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Potentials for Agricultural Development in the Nepalese Hills

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Introduction:

Development of hill agriculture has been of critical importance to maintain the balance between deteriorating food production and increasing population in Nepal. Due care and importance are needed to maintain regional balance in development equity, social justice and employment as well.

Nepal's hill agriculture development potentials in detail have not been explored yet, though in the neighbouring countries much as India, Pakisthan, Burma, China, they have already developed a suitable strategy for deveioping their backward hill and remote areas. Of late, Nepal has begun to realise the acute problems facing the hill agriculture/1. Increasing population pressure on a limited resource base, leading to a continuous decline in agricultural production which have resulted in a lower level of income and employment levels for the hill population. This phenomenon has forced the hill people who are economically active, to leave behind their farm houses and migrate elsewhere. The other population left behind are in general the old, disabled and woman who depend partly on government subsidy programmes.

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1. "Report on Nepal Experience in Hill Agricultural Development" ADC Publication, March 1981, Kathmandu.
2. "Seminar Report on Appropriate Technology for Hill Farming System" DA/ADC/ICP, June 1981, Kathmandu.

Nepal's hill and mountain regions are inhabited by 62 percent of the total population and cover 77 percent of the total physical area. The cultivated land in these region is only 34 percent of the total. Nepal's hill area is marked by a series of clusters of mountain ranges, deep canyons, inter-mountain valleys and terraced farms located in a range of 1200 to 8840 meters above the see level.

Due to population preasure, extensive cultivation has already gone beyond ecological balance resulting in deforestation and washing away of the top fertile soil. The average family since of 6 persons has to subsist on 0.5 hectare of land. The farm out-put derived under dry farming conditions does not provide even subsistence requirements of the family. An average farmer in the hills has foodgrain available for not more than 210 days a year.

Hill Farming System:

Hill farming, in general, is a traditional mixed crop-livestock farm with fodder, fuel and fruit trees, cultivated pasture, the use of organic manure and improved eomposting as inputs to agriculture. Hill farms are often terraced and farm houses are made of local materials. Farmers live in a small micro-settlements often on top of thc hills served by a traditional market. Farmers live in joint family in the traditional environment. They grow the same kind of crops, raise the same type of livestock and enjoy doing the same kind of activities as their grand parents did many decades ago. They start work at the early morning call of cocks and take rest at sunset.

Priority is given for carrying out different farm activities by all the farm family members throughout the year. Though 2 to 3 the peak farming activities for crops spans about two months a year, some members of the family have to lock after livestock, fodder and fuel management all the year round.

Farms are scattered and tiny in size. Irrigation facilities are limited and most crops are raised under dry farms under rainfed conditions. Local manures are applied for the important summer crops. Winter cropping is raised mainly in neighbouring farm plots where family supervision can be carried out. Draft animals are used for ploughing, harvesting and threshing operations of paddy and wheat. Traditional tools and implements are manufactured by local blacksmiths and these are hand operated simple tools. Production for marketing

is limited and sale of crop and livestock is meant for meeting the cash needs of the family. During off-farm seasons, farmers take long distance trips to purchase annual requirements of clothing and other household needs, or they repair and improve their farm land, tools, farm houses and irrigation channels or sell the farm family labour in gainful employments.

Hill farming system, in general, is characterised by subfistence type 'of farming' with a little need for cash expenses.

Objectives of the Study:

Hill farming has been of critical importance in the overall strategy of agriculture development of Nepal. Though the second generation problems exist in the Terai agriculture, a bench-mark level for research, extension, marketing institutions has already been developed in that region. The present study is explicitely limited to hill agricultural production and potentialities available there.

Specific objectives of the study are:

To evaluate the present agricultural production system, in relation to crop production costs and returns;

To develop alternatives that are socially and technically acceptable.

To explore production potentials in the hill agriculrure and suggest strategies for using these potentials.

Method of the Study:

To fulfill the objectives outlined above, four villages were purposively chosen from the four development regions of the country. These villages are Bokhim in Bhojpur (eastern), Chautara in Kavre District (Central), Dahthum in Syangja district (Western), and Silgarhi in Doti Dis.rict (Far Western), all representing hill villages of the concerned districts. A brief explanation of these villages are given in Appendix-1.

A village panchayat is a cluster of 9 wards and a number of villages. A ward is a micro-settlement consisting of one or more villages. In each selected village, two wards were chosen and all the households were enumerated. These households were stratified into three

groups: the first group having less than 10 Ropanies of cultivated land, the second group having 10.1 to 20 ropanies, and the third group having more than or equal to 20.1 ropanis of land. A hectare is equivalent to 19.65 ropanies of land. Having stratified into these groups, 25 households of the total were chosen. Information about the existing state of agricultural production, potentials and types of improvement needed at the cvrrent situation was recorded in a set of questionnaire.

General Characteristics of Sample Farms:

Farm resources available in the hill farms in general, are not adequate to earn the subsistence level of income from present farming system. The resources available determine the present level of agricultural production and resource allocation.

The family size in the selected villages ranged from 6 persons in the Chautara to 10 persons in the Dahthum village. Within the selected villages, family size varied according to the size of holdings. Generally, famiiy size tended to be smaller in the lower strata of land holdings. Family members working in the farm ware 50 percent of the total family except in case of Silgarhi where more than 5o percent were working in the farm.

Table No. 1

Average Farm Size, Family Size, Literacy and Working members

Particular	Sample Villages			
	Bokhim	Chautara	Dahthum	Silgarhi
Farm Size (Ropani)	20.6	22.5	16.4	18.8
Family Size (Number)	8.0	6.0	10.0	7.0
Working Member	4.0	3.0	5.0	5.0
No. of Literates	4.0	2.0	4.0	2.0
Hired Labour days	231.0	125.0	121.0	52.0
Upland (Ropani)	4.7	16.1	7.6	12.0
Lowland (Ropani)	14·0	6.4	8.7	6.1

Average farm size in the selected villages ranged from 16.4 in Dahthum to 22.5 ropanies in Chautara. The average hill farm size in Nepal is estimated at 10 Ropanies (0.5 hectare), whereas the farm size in the present study came to about 20 ropanies. The average farm size seems to be bigger in case of the selected villages. Due to the limited coverage and purposive method of strata classification, the average farm size seems to have been inflated and does not confirm to the general hill farm size of 0.5 hectare.

Upland portion in the total farm was more than twice of the lowland in the villages of Silgarhi and Chautara. Lowland and upland ware equally distributed in case of Dahthum. Lowland is generally meant for paddy crop and upland is for maize, millet and vegetable growing.

The cropping intensity was 1.80 in three villages of Chautara, Dahthum and Silgarhi showing the maximum possible use of the land under the present technology. However, the cropping intensity was only 1. 26 in the village of Bokhim. Major crops grown were paddy, maize and millet in the summer and wheat in the winter.

