3 Block	50,000.00	150,000	
11	Infrastructure- Store	1 Block	100,000.00	100,000	
12	Infrastructure- Processing shed	1 Block	150,000.00	150,000	
13	Green house	2 Block	70,000.00	140,000	
A	Total			2,110,974	
B	Unit cost (Nu per acre)			211,097	

Table 17-4: Capital investment required for Hebesa Farm-C under Gasetsho-om Geog, Wangdue.

SN	Farm infrastructure	Qty/unit	Rate	Amount	Remark
1	Electric fencing	992 m	55.37	54,931	From detail estimate
2	Irrigation- Intake	1 No	10,000.00	10,000	Lump sum
3	Irrigation- Conveyance (50mm HDPE pipe)	10 m	235.21	2,352	BSR item code PO0018
4	Irrigation- Storage	10 cu.m	11,300.00	113,000	Based on RDC Bajo tank
5	Irrigation- Application (sprinkler)	6.87 acre	100,000.00	687,000	
6	Road- Approach (5m wide)	50 m	425.72	21,286	Formation cutting- earth
7	Road- Internal farm road (4m wide)	100 m	222.10	22,210	Formation cutting- earth
8	Land Development	10 acre	20,000.00	200,000	
9	Infrastructure- Office	0 Block	200,000.00	0	
10	Infrastructure- Huts	3 Block	50,000.00	150,000	
11	Infrastructure- Store	1 Block	100,000.00	100,000	
12	Infrastructure- Processing shed	1 Block	150,000.00	150,000	
13	Green house	2 Block	70,000.00	140,000	
A	Total			1,650,779	
B	Unit cost (Nu per acre)			240,288	

17.1 Proposed Crops

The area has a mild sub-tropical climate that supports cultivation of several different crops. Both summer and winter vegetable crops can be successfully grown. Among the vegetables, the following crops are selected based on climatic suitability, production, market demand and income from their sale.

Summer crop: Onion, green vegetables, chili (dalley), tomato, okra, beans, ginger, Asparagus

Winter: Pea, beans, garlic, radish, coriander, cauliflower, Potato, Broccoli, cabbage

Fruit crop: Kiwi, Passion fruits, Cardamom, Avocado, Soft shell walnut, Pear, Peach, persimmon

However, to get the farm started we recommend to go for vegetable production. The farm has a total area of 25 acre. It can be divided to grow the following crops:

Table 17-5: Recommended crops for Hebesa Farm under Gasetsho-om Geog, Wangdue.

Summer		Winter	
Crop	Area (ac)	Crop	Area (ac)
Beans	3.0	Beans	2.0
Bitter guard	2.0	Cabbage	4.0
Carrot	3.0	Carrot	4.0
Chili	3.0	Cauliflower	2.0
Egg plant	1.0	Coriander	0.5
Ginger	8.0	Garlic	4.0
Okra	1.0	Leafy greens	2.0
Onion	3.0	Pea	4.0
Spinach	1.0	Radish	3.5
Tomato	3.0		
Total	28.0	Total	26.0

17.2 Cropping calendar

The following cropping calendar for different vegetables (Table) should be followed.

Table 17-6: Proposed cropping calendar for Hebesa farm, Gasetsho-om Geog, Wangdue

Vegetable	Growing season											
	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Cabbage								SOWING				
	HARVESTING											
Cauliflower									H			
Broccoli		S							H			
Tomato		S								H		
Egg plant		S										
Chili						S						
Onion									H			
Pea			S									
Beans												
Radish												
Carrot												
Cucumber												
Mustard green												
Garlic												
Okra												
Ginger												
Coriander												
Spinach												

17.3 Inputs required

The most basic inputs required for cultivation include: seeds or seedlings, manures, fertilizers and labor days. The table below provides information on inputs.

