

Economic Analysis on Crop Diversification of Farm households in the Selected Township, Southern Shan State

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Abstract

The purpose of this study was to identify the degree of crop diversification and socio-economic status of farm households to measure marginal analysis on crop diversification in Taunggyi district, Southern Shan State in 2013. A simple random sampling technique was used to sample size of 150 farm households with structured questionnaires. Herfindahl method (H_d) was employed to compute the diversification index. Data were analysed by using descriptive statistics and gross margin analysis to measure the profits of crop production.

The results revealed 60% and 40% of farm households in specialized farming and diversified farming, respectively. Finding could be interpreted as decrease intensification of crop diversification among farm households. Crop diversification index showed that an average index was 0.81 and 0.39 in low and high diversified group, respectively. About 77.7% and 83.3% of household heads in low and high diversified groups were males. Average family size in both groups was 5 persons family⁻¹. Most of low farm household heads (76.7%) had only primary education. High farm household heads (35%) had primary education as well as higher education. In addition, 31.3% of low and 29.7% of high farm households received formal credit and 13.1% of low and 9.4% of high farm households received credit from UNDP. Findings indicated that 68% of low farm households cultivated comparatively small land area than high diversified group. Rice-based and maize-based cropping patterns were mainly practiced in the study area. In Nyaung Shwe and Sesai Townships, 60% and 29% of low diversified group mostly practiced mono cropping. In Pindaya Township, 58% of high diversified group mostly practiced multiple cropping. Cropping intensity of low and high diversified groups was 109% and 133%, respectively. In gross margin analysis, the whole year round vegetables cultivation was the most profitable crop in low and high diversified groups (1.99 and 1.96 BCR). Paddy-Oilseed-vegetables cropping was the second profitable pattern with 1.81 of BCR in high diversified group. Maize, the second most profitable crop, in mono cropping was the most efficient capacity in labour used.

Introduction

The agricultural sector plays an important role in the development of Myanmar economy, through its impact on the overall economic growth. A total of 70% of the country's population in rural areas depends on agriculture for the livelihood. For that reasons, agriculture is dominant economic life of work for the rural communities and plays a vital role in the socio-economic development of these communities.

After 1994, the Myanmar was focus on market-oriented economy by favouring competitive market

and rice is mainly exported by private sector. Although agricultural sector is a top priority of the nation's economy, the agricultural activities had not been satisfactory compared to other countries' performances today. Therefore, agricultural product markets will be competitive seriously in both farm community and regional in the economic development process of nation forward other countries (Shwe Mar Than 2013). Nowadays, the chance of changing cropping diversification becomes after 2012 due to acceleration of economic growth and promoting livelihoods of rural poor in Myanmar.

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However, local farmers have low price incentives for crops by facing many constraints. Income generation arises one of the major problems to compete with other regions. Crop diversification, for that reason, becomes a strategy to maximize the use of land and other resources for the overall agricultural development.

Upland agriculture in hilly region is primarily located in the areas of low agricultural and economic potential in terms of rainfall, soils and water while agriculture for irrigation is occupied areas of high natural potential in agriculture (Tin Maung Aye 2009). A majority of farm households in upland were poor socio-economic conditions because of fragmentation of land holdings, lack of appropriate improved technologies and marketing programs that can serve as production incentives. Thus, a pattern of government's agricultural policy is required to address the problems faced in the new domestic of agricultural sector and global economic environmental and opportunities to enhance the income of the farmers.

Although the extension programs have promoted crop diversification for years, research on crop diversification in Myanmar is very limited. This is an urgent need to not only strengthening economically and viability in crop diversification but also the strategy of differentiating sources of agricultural income. Thus, this issue of crop diversification has become very crucial in the agriculture of Southern Shan State. Briefly, the objective of this study is to analyse the level of crop diversification by understanding the cropping patterns and socio-economic characteristics of farm families in the study area.

Specific Objectives

1. To identify the socio-economic characteristics and crop diversification index of farm households,
2. To analysis the gross margin of farm households in the level of crop diversification on farm income and
3. To measure the efficiency of resource used in crop diversification within the existing farming system

Methodology

This study was based on primary data collected in 2013 from Sesai, Pindaya and Nyaung Shwe Townships, Taunggyi District in Southern Shan State which grows the most various crops. A total of 150 farm households were selected by random sampling methods and interviewed using a structure questionnaires to obtain both qualitative and quantitative data. In addition, secondary data collected from various publications and records from government departments, namely, central statistical organization (CSO), department of Agriculture (DoA), Food and Agriculture Organization (FAO), internet access and so on.