Table No. 2

Area Under Crops in Ropani

Villages	Bokhim	Chautara	Dahthum	Silgarhi
Total Cultivated Land	19	20	19	20
Total Cropped Land	24	36	35	36
Poddy	13	10	7.5	10
Maize	4	13	13.0	2
Millet	3	8	12.0	10
Wheat	4	5	2.5	14
Cropping Intensity	1.26	1.80	1.84	1.80

Within the selected villages, minor crops were raised according to the soil and climate conditions. In Dahthum, ginger cultivation was found in some portion of the land. In Bokhim and Kavre, summer and winter vegetables were grown in some patches of the farm land. In Silgarhi, maize in upland was grown by few farm households only.

The major portion of the farm investment was in land ranging from 29 thousand rupees in Chautara to 97 thousand in Dahthum according to the prevailing land prices. Farm house investment was the lowest in Silgarhi with Rs. 5,211 and the highest in Chautara with Rs. 9,748. This was followed by livestock investment. In Silgarhi, Rs. 3,000 was invested in livestock and in Dahthum it was Rs. 7,618. Investment on farm tools and implements did not exceed Rs. 200 in the selected villages.

TableNo. 3

Farm Investment Pattern (Rs.)

Investment	Bokhim	Chautara	Dahthum	Silgarhi
Land (Rs.)	41,299	28,900	97,188	42,752
Livestock (Rs.)	4,103	5,103	7,618	22,631
Tools & Implements (Rs.)	160	131	99	139
Farm House (Rs.)	9,291	9,748	7,303	5,211

Table No. 4

Literacy Percentage and the Use of Improved Inputs

	Eokhim	Chautara	Dahthum	Silgarhi
No. of Households Using Improved Inputs:				
Seeds	3	19	21	6
Fertilizers	8	17	13	6
Pesticides	1	1	4	–
Tools	–	–	–	–
Reasons for not Using Improved Inputs	4*	–	–	4*

★ Lack of Capital.

In the use of modern inputs such as improved seeds and chemical fertilizer, more than 80 percent of the farmers in Chautara and Dahthum of the total selected farms were using whereas in Silgarhi and Bokhim only about 25 pereent and 12 percent respectively were using these two inputs. Major reason for not using the improved seeds and fertilizers in the latter two villages were found as lack of credit and inputs in their villages.

Costs and Returns Per Farm Household:

The existing farm plans for the crop enterprises consisting of the major crops like paddy, Maize, millet and wheat in the selected villages are presented in this section of the report. Although the average farm size in the selected villages did not vary much, the cropping intensity varied from 1.26 in Bokhim to 1.84 in Dahthum village. The major crop paddy occupied more than 50 percent of the cultivated land in three village of Bokhim, Chautara and Silgarhi, whereas this percent was lower in the village Dahthum. The other major crops were maize and millet in Chautara and Dahthum. Wheat was grown as a major and maize as minor crop in village Silgarhi.

Total cost per farm was highest in Dahthum with Rs. 6,507 and lowest in village Silgarhi with Rs. 3,405. Total costs were Rs. 4,254 in Bokhim and Rs. 4,388 in Chautara. In village Dahthum, the total fixed costs as well as variable costs were higher than in other villages. Fixed cost was comparatively higher with Rs. 3,073 in village Dahthum, mainly because of tne highest family labor cost in the fixed cost component in village Dahthum. In the variable cost expenses on hired human labor, animal labor and manures accounted for major portions of the total variable costs. Hired human labor alone constituted about 50 percent of the variable costs in village Bokhim. Animal labor use was highest in Dahthum village.

Gross value of production per farm was highest with Rs. 10,855 in village Dahthum and the lowest in village Silgarhi. The same trend was seen in case of returns over variable costs and returns over total costs in th e two villages. The farm business income as the returnt for marmer's own land, labour, capital and management was also highest in Dahthum village and the lowest in Silgarhi village (Table-5).

In addition to income obtained from these crop

avenues of income from off-farm employment, Army services and income earned by working in other's farms were also obtained during the field study. Income received by farm households from off-farm works was highest in village Silgarhi with Rs. 1924 whereas income obtained from army services and income from working in other farms was comparatively higher with Rs. 1960 and Rs. 490 respectively in Bokhim.

Total income available for farm households from crop enterprises and other sources of income as specified above, was Rs.8,185 in Dahthum, Rs. 7,798 in Bokhim, Rs. 4,581 in Silgarhi and Rs. 3,598 in village Chautara.

Table No. 5

Summary Data on Costs and Returns for a Case-study Farm in Nepal Hills

Costs and Returns (Rs.)	Bokhim	Chautara	Dahthum	Silgarhi
Variable Costs	3,052	2,429	3,434	1,932
Seeds	270	169	210	341
Manures	470	774	1,189	270
Hired Labour	1,468	682	1,008	120
Total Animal Labor	588	596	777	210
Repair Costs on Tools and Implements	32	28	4	48
Interest on V. Cost	224	180	255	143
Fixed Costs	1,202	1,959	3,073	1,473
Land Revenue	62	94	92	92
Family Labor (Rs.)	1,108	1,839	2,961	1,170
Depreciation on Farm Tools	32	26	20	210
Total Costs	4,254	4,388	6,507	3,405
Returns				
Gross value of Productions in Rs.	7,617	5,800	10,855	4,752
Ret/Var. Cost	4,574	3,371	7,421	3,000
Ret/Total Cost	3,372	1,412	4,348	1,487
Farm Business Income	4,480	3,345	7,309	2,657

Table No. 6

Per Farm Costs and Returns for Case Study Farms

Costs (Rs.)	Bokhim	Chautara	Dahthum	Silgarhi
Variable Costs	3,052	2,429	3,434	1,932
Fixed Costs	1,202	1,959	3,073	1,473
Total Costs	4,254	4,388	6,507	3,405
Returns (Rs.)				
Gross Value of Prod.	7,626	5,800	10,855	4,752
Ret/Variable Costs	4,574	3,371	7,421	3,000
Ret/Total Costs	3,372	1,412	4,348	1,487
Farm Business Income	4,480	3,345	7,309	2,657

Table No. 7

Per Farm Costs and Returns for Case Study Farm in the Selected Village

Village : Silgarhi

Costs and Returns (Rs.)	Paddy	Maize	Millet	Wheat
Area Operated (Ropani)	10	2	10	14
Seeds (Rs.)	135	8	30	168
Manures (Rs.)	–	70	–	200
Hired Labour (Rs.)	530	10	320	60
Total Animal Labour (Rs.)	70	30	60	50
Repair Costs	12	12	12	12
Interest Charges	60	10	34	39
Total Variable Cost	807	140	456	529
Land Revenue	26	5	26	36
Family Labour (Rs.)	400	170	260	340
Depreciation	84	63	21	42
Total Fixed Cost	510	238	307	418
Total Cost	1,317	378	763	947
Gross Value of production	2,100	320	732	1,600
Return/Variable Cost	1,293	180	276	1,251
Return/Total Cost	783	82	-31	653
Farm Business Income	1,183	252	229	993