Table 17-7: Farm inputs and expected yield for Hebesa farm, Gasetsho-om Geog, Wangdue

Crop	Seed rate (per ac)	FYM (MT/ac)	Fertilizer rate (kg/ac)				Labour (day/ac)	Yield (kg/ac)
			Urea	SSP	MoP	Suphala		
Chili	300 gm	8.0	100.0	150.0	25.0	0.0	84.4	2364.0
Tomato	160 gm	8.0	77.0	125.0	17.0	0.0	108.6	2629.0
Carrot	600 gm	5.9	15.0	25.0	40.0	0.0	54.3	2600.0
Egg plant	300 gm	8.0	70.0	175.0	20.0	0.0	80.0	1200.0
Radish	4.0 kg	5.0	44.0	125.0	34.0	0.0	57.4	3143.0
Beans	20.0 kg	2.6	22.0	187.5	0.0	0.0	59.6	1700.0
Garlic	175.7 kg	4.8	65.0	100.0	0	0.0	59.1	724.0
Pea	40.0 kg	5.2	44.0	187.5	50.0	0.0	51.8	1400.0
Cabbage	300 gm	7.4	75.0	150.0	25.0	0.0	68.3	2858.0
Cauliflower	180 gm	5.5	75.0	150.0	25.0	0.0	74.6	1600.0
Onion	1.6 kg	4.3	88.0	187.5	50.0	0.0	82.7	2772.9
Leafy Greens	1.0 kg	8	44 kg	0	0	0	47.2	2106.1
Bitter gourd	2.5 kg	5	108	150	40	0	49.33	1785.8
Okra	8.0 kg	6	87	120	0	0	53.4	1007.7
Ginger	554.1 kg	5.6	65.0	100.0	0.0	0.0	60.9	2772.9

17.4 Economics of the farm

Table 17-8: Farm production economics for Hebesa farm, Gasetsho-om Geog, Wangdue.

Crop	Yield (kg/ac)	Production cost		Area (ac)	Production (kg/yr)	Cost (Nu/yr)	M-price (Nu/kg)	Income (Nu/yr)	Net Profit (Nu/yr)
		(Nu/kg)	(Nu/ac)						
Chili	2364.0	15.1	35649.1	3.0	7092.0	106947.4	50.0	354600.0	247652.6
Tomato	2629.0	16.7	43904.3	3.0	7887.0	131712.9	30.0	236610.0	104897.1
Carrot	2600.0	9.8	25376.0	4.0	10400.0	101504.0	32.0	332800.0	231296.0
Egg plant	1200.0	13.7	16380.0	1.0	1200.0	16380.0	32.0	38400.0	22020.0
Radish	3143.0	8.3	26212.6	3.5	11000.5	91744.2	15.1	165777.5	74033.4
Beans	1700.0	16.9	28662.0	4.0	6800.0	114648.0	35.7	242964.0	128316.0
Garlic	724.0	46.7	33810.8	4.0	2896.0	135243.2	86.0	249056.0	113812.8
Pea	1400.0	18.8	26334.0	4.0	5600.0	105336.0	39.6	221928.0	116592.0
Cabbage	2858.0	9.8	27894.1	4.0	11432.0	111576.3	20.7	236413.8	124837.4
Cauliflower	1600.0	20.3	32496.0	2.0	3200.0	64992.0	45.0	144000.0	79008.0
Onion	1100.0	31.5	34650.0	3.0	3300.0	103950.0	40.0	132000.0	28050.0
Ginger	2772.9	17.7	48941.2	8.0	22183.0	391529.2	80.0	1774636.8	1383107.6
Bitter guard	1785.8	13.3	23787.0	2.0	3571.6	47573.9	31.1	110970.1	63396.2
Okra	1007.7	24.0	24154.3	1.0	1007.7	24154.3	40.0	40307.6	16153.3
Leafy greens	2106.1	10.2	21376.8	3.5	7371.3	74818.8	16.3	120447.3	45628.4
Total				50.0		1622110.3		4400911.1	2778800.8

- Estimation of costs and profits and evaluation of the economic feasibility of production techniques are aspects of the management of a farm as a business enterprise.
- Production economics of the selected crops are computed for two season summer and winter.
- Cost of production calculation is based on Vegetable Production Economics conducted by Horticulture Division, DoA, MoAF. For land preparation, ploughing power tiller present government rate is use for the farm machineries rate. Market price is taken at prevailing market wholesale rate. Labours cost is kept at Nu 340 per day which includes meals and refreshment.
- The gross value of production is calculated based on the average yield of vegetables in Bhutan (Agriculture Statistics, 2014).
- The production cost involve materials inputs like seeds, manures, chemical fertilizers, plant protection and tools and labour inputs involved for production of the crop in each season.
- The total production cost incurred for production of the selected crops per year is computed at Nu. **1622110.3** The total income that will be generated from the farm is computed at Nu. **4400911.1** per year and the net profit is Nu. **2778800.8** per year from