Descriptive analysis was employed to analyse the socio-economic characteristics to determine the profitability and to examine the degree of crop

$$H_d = \sum_{j=1}^J \left[\frac{Y_j}{\sum_{j=1}^J Y_j} \right]^2 \quad 0 \leq H_d \leq 1$$

diversification for farm households. Firstly, the crop diversification was computed using Harfindhal Index is that the sum of the squares of the acreage/revenue proportion of each crop in total cropped area/revenue (Ogundari 2013). The following method was as following:

Where, Y_i = Income share occupied by the j^{th} crop in farm income

Y = Farm income of the households

J = Total number of crops

The index is defined as boundary by '0' (complete diversification) and '1' (complete specialization).

Secondly, according to objective (2), the net returns from various crop production activities over different farm management cost concepts were computed. Then, marginal analysis including benefit cost ratio (BCR) was determined to work out the financial viability for the profits of various crop activities. Profitability is obviously related not only to costs of production but also to revenue as the difference between revenue and costs. Gross margin will be computed at the farm level as the difference

between total revenues minus variable costs.

Results and Discussion

Crop Diversification

The farm households were classified based on the farm level diversification observed in the study area. Farm level diversification is measured by the Herfindhal Index.

It was conducted that 60% of farm households were in low diversified farming in which indices ranged from 0.5 to 1.0 and 40% of farm households indices were ranged from 0.01 to 0.49 under the high diversified farming. Average index of low diversified farm households was 0.81 and the high diversified farm households was 0.39 (Table 1).

Socio-economic characteristics

Table 2 illustrates the socio-economic charac-

teristics of farm households varied in the crop diversification. Average family size was similar in both groups with 5 members per household. Number of persons who work on farm in both groups was also the same about 2 persons per household. Average age of low diversified household heads was 47 years compared to 48 years of high diversified group. Dependency ratios were 44% and 45% in low diversified group and high diversified group, respectively.

According to the findings, 77.7% of low diversified household heads and 83.3% of high diversified household heads were males. Average education level of high diversified households and low diversified households were 2.8 and 3.1 years, respectively. It means that they were in the primary education level. About 76.6% of farm household's head in the low diversified group in primary education level compared to 35% of farm household heads in high diversified group. However, it found

Table 1. Classification of sample households by degree of diversification in the study area, 2013

Categories of Diversification	No. of households	Average Index
Low Diversification (H_d ; 0.5 – 1.0)	90 (60%)	0.81
High Diversification (H_d ; 0.0 - 0.49)	60 (40%)	0.39

H_d = Herfindahl Index

Table 2. Characteristics of farm households in the study area

Items	Low Diversified Group (n= 90)	High Diversified Group (n= 60)
Average family size	5.0	5.0
Average number of males (14- 60 years old)	2.1	2.1
Average number of females (14- 60 years old)	2	1.7
Average numbers of unemployed persons (<14 years and >60 years old)	1.8	1.7
Average age of household head (years)	47	48
Dependency ratio (%)	44	45
Male household heads (%)	77.7	83.3
Average level of education(years)	2.8	3.1
1- Primary education level	76.6	35.0
2- Secondary education level	17.8	30.0
3- Higher education level	5.6	35.0
Average years in farming experience of households	23.7	26.1
Average cultivated land area (ha)	2.01	2.94

that 5.6% of the farm household heads in low diversified group and 35% of farm households in high diversified group were in higher education level. In addition, the secondary education level was finished by 17.8% and 30% of low and high diversified groups, respectively.

Average farming experience of farm household heads in low diversified group was 23.7 years whereas high diversified group was 26.1 years. Therefore, farm households in both groups were dependent on farming as a major source of employment (Table 2). In the low diversified group, 68% of

farm households cultivated the lands between 0.2 and 2 hectares whereas 45% of household heads in high farm diversified group cultivated on that size of area. Therefore, the low farm diversified group was comprised of most of the small farm holding farmers (Table 3).