Table No. 8

Per Farm Costs and Returns for a Case Study Farms

Village/Bokhim

Costs and Returns (Rs.)	Paddy	Maize	Millet	Wheat
Area Operated (Ropani)	13	4	3	4
Seeds (Rs.)	180	6	12	72
Manures (Rs.)		120	-	350
Hired Labour (Rs.)	1,170	100	90	108
Total Animal Labour (Rs.)	324	192	-	72
Repair Costs	8	8	8	8
Interest Charges	134	34	8	48
Total Variable Cost	1,816	460	118	658
Land Revenue	34	10	8	10
Family Labour (Rs.)	492	200	136	200
Depreciation	13	10	3	6
Total Fixed Cost	539	300	147	216
Total Cost	2,355	760	265	874
Gross Value of Production	4,700	1,136	930	860
Return/Variable Cost	2,884	676	812	202
Return/Total Cost	2,345	376	665	14
Farm Business Income	2,837	656	801	186

Table No. 9

Per Farm Cost and Returns for Case-Study Farms in the Selected village

Village: Chautara

Cost and Returns (Rs.)	Paddy	Maize	Millet	Wheat
Area Operated in Ropani	I0	13	3	5
Seeds (Rs.)	80	35	9	45
Manures (Rs.)	500	87	–	187
Hired Labour (Rs.)	110	154	242	176
Total Animal Labour (Rs.)	390	123	–	83
Repair Cost	7	7	7	7
Interest Charges	87	32	21	40
Total Variable Cost	1,184	451	282	543
Land Revenue	26	34	21	13
Family Labour (Rs.)	1,045	324	357	113
Depreciation Farm Tools Implements	10	8	3	5
Total Fixed Cost	1,081	336	81	131
Gross value of Production	2,760	1,120	1,120	800
Return/Variable Cost	1,586	682	841	262
Return/Total Cost	505	316	460	131
Farm Business Income	1,550	640	817	244

Table No. 10

Per Farm Cost and Returns for Case-Study Farm in the Selected Village

Village/Dahthum

Cost and Returns (Rs.)	Paddy	Maize	Millet	Wheat
Area Operated in Ropani	7.5	13	12	2.5
Seeds (Rs.)	66	62	43	300
Manures (Rs.)	67	1,100	-	22
Hired Labour (Rs.)	113	286	526	81
Total Animal Labour (Rs.)	375	312	-	90
Repair Cost	1	1	1	1
Interest Charges	50	141	46	18
Total Variable Cost	679	1,915	628	514
Land Revenue	20	34	31	7
Family Labour (Rs.)	720	806	1,364	71
Depreciation on Farm tools and Implements	8	6	2	4
Total Fixed Cost	748	846	1,397	82
Total Cost	1,420	2,748	2,015	324
Gross Value of Production	4,040	2,925	3,360	530
Return/Variable Cost	3,868	1,023	2,742	288
Return/Total Cost	2,620	177	1,345	206
Farm Business Income	3,340	983	2,709	277

Yield Varieties of Major Crops in Selected Villages:

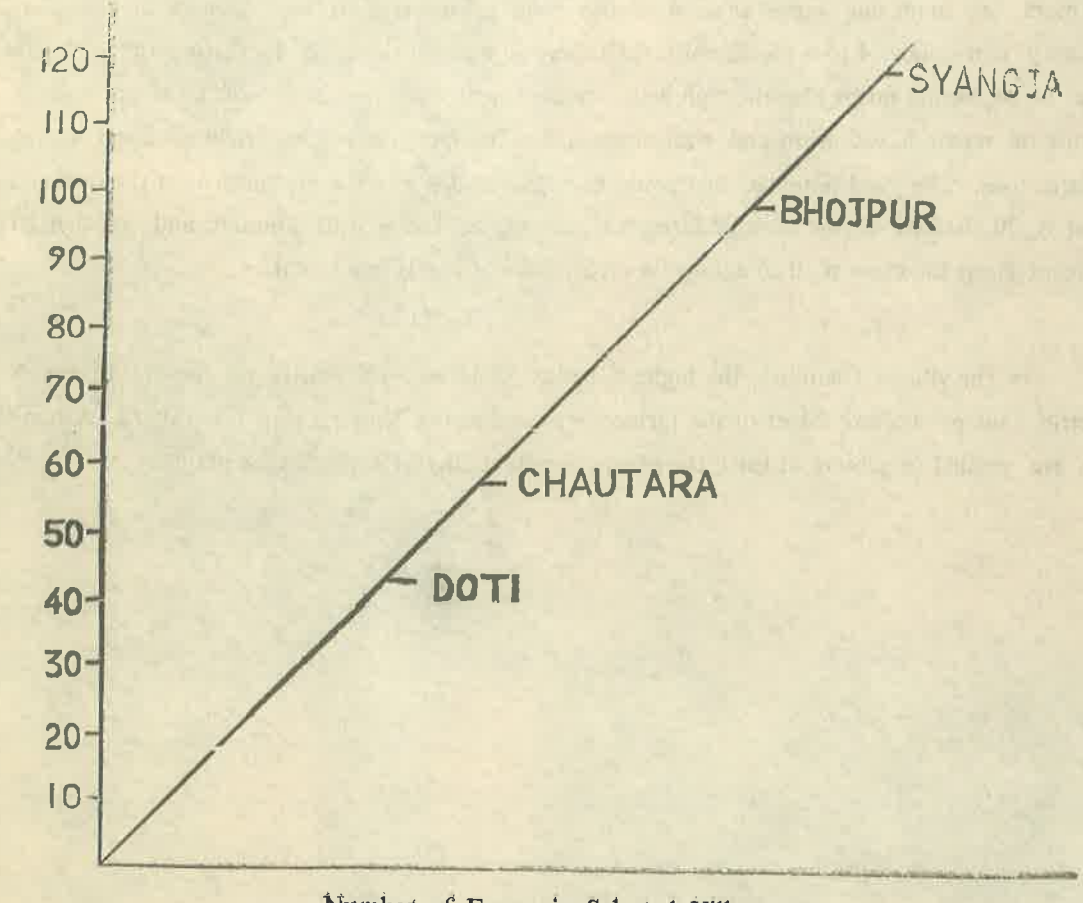
Among the selected villages, and within the villages, the variation in yield per hectare, without taking the influence of farm size factor, is one of the basic indicators for finding out the potential of increasing farm production. In case of paddy, as shown in Chart 1, highest yield per hectare was achieved by the sample farms of Dathum (Syangja) followed respectively by Bokhim (Bhojpur), Chautara (Kavre) and Silgari (Doti). Within Syangja, the per hectare yield of paddy varied from 120muries that is equivalent to 6metric tons to 20muries, that is, 1 metric ton. The potential yield that could be gained through better farm manangement is recorded at 80 muries, that is, 4 metric tons per hectare. More than 50 percent of the selected farmers are achieving more than 4 metric tons per hectare. If the farmers in the same locality can achieve 4 to 6 metric tons, then there is enough room for increasing the yield in the neighbouring farms also through better management and provision of farm services in terms of research, extension and other inputs. In Bhojpur, the highest yield achieved was 5 metric tons. The yield potential that could be achieved is 3 metric tons since 4 of the farmers, that is, 20 percent of the sample farmers is already achieving this amount and another 20 percent is at the cross road to achieve 3 metric tons of paddy per hectare.

