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PRODUCTION AND PRICE RESPONSIVENESS OF CROPS IN NEPAL

Som P. Pudasaini

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STRENGTHENING INSTITUTIONAL CAPACITY IN THE
FOOD AND AGRICULTURAL SECTOR IN NEPAL

Foreword

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One of the most important components of this project is advanced training, at the Masters and Ph.D. levels, of young professional staff of agricultural agencies of the MOA and other related institutions. ADC Fellows have been selected for advanced training in Asia, Australia and the U.S.A. Most of them have written a thesis based on their research of a particular problem area in Nepal's agricultural and rural development. In addition, this project sponsors problem-oriented research activities which are carried out by the staff of agricultural agencies of the MOA and other related institutions with the cooperation of ADC staff.

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PRODUCTION AND PRICE RESPONSIVENESS OF CROPS IN NEPAL

Som P. Pudasaini*

ABSTRACT

This study examines the production pattern, resource productivity and price responsiveness of rice, wheat, maize, and sugarcane in the terai and hill regions of Nepal.

Crop yields were low in all regions of Nepal from 1967/68 to 1982/83. Rice and maize yields began to decline beginning in the mid-1970s, the largest yield decline occurring in the mountain region, followed by the hills and terai. The wheat yield continued to increase marginally during the whole period in the hills and terai, while it started to drop in the mountain beginning in the mid-1970s. Rice and maize production peaked in the mid-1970s and has stagnated or declined since then. While wheat production registered a modest increase in the terai and hill regions throughout the study period, it declined in the mountains. Area expansion was the main source of increased production for all crops.

Fertilizer contributed positively to crop production in both the terai and hill regions but its impact was stronger in the former. Capital investments in traditional tools and area expansion had lower returns than their respective opportunity costs in both regions. The marginal value products of labor in the terai and of bullocks in the hills exceeded their respective opportunity costs. Education contributed positively to production.

Price responsiveness for marketed crops (sugarcane and wheat) was higher than for subsistence (rice and maize) crops. Output supply and input demand were more elastic to changes in output prices than to input prices. Both output and input price elasticities of all crops were higher in the terai than in the hills.

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INTRODUCTION

Agricultural development is crucial for Nepal's overall economic development. Crop productivity growth is essential for agricultural development because crops account for about 90 percent of total agricultural output. However, the crop sector has remained subsistent and is now characterized by stagnating or declining productivity. While increased crop productivity may be achieved through better allocation of existing resources or increasing technological innovation and investment in human capital, increased productivity gains through better allocation are limited in traditional agriculture, where farming practices are mastered by farmers over generations (Schultz 1964). Consequently, a massive influsion of modern agricultural innovations coupled with appropriate market or price incentives may be crucial for raising crop productivity. The purposes of this study are to examine the past production patterns of rice, wheat, sugarcane and maize in the terai and hill regions;[1/] to determine the resource productivity and price responsiveness of these crops; and to derive implications for increasing crop production and productivity.

PRODUCTION PATTERN

Rice, maize and wheat are the three most important crops in Nepal, occupying about 53, 18 and 14 percent of the cultivated area (Pudasaini 1981), respectively, while millet and oilseeds cover about 10 percent of the area. Rice (65 percent of the cultivated areas) and wheat (25 percent) are the dominant crops in the terai, while maize (38 percent), rice (28 percent) and millet (18 percent) are the important crops in the hills.

Total rice production in Nepal gradually expanded after 1967/68 and peaked in the mid-1970s (Appendix 1). While rice yields registered a marginal increase until the mid-1970s, the major contribution to increased output came from the expanded crop area. Area expansion began to decelerate and yields started to decline after the mid-1970s and consequently total production took a downward

turn in subsequent years. The rice production, area, and yield patterns in the mountain, hill, and terai regions are similar to the national trend except for a variable yield pattern in the mountains. In the past 15 years, total national rice production increased by about one percent, while cultivated area expanded by 11.5 percent and yield declined by 9.5 percent (Table 1). The yield decline was the largest in the mountains, followed by the hills and the terai (Fig. 1).

The area under maize cultivation expanded until the mid-1970s, but both yield and production began to dwindle in early 1970s in all regions (Appendix 2). Between 1967/68 and 1982/83, the total area under maize increased by about 10 percent and production declined by 11.8 percent as a result of a substantial reduction in yield (19.8 percent). Greater production and yield reductions occurred in the mountains and hills than in the terai (Table 1). A small reduction in area also occurred in the terai, perhaps as a result of the substitution of other crops, particularly wheat, for maize.