Cropping Patterns and Land Allocation in the Study Area

Table 4 revealed the cultivated area by the main crops. The important crops in the study area were maize, paddy and oilseed and vegetables in diversi-

Table 3. Cultivated area of farm households in the study area, 2013

Land area (ha)	Low Diversity Farm (n= 90)	High Diversity Farm (n= 60)
Average of cultivated land area (ha)	2.01	2.94
Percentage of farmers cultivated lands		
< 2.0ha	68.00	45.00
2.01 ha- 4.0ha	32.00	42.00
> 4.01 ha	0	13.00
Min: cultivated area (ha)	0.20	0.81
Max: cultivated area (ha)	10.12	12.15

Table 4. Average cultivated area by crop in the study area, 2013

Items	Average cultivated area (ha)	
	Low diversity group	High diversity group
Maize	2.94	1.71
Paddy	1.49	1.07
Sugarcane	0.92	0.73
Groundnut	0.54	0.60
Niger	1.62	0.81
Tomato	0.41	0.55
Mustard	0.39	0.63
Other crops	1.15	0.87

Table 5. Various cropping system by farm households in the study area, 2013

Townships	% of HH					% of Mixed	
	% of HH in LDG	%of Mono cropping	% of Double cropping	% of HH in HDG	% of triple cropping	4 crops	More 5 crops
Sesai	29	8	21	32	23	8	0
Pindaya	11	3	8	58	22	15	22
Nyaung Shwe	60	29	31	10	5	3	1
Total	100	40	60	100	50	27	23

fied cropping pattern. The average maize cultivated area were 2.94 hectares and 1.71 hectares, while the average area for paddy were about 1.5 hectares and 1.07 hectares in low and high diversified groups, respectively (Table 4). Table 5 indicated that number of crops by farm households in the study area. In the low diversity group, about 29 % of farm households in the Sesai area, 11% of low farm households in the Pindaya while 60 % of low farm households in the Nyaung Shwe cultivated mono and double crops. However, about 58 % of high farm households in the Pindaya, 32% Sesai, and 10% Nyaung Shwe cultivated more than three crops in the study area.

Cropping Intensity in Southern Shan State

According to the finding, cropping intensity of farm households were 109 % and 133 % in the low and high diversified groups, respectively (Table 6). The lower cropping intensity was attributed to the

practice of mono cropping of rice, sugarcane and maize in an entire cropping season. Because of cultivating more than one cropping pattern, total effective acreage was 197.6 hectares in the high diversified group. Therefore, it could be explained that there was a higher chance of crop diversification with increasing cropping patterns, however, lower cropping intensity was due to growing perennial crop such as sugarcane.

Credit Access

Although MADB was paying credits to farmers for monsoon rice production, the amount was insufficient to cover the requirements of crop production. Therefore, farm households had to take credit from other sources such as money lenders and relatives.

About 61% of farm households in both groups had taken credit. About 31.3% and 29.7% of farm households in low and high diversified groups, re-

Table 6. Percentage of cropping intensity of farm households in the study area, 2013

Cropping Intensity (%)	Low Diversified Group		High Diversified Group
	Mono cropping	Double cropping	Multiple cropping
Average CI (%)	109		133
CI (%)	100.00	117.00	128.94
Total Effective Area (ha)	58.90	151.90	197.60