In the village, Chautara, the highest paddy yield was 60 muries per hectare, that is, 3 metric tons per hectare. Most of the farmers were achieving 2 metric tons per hectare. Attempts are needed to achieve at least the observed potentiality of 3 metric tons per hectare.

Graph No. 1

Per Hectare Yield Variation Among Sample Farms in Selected Villages

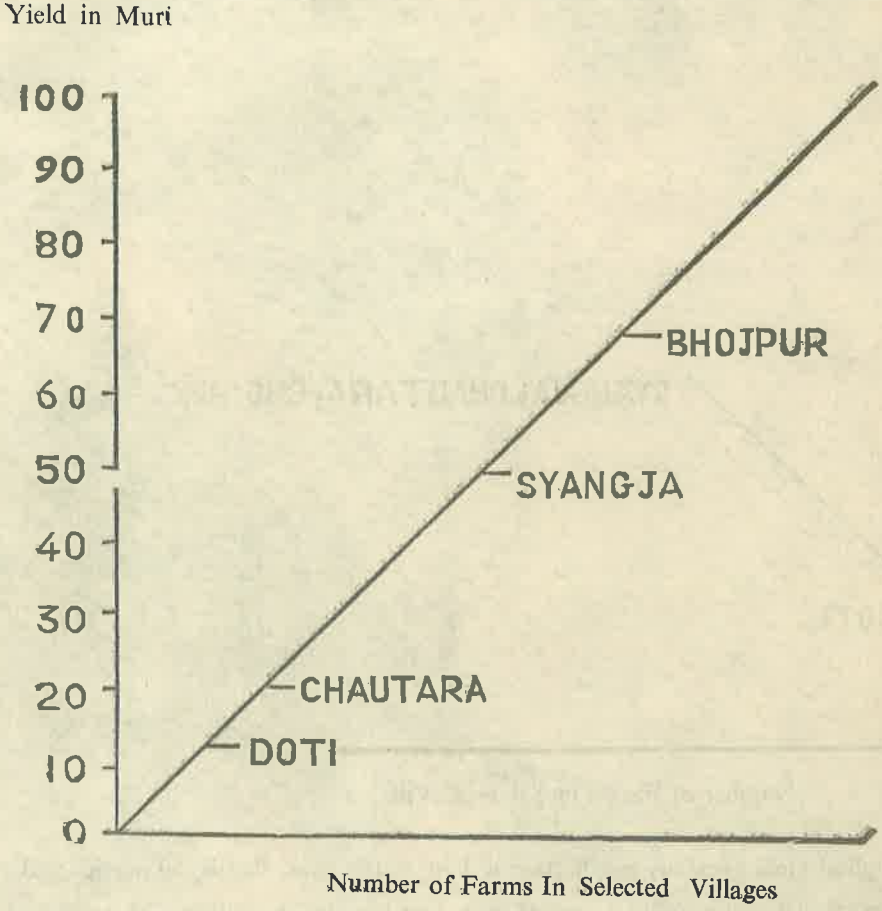
(PADDY)



Graph No. 2

Per Hectare Yield Variation Among Sample Farms in Selected Villages

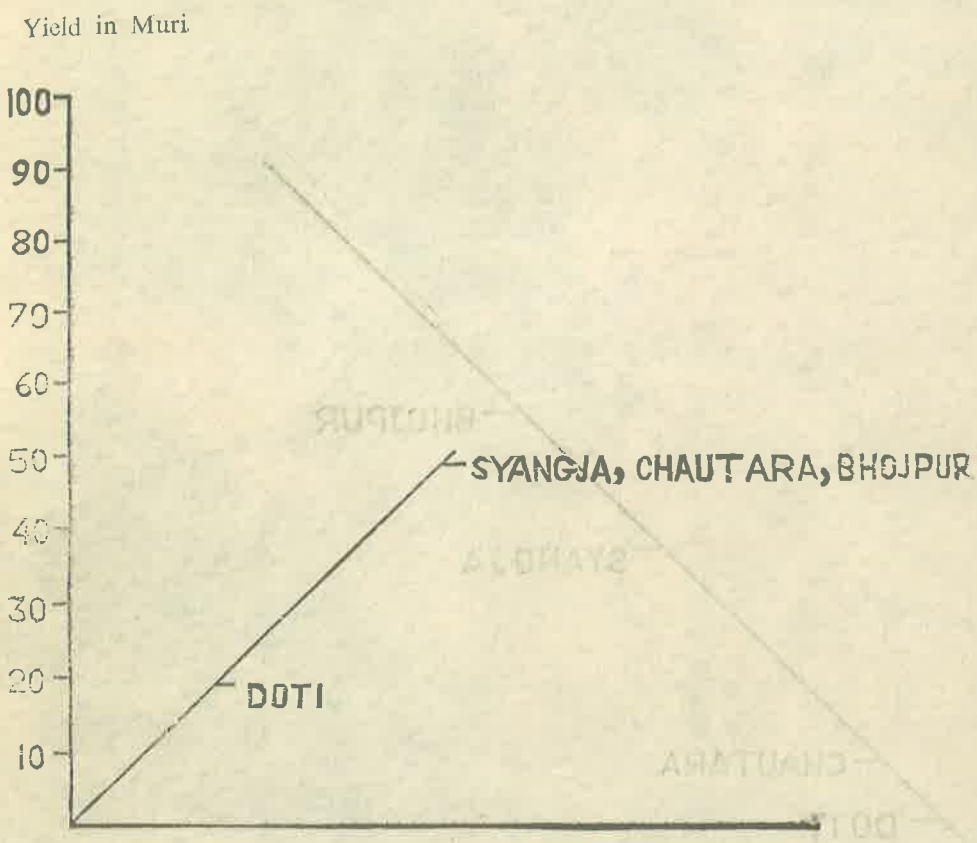
(MAIZE)



Graph No. 3

Per Hectare Yield Variation Among Sample Farms in Selected Villages

(WHEAT)



In Doti, the highest yield of paddy per hectare is 2.50 metric tons, that is, 50 muries and some of the farmers were achieving only 2 metric tons and less. In this village, there is an acute need for increasing the overall average yield rate from 2.50 metric tons per hectare to 3.0 and 3.5 metric tons keeping view of the continuing food scarcity in the district.

Maize: In the case of the maize, the highest yield of 6.8 metric tons or 68 muries was achieved by the farmers of Bhojpur village compared to 1.4 metric tons in the Doti village (Graph 2.)

In Bhojpur, more than 25 percent of the farmers were achieving 3.5 to 4.0 metric tons. The highest yield in Syangja wsa 4.8 metric tons and more than 70 percent farmers were achieving less than 3.5 to 4.0 metric tons of maize per hectare. In village, Chautara, the highest yield was 2.04 metric tons and most farmers were getting about 1.36 metric tons. In village, Doti, the yield was comparatively lower, that is, 680 kg. to 1360 kg. per hectare. The observed achieveable yield in Bhojpur and Syangja was 3.5 to 4.0 metric tons, whereas in Chautara and Doti, the per hectare yield needs to be boosted by special programmes for maize farms improvements.