Table 1. Changes in Crop Area, Production and Yields, 1967/68 to 1982/83

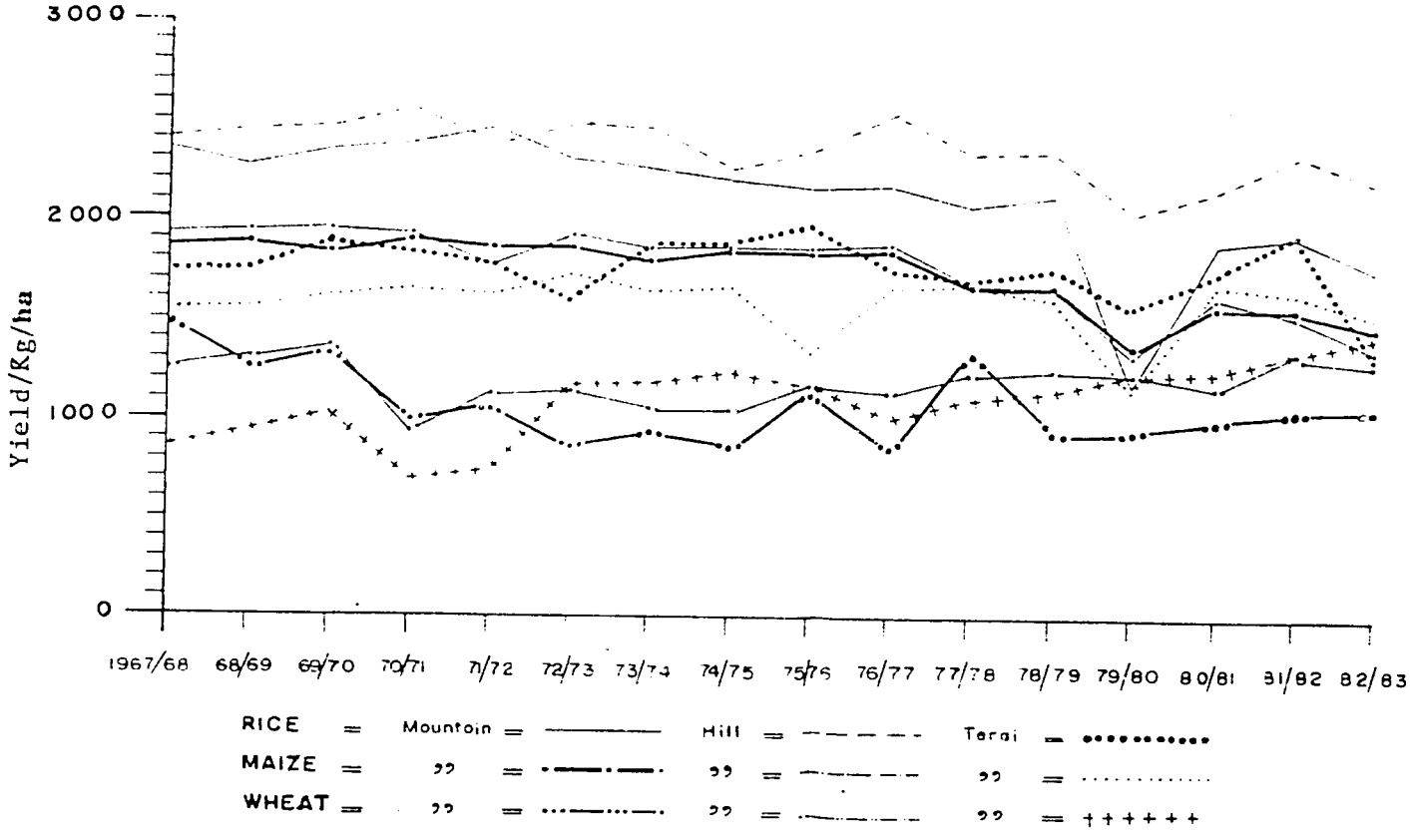
		(Percentage changes)			
		National	Mountains	Hills	Terai
Paddy:	Area	11.5	39.7	29.1	7.3
	Production	0.7	15.7	10.8	-2.1
	Yield	-9.5	-20.4	-15.2	-9.3
Maize:	Area	9.6	5.1	16.5	-1.8
	Production	-11.8	-15.8	-13.1	-7.8
	Yield	-19.8	-20.0	-25.7	-6.6
Wheat:	Area	91.9	-45.5	70.1	143.3
	Production	135.8	-54.1	75.4	262.9
	Yield	22.0	- 3.4	2.5	48.2

Crop area, production, and yield data for 1967/68 to 1982/83 are presented in Appendices 1-3. Changes in area, production and yield were calculated by comparing the average of the first four years (1967/68 - 1970/71) with the average of the last four years (1979/80 - 1982/83).