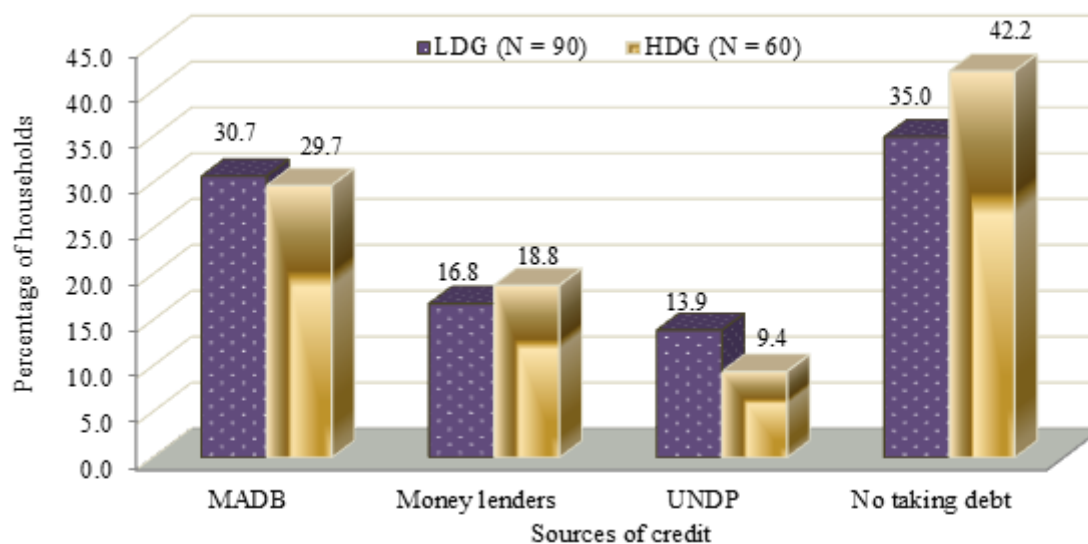


Figure 1. Credit access of farm households in the study area, 2013

spectively, received from MADB (formal credit). About 20.2% of low farm diversified households and 18.8% of high farm diversified households borrowed money from private lenders (informal credit). Moreover, 13.1% and 9.4% of total farm households in the both groups took credit from United National Develop Program (UNDP). However, 35.4% of low farm diversified households and 42.1% of high farm diversified households did not

take credit due to be risk in capital to their crop production (Figure 1).

Gross margin analysis of cropping patterns by level of diversified farm households

In gross margin analysis of low diversified

Table 7. Gross margin analysis of cropping patterns by level of low diversified farm households in the study area, 2-13

Cropping Pattern	No. of HH	(MMKs/ha)							BCR
		Gross benefit	Materials cost	Labour cost		TVC	TVCC	Net benefit	
				Family labor	Hired labor				
M+ Pi	10	595576	143233	128543	108593	380370	264448	215205	1.57
P-M	10	338801	64099	65265	78422	207787	167661	131013	1.63
P-S	10	1608896	286530	296074	252591	835195	800429	773701	1.93
P-O	4	182921	52433	64991	41990	159415	111234	23505	1.15
P-V	10	358526	103346	62316	30704	196367	121182	162158	1.83
V-V	10	915045	272076	104982	82530	459588	299036	455456	1.99

Notes: M= Maize, Pi= Pigeon pea, P= Paddy, S= Sugarcane, O= Oilseeds, V= Vegetables

Table 8. Gross margin analysis of cropping patterns by level of high diversified farm households in the study area, 2013

Cropping Pattern	N o. of HH	MMKs/ ha							BCR
		Gross benefit	Material costs	Labour cost		TVC	TVCC	Net Benefit	
				Family Labor	Hired Labor				
(M+ Pi)-O	18	469545	106313	89219	100599	296131	226050	260132	1.59
P-V-Others	5	643405	190010	84649	115207	389866	1210581	453175	1.65
V-V-V	9	1752148	566419	67864	260205	894489	829346	421889	1.96
P-(O+M)-V	15	1290661	539081	103839	112061	754982	589741	484563	1.71
P-O-V	13	1513926	545386	86232	205810	837428	962160	639090	1.81

Notes: M= Maize, Pi= Pigeon pea, P= Paddy, S= Sugarcane, O= Oilseeds, V= Vegetables

group, gross benefit was 595576 MMKs hectare⁻¹ and the average total variable cost was 380370MMKs hectare⁻¹ by growing maize with pigeon pea cropping pattern. Therefore, net benefit was positive (215205 MMKs hectare⁻¹) with 1.57 of benefit cost ratio (BCR) (table 7).

In paddy after maize mono cropping pattern, gross benefit was obtained 338801 MMKs hectare⁻¹ and total variable cost (TVC) was 207787 MMKs hectare⁻¹, respectively. Consequently, a net benefit of low diversified household was 131,013 MMKs hectare⁻¹ and positive gain with 1.63 BCR. The most profitable crop was vegetables-vegetables pattern and 915, 044 MMKs hectare⁻¹ for gross benefit with BCR (1.99). In sugarcane after paddy production, gross benefit (773701 MMKs hectare⁻¹) was the second most profitable crop with BCR (1.93) in

the low diversified group. In addition, the positive net benefit income of vegetables followed by paddy crop was obtained 162158MMKs hectare⁻¹ with 1.83 in BCR. However, oilseed followed by paddy was observed that the net benefit income was the smallest in BCR (1.15) from gross benefit 182921 MMKs hectare⁻¹ (Table 4.7).

In the high diversified group, vegetables cultivation in a whole year gained the most profit with BCR (1.96). Paddy-oilseed-vegetables was the second most profitable pattern giving 639,090 MMKs hectare⁻¹ and total variable cost was 962160 MMKs hectare⁻¹ with 1.81 of BCR. However, although maize crop took mainly dominant cultivated areas in the study area, the profit was less than other cropping patterns (Table 8).