Wheat: In wheat yield, there was not much variation in observed highest yield, that is, 2,729 kg. per hectare or 40 muries in village of Syangja, Chautara and Bhojpur (Graph 3). In case of Doti, the highest yield was 1,360 kg. per hectare. In the immediate future the observed potentiality of improving yield is at 3 metric tons per hectare for which considerable effort from the Department of Agriculture is needed.

Farm Production and Family Consumption:

The household income level reported by the National Planning Commision Study on Employment, Income Distribution and Consumption patterns in Nepal (1976) is Rs. 6,908 and two-thirds of the total sample fall below Rs. 7,750 income group. The average farmer's gross level of income for the selected village for the present study is about Rs. 8,826 which is very close to the National Planning Commission's findings.

In general, the selected farm households have income level just for meeting their consumption needs. This leaves no cash-at-hand with farmers for farm investments and long -term family and farm inprovement works. The average income and consumption figures do not take into account the actual levels of consumption and income between size groups. The National Planning Commission Report indicates that the income distribution in Nepal is very much skewed. The lowest 40 percent of households received no more than 8.64 percent of the total income whereas the highest 20 percent received 60 percent of the total income. In the present study, one attempt has been made to present the variation in income and consumption levels by different farm size groups.

Among the selected villages the highest farm production[1] of Rs. 12,002 was made in Dahthum, which exceeds the consumption level of Rs. 9,546 per farm household. The second highest level of farm production of Rs. 93,01 was found in Chautara with the consumption level of Rs. 7,334 in that village. In village Silgarhi, production valued at Rs. 7,867 was made which is lower than the average consumption expenses of Rs. 8,867 (Table 15).

In terms of cereals, all the selected villages produced a surplus amount except in the village of Silgarhi, After food, the other important items of farm expenses are in clothing, liquour and tobaco and livestock products —meat, milk and eggs.

For raising farm income in the selected villages, crop diversification including legumes and other vegetables, root crops, livestock, poultry and swine raising and other farm enterprises of local importance should be made. This possible switch-over provides better dietary food on the one hand and helps to raise farm output on the other.

Alternative farm plans based on current farm technology are needed to uplift the present level of farm income.

1 Includes total value of farm produetion such as crops, livestock products; vegetables aud other major crops.

Table No. 15

Per Farm Household Consumption Expenses and Volume of Farm Production

Particulars	Chautara (Rs.)		Bokhim (Rs.)		Silgarhi (Rs.)		Dahthum (Rs.)	
	C	P	C	P	C	P	C	P
Foodgrains	3,756	5.800	3,896	7,626	4,856	4,752	4,786	10,855
Pulses	158	377	230	29	501	386	245	333
Vegetables	871	1,133	250	242	126	81	210	177
Salt & Spices	189	—	104	—	56	—	210	—
Kerosrene	510	—	500	—	118	—	700	—
Liquors and Tobaco	432	—	449	—	171	—	486	8
Health	.47	—	225	—	84	—	438	—
Education	84	—	286	—	226	—	458	—
Clothing	792	—	1,060	—	1,034	—	1,212	—
Milk, Meat and Eggs	300	1,058	300	169	250	375	369	627
Others	196	933	300	351	375	—	432	102
Total	7,334	9,301	7,550	8,417	7,867	5,594	9,546	12,002

C= Consumption P= Production —= Not available

Table No. 15 a

Use of Important Essential Itmes in Rs.

Import items	Chautara	Bokhim	Silgarhi	Dahthum
Salt, Spices	189	104	56	210
Kerosene	510	500	118	700
Clothing	792	1,060	1,034	1,212
Total	1,491	1,664	1,208	2,122
Percent of the Total	20%	22%	15%	22%

Table No. 16

Income and Consumption Expenses

Particulars	Bokhim	Chautara	Dahthum	Silgarhi
Income from off-farm Employment	868	176	138	1,924
Income received from Army Services Abroad	1,960	—	370	—
ncome From Working in Other's Farms	490	77	168	—
	3,318	253	876	1,924
Gross Farm Business Income levels	4,480	3,345	7,309	2,657
Total Income Available For Dispsoal	7,798	3,598	8,185	4,581
Actual consumption Eepenses	7,550	7,334	9,546	7,867
Balance + —	+ 248	—3,736	—1,361	—3,286
Requirement per Family for Minimum Subsistence	7,300	5,110	5,110	6,570
Family size (Number)	8	6	10	7

Table No. 17

Per Farm Income from Off-Farm Employment Army Services and from Working in Other's Farms

Particulars	Bokhim	Chautara	Dahthum	Silgarhi
Income from off-farm Employment	868	176	338	1,924
Income received from Army services abroad	1,960	—	370	—
Income from working Other's farms	490	77	168	—
Total	3,318	253	876	1,924

Need for Alternative Farm Plans:

Farm planning is an effective way to determine a more profitable and efficient way of combining and allocating the farmer's resources. Each farmer makes a farm plan when he decides what to grow, how much to grow and how to combine the limited resources to meet the farm family objectives. Most Nepalese farmers do not base their decision on written records and analysis. Their plans are tailor-made plans handed down from generation to generation, which usually takes into account the physical and economic constraints and local adaptability of the crops to be grown.

Experience has indicated that farm plans, however profitable and nice they may seem,, cannot be imposed on farmers. For this reason, planners should intiate farm planning

concepts step by step. The farmer, unless he observes himself the crops, livestock and production practices and is satisfied with the results, will not willingly adopt the improved technological packages, regardless of the promises associaied with them.

In the present study, a simple partial budgeting method has been adopted to develop alternative farm plans. A farm plan, as a scheme for the operation and organisation of the farm business and as an effort to question and evaluate what is now being done and to explore alternatives and if possible to suggest in more practical and profitable way to use the existing resources to achive a higher level of farm business incomes, has been adopted.

This type of approach was a long felt need in the context of Nepal's agricultural development. A coment by Dr. Y. P. Pant indicates the usefulness of this approach for hill farms in Nepal.

"For maximum utilization of resources, planning in agriculture should proceed at the micro-level. Farm plans should be prepared for each farmer initially by the budgeting method. Programming may be adopted later on. If the cultivators are convinced of the merits of plans and if their income rises as compared to their own plan, it will not only benefit the farmers by maximizing higher returns but would also result in the most profitable way of using limited resources.[1]

The farm planning approach adopted in the present study has been developed through a trial and error method, keeping in view the farmer's preferences, objectives and resource availability. Since the validity of the alternative farm plans depends upon the fair game of experience and undrstanding of the local farming system, the alternatives may have some weakness and their application should consider these limitations.