Table 9. Value of farm production per person in low diversified farm groups in the study area, 2013

Group	Cropping Patterns	total sown area	Yield (Kg/ha)	Price (Ks/Unit)	Total value of Agri. Products (MMKs/ha)	Total labor used (md/ha)	Value of Farm Production (VFPP) (MMKs/md)
Low Diversified							
Sole crop	Maize	17.01	2108.80	393.06	828884.93	124.00	6684.56
	Paddy	29.15	2676.20	234.94	628746.43	144.29	4357.52
	Sugarcane	7.9	69270.0	40.00	2770800.00	146.35	18932.70
	Vegetable	4.06	3694.67	168.33	62251.9	138.34	4500.16
Double Cropping patterns	M+ Pi	57.92	2600.77	229.00	595576.33	91.10	6537.61
	M/ P	40.09	1318.60	256.94	338801.08	91.76	3692.25
	P/S	21.26	10825.5	148.62	1608896.21	197.28	8155.39
	P-O	7.3	666.21	274.57	182921.28	76.07	2404.64
	P-V	17.42	2252.33	159.18	358525.89	83.27	4305.58
	V-V	7.09	3244.84	282.00	915044.88	174.87	5232.72
High Diversified Farms							
Multiple Cropping patterns	(M+ Pi)-O	121.9	1608.03	292.00	469544.76	79.25	5924.86
	P-V-	13.16	8674.00	202.00	1752148.00	119.33	14683.21
	V-V -V	23.7	4957.84	305.36	1513926.02	118.51	12774.67
	P-(M +	45.88	3174.80	202.66	643404.97	196.50	3274.33
	P-O-V	8.1	5546.46	232.70	1290661.24	146.57	8805.77

Notes: M= Maize, Pi= Pigeon pea, P= Paddy, S= Sugarcane, O= Oilseeds, V= Vegetables

Labour use Efficiency

Gross margin provided not only the profitability of the farm activities but also resource use in efficiency which is at the heart of farming. Therefore, labour use efficiency was measured by three ways; (1) value of farm production person⁻¹, (2) labour cost crop hectare⁻¹, (3) crop area person⁻¹ in this study.

In low diversified farm households, total labour used for maize was 124.00 man-days hectare⁻¹. The value of farm production for a hectare was 6684.56 MMKs man-days⁻¹ for maize. It was the second most profitable crop with benefit cost ratio of 1.74. Although paddy was the most profitable crop, labour used efficiency was low compared to maize. Value of production was 4305.58 MMKs man-days⁻¹ for vegetables after paddy cultivation in two seasons although it was the third most profitable in two crops cultivation. It expressed that farm households

were efficiently utilized in resources than other diversified farming. In high diversified farm group, one man- day of labour can produce amount of 12774.67 MMKs man-days⁻¹ in vegetables cultivation for the whole year and it was the second most profitable farming. However, the result revealed that paddy - vegetables pattern was more efficient in labour resource utilization compared to vegetables cultivation in the whole. It means that farm households more efficiently utilized resources for paddy - vegetables pattern than other diversified farming (Table 9).

The results revealed that maize, the second most profitable crop, in mono- cropping had the lowest labour cost hectare⁻¹. It means that in low diversified farm households, maize was more capacity in efficient labour used compared to other mono-cropping. Vegetable cultivation in two seasons was observed that it gave more capacity in efficient la-

Table 10. Labour cost per crop area of low diversified farm groups in the study area, 2013

Group	Cropping Patterns	Total labor Cost(MMKs/ha) (Family+ Hired)	Total labor used (md/ha)	Labour use efficiency (MMKs/ha)
Low Diversified Farms				
Sole crop	Maize	232720.31	124.00	232720.31
	Paddy	233402.38	144.29	233402.38
	Sugarcane	272207.48	146.35	272207.48
	Vegetables	358004.60	138.34	358004.60
Double Cropping patterns	M+ Pi	237136.80	91.10	237136.80
	M/ P	143688.30	91.76	143688.30
	P/S	548665.00	197.28	548665.00
	P-O	106982.40	76.07	106982.40
	P-V	193021.00	83.27	193021.00
	V-V	187512.00	174.87	187512.00
Multiple Cropping patterns	(M+ Pi)-O	189818.00	79.25	189818.00
	P - V - Others	328070.17	119.33	328070.17
	V - V - V	292042.30	118.51	292042.30
	P - (M + O) - V	199856.00	196.50	199856.00
	P - O -V	215901.02	146.57	215901.02