One of the measures used in the present study is the Farm Business Income and not the size of holding. The level of farm business income depends upon the cropping intensity, resource productivity and production practices. Hence, two- farms of similar land holdings may have difference farm business income levels. Farm Business Income, as defined for the present purpose, is the different between gross value of production and total costs in which the imputed value of family labour is added up.

1. Y. P. Pant and S. C. Jain. "Agricultural Development in Nepal", 1969.

The proposed alternative plan would not exactly fit into the varied economical, natural and other conditions prevailing in the selected villages. Those plans would indicate that in the selected villages, farmers should be ready to consider alternative farm plans to the current one to raise their lower levels of farm business income.

Hill Farm Income:

The data on actual consumption of basic food stuff as well as other necessary expenses of the farm family per year showed that in all the selected villages, the farm households were saving very little for investment and on the contrary they were meeting the difference between total income and consumption by external borrowing or withdrawing savings from accumulated or inherited wealth.

Even at the minimum subsistence level of consumption requirement of Rs. 2.0 as set up by the National Planning Commission an average farm household was running in dificit to meet his family's minimum requirements from the current farm business income except in village Dahthen. Adding up of income from sources just enables the fram-households to meet their minimum subsistence consumption requirements with exception to Chautara and Silgarhi villages.

The external source of finance included village money–lenders, co-operatives and Sajha societies, Agricultural Development Bank and other commercial-banks. The average amount of credit borrowed per farm household in the selected villages varied from Rs. 2,965 in Chautara to Rs. 1,176 in Bokhim. The borrowing was above the actual consumption needs of the farmers in village Dahthum and Bokhim.

Improvement in the income levels of people in rural areas, particularly hills, has become a critical concern to the govenrnment of Nepal. Dwindling land and labour productivity and continuous migration from the hills to tarai and urban areas in search of employment have led to the degradation of hill economy and creation of seasonal unemployment in Terai and urban areas. In an essentially agricultural country with inadequate and difficult infrastructrual and financial resources, much can be gained from locating developmental activities in the hills where majority of population is centered. At the same time, capacity of the the government to deliver services to the hill population though quite limited at present due

to difficult terrains should be intensified to re-vitalize the week economy.

As has been reported earlier, the farm households in the selected villages are living in a precarious balance with the meagre resources available at or near subsistence level. This they have been doing through supplementary income earning from seasonal off-farm employment and remittance from the army services abroad. Inspite of these earnings, the economic conditions of the farmers in the hills showed not much savings for the future. Lack of land and employment has forced many young enterprising and skilled people to give up their life in hills and settle elsewhere. As a result, the population growth per annum in the hills is only 1.4 per cent whereas in Terai and Kathmandu, the growth rate is 2.6 and 4.6 per cent respectively.

Development in Nepal is unthinkable without a prosperous and active hill economy. There is significant scope for the hill development in Nepal, particularly in the agricultural sector. High value and special crops like fruits, vegetables, spices and livestock products can be grown in many of the hill areas for sale and in Tarai provided an assurance and guarantee of purchasing their farm produces is given. Even from the efficiency consideration, the government can concentrate its developmental efforts on those programmes which give high returns and which interlink with the development activies in other sectors. Though the development of hill economy is exacerbated by its isolated condition and terrain topography, many of the hillrhcoweutn

For the present, some of the adjoining village in the existing highway and other hilly high ways such as Chutara and Dahthnm can be developed into supply centers of vegetable, fruits, livestock products and other typical cottage industry products of high value to the nearby urban and Terai areas. Income thus earned can be spent in the procurement of food and other necessary items to be brought up from the Terai. A strong economic interaction between the hills and terai is a must for uplifting the Nepalese economy. Critical assessment of the strengths and weeknesses of the hill economy should be made for this purpose in the future.

Alternative Farm plans:

Many alterntives are available for uplifting rural economy. Since the major occupation

and source of income is agriculture in the hill areas, attempts should be made to develop alternative systems for the present crop enterprises. Livestock, horticulture and other farming enterprieses are still regarded by hill people as secondary sources of income.

In developing alternative farm plans, the factors taken into consideration are farm resource limitations, physical and financial constraints faced by farm households, their priority for growing subsistence crop and need for enlarging their present farm busines income levels.

In the variable cost, the expenses incurred at present on hired human labour was reduced since there is plenty of labour days available within the farm household itself. Use of farm yard manure and compost manures was increased since these are locally available and does not involve cash expenses. On the other hand, use of family labour was increased. In the selected villages, dryland and rain-fed farming were prevalent; hence no attempt was made to introduce new high yielding varieties of seeds expect in wheat; and chemical fertilizers were used only in low land crops of paddy and wheat. But legume and soyabean crops have been suggested in the alternative farm plans which are important for the family nutrition and enriching land fertility as well. Depending on the location of the selected village, commercial crops such as potatoe, green vegetables, ginger and peanut have been substituted in place of existing dryland crops such as millet and maize.

No substantial changes in yield of the crops are introduced. Major input and output prices are assumed as constant at the current levels. The major deviation from the exisisting plan is the change in cropping combination and land–labour used in the selected farm households.

The cropping intensity has almost been doubled to 2.0 except in the village, Bokhim. The increase in total costs in the alternative farm plans as compared to the existing farm plans is mainly due to the reduction in hired labour and corresponding increase in the use of family labour and additional use of compost manures (Table 18 to 22).

The gross value of production has been almost doubled in Chautara and Silgarhi. The farm business income in the alternative farm plans are Rs. 6,037 in Bokhim, Rs .8,267 in Chautara, Rs. 9,874 in Dahthum and Rs. 6.163 in village Silgarhi. These farm business income levels are more than adequate to meet the minimum subsistance consumption requirements

in their villages and just not sufficient by Rs. 1,263 in village Bokhim. Asumining that the current level of income from other sources of employment as constant, the total income available to farm households is Rs. 8,000 to 11,000 in these villages which exceeds even the actual consumption expenses reported by the farm households.

Table No. 18

Per Farm Cost and Returns for Alternative Farm Plans

Particulars	Bokhim	Chautara	Dahthum	Silgarhi
Cultivated Farm Size (Ropani)	19	20	19	28
Crop Area (Ropani)	28	45	41	39
No. of Crops	8	9	7	9
Total Variable Cost (Rs.)	2,961	4,404	5,329	2,856
Total Fixed Cost (Rs.)	1,787	2,591	2,441	1,425
Total Cost (Rs.)	4,808	6,995	7,770	4,281
Gross Value of Production (Rs.)	9,181	12,841	15,336	10,173
Ret/V. Cost (Rs.)	6,219	8,377	10,007	6,217
Ret/Total Cost (Rs)	4,433	5,836	7,566	4,895
F. B. Income (Rs.)	6,037	8,267	9,874	6,163
Other Sources of Income (Rs.)	3,318	253	876	1,924
	9,355	8,520	10,750	8,087

Table No. 19

Alternative Farm Plans, Silgarhi (Doti)

Costs & Returns	Paddy	Wheat	Maize	Millet	Mustard	Soya-been	Pulses	Leafy Vegetables	Potato	Total
Area Operated in Ropani	10	10	2	2	3	4	4	2	2	39
Seeds	84	125	6	5	8	50	28	6	150	462
Manures	400	340	45	—	80	80	100	76	120	1241
Hired Labour	300	60	10	64	35	35	35	—	80	619
Total Animal Labour	70	40	30	12	50	35	50	—	20	307
Repair Costs	7	8	2	2	4	4	4	2	4	27
Interest Charges	69	46	7	7	14	16	17	6	28	210
Total V. C.	930	619	100	90	191	220	234	90	402	2876
Land Revenue	26	26	5	5	7	10	10	5	5	99
Family Labour	400	340	34	80	70	75	65	100	150	1314
Dep. on Tools and Implements	3.0	3.0	0.5	0.5	1.5	1.0	1.0	0.5	1.0	11
Total F. C.	429	369	39.5	85.5	78.5	86	76	105.5	156	1424.0
Total Cost	1359	988	139.5	175.5	69.5	306	310	195.5	558.5	4301
Gross Value of Production	2100	1600	400	300	385	1100	380	1108	1500	10173
Ret/V.C.	1170	981	300	210	394	880	146	1018	1118	6117
Ret/T.C.	747	611	261	125	315.5	794	70	913	963	4794
F B· Income	1141	946	255	205	385.5	869	135	1013	1113	6962

Table No. 20

Alternative Farm Plans (Bokhim)

Costs & Returns Rs.	Paddy	Maize	Millet	Wheat	Vege-tables	Black-gram	Potato	Soil-seed	Total
Area Oriented in Ropani	10	4	1	6	1	3	2	1	28
Seeds	139	6	4	108	4	7	156	5	429
Manures	300	120	—	525	—	60	170	30	1205
Hired Labour	246	100	20	162	5	5	20	5	563
Total Animal Labour	249	192	—	108	—	30	20	10	609
Repair Cost	7	8	2	12	2	2	2	1	36
Interest Charges	75	34	2	73	·8	8	21	4	217.8
Total Variable Cost	1016	460	28	988	11.8	112	389	55	3059.8
Land Revenue	26	10.4	2.6	16	2.6	8	5	2.5	73
Family Lalour	900	400	45	204	75	20	50	10	1704
Dep. on Tools & Implements	3	2.5	0.5	1.8	1.3	1.0	0.6	0.3	10
Total F.C.	929	413	48	221	78	29	56	13	1786
Total Cost	1945	873	76	1209	90	141	445	68	1846
Gross Value of Production	3615	1136	310	1230	1200	260	1300	130	9181
Ret/Variable Cost	2598	676	283	242	1188	148	1011	75	6219
Ret/Total Cost	1670	263	234	21	1110	119	855	62	4433
F. B. Income	2570	663	279	225	1185	139	905	72	6037

Table No. 21

Alternative Farm Plans (Chautara)

Costs & Returns Rs.	Paddy	Maize	Wheat	Millet	Oil-Seed	Vege-tables	Soya bean	Potato	Ground nut	Total
Area Operted in Ropani	10	10	8	4	2	2	4	2	3	45
Seeds	80	27	72	4	9	15	0	160	16	393
Manures	300	67	299	—	40	1200	100	125	50	2181
Hired Labour	75	77	160	75	30	35	36	75	70	633
Total Animal Labour	390	95	133	—	60	30	50	30	50	833
Repair Cost	7	5	11	3	1	0.5	2	2	2	33.5
Interest Charges	68	22	54	7	11	102	16	31	15	32.6
Total Variable Cost	920	293	729	89	511	1382.5	214	423	203	4404
Land Revenue	26	26	21	11	5	5	10	5	8	117
Family Lagour	1045	291	300	225	45	200	90	160	75	2431
Dep. on Tools & Implements	10	6	8	2	2	6	4	2	3	43
Total F.C.	1081	323	329	238	52	211	104	167	86	2591
Total Cost	2011	616	1058	327	203	1593	318	590	289	6995
Gross Value of Production	2760	861	1280	600	472	3000	1168	1400	1300	12841
Ret/Variable Cost	1780	568	551	511	321	1618	954	977	1097	8377
Ret/Total Cost	740	245	222	273	269	1407	850	810	1101	5836
F. B. Income	1794	536	522	498	314	1607	940	970	1086	8267

Table No. 22

Alternative Farm Plans, (Dahthum)

Costs & Returns (Rs.)	Paddy	Maize	Wheat	Vege-tables	Millet	Ginger	Mus-tard	Total
Area Operated in Ropani	75	13	5	2.5	2	5	6	41
Seeds	66	62	60	7	4	1178	27	1404
Manures	167	800	44	85	—	375	120	1591
Hired Labour	113	286	140	—	88	56	90	773
Total Animal Labour	375	312	180	—	—	45	180	1092
Repair Costs	11	11	11	12	11	11	12	79
Interest Charges	58	117	34	8	7	132	34	390
Total V. C.	790	1588	469	112	110	1797	463	5329
Land Revenue	20	34	14	5	5	13	16	107
Family Labour	720	806	160	110	227	150	185	2308
Dep. on Tools and Implements	8	6	4	2	2	2	2	26
Total F. C.	748	846	178	117	234	165	153	2441
Total Cost	1538	2434	647	229	344	1962	616	7770
Gross Value of Production	4040	2925	1060	1385	560	3950	1416	15336
Ret/V.C.	3250	1337	591	1273	450	2153	953	10007
Ret/T.C.	2502	491	413	1156	216	1988	800	7566
F B. Income	3222	1297	573	1266	443	2138	935	9874

Possible Strategies for Agricultural Development in Nepal's Hills Areas :

A strategy for development of Hill Agriculture should necessarily take into account the ways and means of promoting farm employment, income and family well being of rural masses in the hills. This strategy would strengthen the weak economy of the hills and will generate a demand for relatively abundant but under employed factors of production, particularly labour. Development of Hill Agriculture is a complicated process governed by physical terrain and limited availability of cultivated land and mounting pressure of population on these limited resources. A multi-disciplinary system approach toward hill agricultural development, hence, is needed.

A continuous and effective growth of hill agriculture depends upon solving not only one or two problems of development but upon the whole range of related and interacting problems covering rural life. Education, health, transport, drinking water, roads, markets, family planning, leadership development are other few areas besides agricultural and industrial development programs, where immediate attention is called for.

But with limited technology, manpower and other material resources, the government of Nepal must make a choice among the development priorities and then action must be initiated to identify problem areas.