Notes: M= Maize, Pi= Pigeon pea, P= Paddy, S= Sugarcane, O= Oilseeds, V= Vegetables

Table 11. Crop Area per person of low diversified farm groups in the study area, 2013

Group	Cropping Patterns	total sown area (ha)	Total labour used (md/ha)	No. of man-days used	Labour use efficiency (ha/man-day)
Low Diversified farms					
Sole crop	Maize	17.01	124.00	2109.24	0.0081
	Paddy	29.15	144.29	4206.05	0.0069
	Sugarcane	7.90	146.35	1156.17	0.0068
	Vegetables	4.06	138.34	561.66	0.0072
Double Cropping patterns	M+ Pi	57.92	91.10	5276.51	0.0110
	M/ P	40.09	91.76	3678.66	0.0109
	P/S	21.26	197.28	4194.17	0.0051
	P-O	7.30	76.07	555.31	0.0131
	P-V	17.42	83.27	1450.56	0.0120
	V-V	7.09	174.87	1239.83	0.0057
High Diversified Farms					
Multiple Cropping patterns	(M+ Pi)-O	121.90	79.25	9660.58	0.0126
	P - V – Others	13.16	119.33	1570.38	0.0084
	V - V - V	23.70	118.51	2808.69	0.0084
	P - (M + O) - V	45.88	196.5	9015.42	0.0051
	P - O -V	8.10	146.57	1187.22	0.0068

Notes: M= Maize, Pi= Pigeon pea, P= Paddy, S= Sugarcane, O= Oilseeds, V= Vegetables

bour used for low diversified farm households. In high diversified farm group, vegetables cultivation, the most profitable crops in the whole year, was required to be efficient in labour used compared to paddy - oilseeds - vegetables pattern, the second most profitable crops. (Maize + pigeon pea) - Oilseeds pattern was the most capacity in efficient labour used. Whereas, it was the lowest profitable activity, therefore, it implies that it was needed to be efficient labour used at low costs in the high diversified farm households group (Table 10).

Results revealed that capacity of labour used in maize production was the highest for low diversified farm households. It implies that it was the most efficient capacity in labour used for maize in mono crop although it was the second most profitable crop. Paddy-vegetable pattern was the highest crop productivity person⁻¹ with 0.012 hectare man-day⁻¹ and 1.83 of BCR. It was the most efficiency in la-

bour used (83.27 man-days hectare⁻¹) compared to vegetable cultivation (174.87 man-days hectare⁻¹), the most profitable crop in two seasons. It implies that paddy- vegetables pattern was more efficient in capacity resource used compared to vegetables in the whole year for low farm households group. Paddy-vegetable-other crops and vegetables in the whole year pattern were equal in capacity of labour used amount of 0.0084 hectare man-day⁻¹ in the high diversified farm group. However, their BCR were different (Table 11).

Conclusion and policy implication

According to the summarizing the results and gross margin analysis, vegetables cultivation around the year gained the most profit with benefit cost ratio (BCR) 1.99 and 1.96, respectively, in both groups. Then, paddy-oilseed-vegetables pattern was

the second most profitable cropping with 1.81 of BCR for high diversified group. However, capacity of labour used in crop production should be efficient for both farm households. Therefore, proper improved and efficient technologies with low cost production should be considered to increase efficiency of crop diversification at farm level. In addition, planners should always focus on the design and implementation of crop diversification to increase national food sufficiency in future.

The economics of crop diversification revealed that vegetables cropping pattern generated a higher rate of return as compared to other cropping patterns in both diversified farm households. However, in both groups, there is absolutely no processing of the vegetables products, all of their products are sold immediately to the local as well as domestic market. Therefore, access to market information is needed to be given attention for farm households for avoiding risk and to ensure a better farm returns. Farm machinery especially processing machine should be provided through easy loan schemes and investment in postharvest technology projects which would also save the farm household's income. In addition, farm infrastructures like farm to market roads and access to market are essential to play major role in enhancing crop diversification among rural farm households in the study areas.

Policy makers should give priority for conducting special education program to improve farm households' capability of decision and management of their crop production. Moreover, credit agencies should provide adequate amount of credit to support the requirements of farm households.

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