Given the current stage of agricultural development in Nepal, topmost priority should be placed upon developing an appropriate agricultural technology. This technology should be oriented to the felt-needs of farmers and be adjusted to their resource availability and risk-bearing capacity. This technology should be based on locally avilable seeds, production practices and rainfed conditions of hill farming. For example, this type of technology will give priority on local open-pollinated maize rather than on hybrids, though the resultant output may be less than that from hybrid ones. The soil treatment should consist more of organic farm yard manures, compost manures, green manures than the use of chemical fertilizers. Also the tools and implements should more be of animal and manul operated type than involving tractors and other imported machineries. In brief, this techonolgy would place more emphasis upon the effective use of locally available inputs and generation of tested production practices. This would not mean that the use of chemical and mechanical inputs would be ruled

out under this technology for those who can afford and bear the risk of additional costs of production. Even for small farms, some amount of chemical fertilizer, mechanical and pest control inputs would be needed alongwith local inputs and practices. But the main feature of this technology will be the shift from complete dependency upon fossil based inputs and improved technology either imported from outside or developed in controlled experimental plots to a less costly and easily avilable local input and production practices suited to rainfed conditions of hill farms.

The current agricultural development strategy, it seems, has not taken into-account the felt needs of the hill farmers and varied needs of agricultural technology for different geo-climatic and socio-economic groups of hill farmers. Adequate research is not available to guide the improvements in local seed varieties, production practices, cropping patterns and use of local-based inputs. No rice varieties suitable for rainfed monsoon planting and corn varieties socially and agronomically acceptable have been developed. Little research has been carried out for legumes, soyabeans, oilseeds, vegetables and other commercial crops and livestock except for jute and potatoes. Almost all the research extension and training have been on the fertility and varietal trials, i.e., to run demonstration, cum-trial experiments of the imported varieties from abroad.

The current approach to agricultural research on crops has emphasized mainly on breeding lines from exotic varieties imported from abroad. Research on rice varieties has been limited to those which require irrigation. The crop which has extensively been adopted by farmers is the wheat crop-which also is feared to be degenerating due to lack of seed multiplication and distribution programs.

The extension service also is very weak and one J.T. or J.T.A. is covering about 7000 farmers. The extension service mainly deals with distribution aspects rather than diffusing improved practices and learning from farmers the local techniques production and evaluation the farmer's problems through the help of agricultural research. The extension service has few readily extendable and locally adoptable production inputs, practices and other services.

In brief, a need-oriented agricultural technology is yet to be developed in Nepal. Some of the reasons for this are:-

(i) The researcher has not taken into consideration the problems of small hill farmers and the system of farming.

(ii) The researcher has not tested his so-called green-house technology at the actual farmer's fields and under varied socio-economic conditions of hill farmers, because he has not mastered their system and has not truly felt responsibility to do so.

(iii) Acceptance by hill farmers has not been a part of the evaluation of agricultural research, extension and training in Nepal.

In Japan and other countries, the extension of irrigation, introduction of high yeilding varieties and use of fertilizers and improved tools and production practices were developed by scientists to suit the needs of small farmers.

Traditional Japanese agriculture was based upon rainfed farming system and paddy yeilds per hectare were less than a metric ton, whereas the recent Japanese agriculture produces more than 6 tons of rice per hectare. Most of the developing countries these days are at the initial stage of agricultural development with reliance upon monsoon and traditional practices and inputs where paddy yeilds approximate by only two or three metric tons per hectare.

Multiple cropping systems seem most promosing foi utilizing the development potentials of hill land, labour and other resources to produce more per unit of land and capital. The cropping system designed to blend available resources and traditional farming practices with some selected modern technological inputs has the potential to improve the efficiency in the use of land, labour, capital, which will lead to an increase in farm business income and a decrease in rural unemployment. These will strengthen the national goals of increasing income, employment and equity and help resolve many of the problems faced by small farmers and sustain the dietary needs through increased production or grains, vegetables and other locally important crops. Though intensive irrigation facilities are needed for a new system of cropping pattern, the cropeing pattern suggested in the alternative farm plans of the study is dry-land oriented. Increased emphasis on small irrigation systems is needed for long-term development of hill agriculture. Low lift pumping or gravity methods of irrigation from streams and rivers can provide a good source of supplementary irrigation to hill farms.

The lack of irrigation water emphasizes the need of crop research adapted to rain-fed crop variieties in hills. Locally selected high yielding varieties should replace some of the fertilizer plus irrigation responsive crop varieties at present.

With a view to use effectively the limited technical and financial resources of the Nepal Government, it is highly diserable that the agricultural development programme should be concentrated to a fewspecific localities to provide an intensive ground of learning by doing for the Nepalese planners, research workers and extension workers. This will also provide a chance for farmers to show their local technology, its practicability at the same time evaluating how the modern technical packages brought by research workers really work in their local conditions. This check and balance method would generate a technology which afterwards can be extended to a large mass of farmers having a similar geo-physical and economic conditions. An immediate start is needed with a few capable agricultural research, extention, planner, administrator aud the social scientists to launch a programme of 'on farm testing' and generation of technology.

This new programme should consider studying the rural situation and the farmers, problems related to increasing farm output. The main thrust should be to synthesize the better qualities of both traditional as well as modern varieties and practices. Since traditional techniques were retained over many generations and new technologies, for plaming output increasing still need to be tested under real farm conditions in micro-settlements of Nepal hills. Hence, the current approach of imposing technological package which is assumed to be beneficial for, farmers, needs first to be tested on farmers, land and socio-economic setting where the ylive.

Testing of this agricultural techonology package in the local conditions in the farmers' field will form a part an "on farm testing of local and improved technology." This would be diffirent from the traditional experimental and demonstration plots under research and extension programmes. This on-farm testing would be a final trial or step in the process of adapting research inputs and findings that will be a first step in teaching process. On-farm test plots should be designed to test a very limited number of important variables that previous researches have shown to be promising or have a highest probability of success. This should not be designed to discover new practices but to learn more about the known technology in different settings and constraints faced by farmers. This should precede blanket recommendation to the general farming population. This would help bring better co-ordination between extension and farmers. Research people could identify the future research problems based upon the on-farm

test results. Extension people would have locally-proved extension methods to disseminate and farmers would have a ready access to government research, extension and plans and policies, since they would be a part of the system.

In developing hill agriculture in Nepal, a systematic approach based on the 'on-farm testing of agricultural technology' could prove a practical and efficient way of utilizing the available limited public funds on the one hand and making farmers realise and participate in the generation of applicable agricultural technology in the hills.

This development of technology would lead to increase in farm business income and help diversify and utilize the development potentialities such as vegetables, fruits, livestock, spices and other special crops that can be grown in the hills. Of course, the infrastructures, such as roads, storage, marketing, processing, credit facilities, have to be streamlined for obtaining higher returns from these development potentialities. After the streng-thening of hill economy, the tarai economy will get a rapid boost, since the hills provide a ready-market for tarai's surplus goods, particularly foodgrains. A strong interaction between the hill and tarai can be developed only if the hill people have enough absorbing, purchasing power for tarai goods. The tarai urban areas and capital city of Kathmandu need many hill farm products and they have been inviting hill people to co-operate in this dual process of inter dependency.

Hill agriculture has the substantial development potentiality and what is needed is the development of effective ways of exploiting these potentialities. Hills, upto now, have been a liability to the Government of Nepal, drawing often the vast resources of food, fibre and financial resources. It is almost overdue to turn the hills of our country into assets by utilizing the limited land, enterprising people and their management abilities.