Total production and area under wheat cultivation have consistently increased in Nepal during the last 15 years (Appendix 3). Wheat yields have also been increasing continually but marginally during this period. However, the yield levels have been so low that most of the increased production has come from area expansion. The terai has registered the highest increases in area, production and yields (Table 1). While expansion in area and production have been considerable in the hills, yield increases have been negligible. The mountains are the only region where reductions in area, production, and yields have occurred. While the potential for increasing food production by cultivating new land is negligible in Nepal, production can be substantially raised by increasing the area under second crops in addition to yield improvements. Consequently, concerted efforts should be made to increase wheat cultivation to cover all suitable areas in the terai and hills.

The general picture that emerges from this analysis is that rice and maize production and yields in all regions peaked in the mid-1970s. Production and yields began to decline after the mid-1970s and area expansion also substantially slowed since then. A mild increase in wheat production, area, and yield has continued except in the mountain region. The major contributor to the increased production of rice, wheat, and maize in Nepal has been expansion of cultivated area, not yield increases. The largest yields decline occurred in the mountain region, followed by the hills and terai (Fig. 1). While the potential for production increases through area expansion is limited, a significant increase in crop production can be attained through yield improvements and cropping intensification.

Figure I. Yield Trend in the Mountain, Hill and Terai of Nepal



RESOURCE PRODUCTIVITY

The preceding section suggests that crop production and productivity is declining and that yields must be raised to increase production. Many inputs must be used to raise crop yields, and use of these inputs should be based on their contribution to productivity. To identify the resources that may increase crop production, a log-linear Cobb-Douglas production function was estimated and the marginal value products (MVPs) of inputs were computed from the estimates obtained from this function and compared with their respective opportunity costs.

$$(1) \quad \ln Y = \ln a + b_1 \ln L + b_2 \ln K + b_3 \ln NF + b_4 \ln A + b_5 \ln M + b_6 \ln NH + b_7 \ln B + b_8 \ln F + b_9 E + b_{10} X + b_{11} EX + b_{12} DL$$

where

Y = total crop output, in quintals per farm;

L = the market value of land under crop, in rupees per farm;

K = a measure of the flow of capital services entering into production, in rupees per farm, measured as 12 percent of the total investment in farm machinery, farm tools and equipment, and livestock;

NF = total man-years of available family labor, calculated as the sum of family members over 10 years old;

A = age of farm operator, in years;

M = tractor-hours equivalent of machine use on the crop, in hours per farm, calculated by dividing the sum of the costs of tractors and pumpsets by the tractor rental rate;

NH = hired labor used on the crop, in man-days per farm;

B = bullock labor used in crop cultivation, in bullock-days;

F = fertilizer used in crop production, in kilograms per farm;

E = years of schooling of farm operator;

X = number of extension contacts during crop season;

EX = interaction between X and E;

DL = 1 if area under a crop is at least 6 bighas in Bara, or at least 1.54 bighas in Gorkha, and 0 otherwise.

Production Function Estimates

Production function results for the terai and hill regions are presented in Tables 2 and 3 respectively.

Most of the estimates of the rice production function for both regions had the expected signs, and some are also statistically significant. Fertilizer significantly contributed to rice production in the terai, while its contribution in the hills was not significant. Farmers in the terai probably made more effective use of fertilizer because they have been using more HYVs, irrigation and machines, while hill producers have not been able to introduce such innovations (Pudasaini 1983). Farmers in the terai use tractors in addition to bullocks in rice cultivation, while hill farmers use only bullocks. Consequently, bullocks appear to influence rice production more in the hills than in the terai. While family labor supervises and hired labor carries out farm operations in the terai, family labor in the hills performs many farm operations in addition to supervisory work. Consequently, the significant contribution of labor in the terai was expected, while non-significant labor co-efficients in the hills were a bit surprising. Land, the most important input, had a significant contribution to rice production in both the areas. The large farms (DL) in the terai were technically more efficient than the small ones, while that was not the case in the hills. While education had a mild contribution, extension did not have any effect on rice productivity in both regions. The negative co-efficient of the education-extension interaction term (EX) indicated that they were substitutes in information gathering and processing.

As with rice, most of the estimates for the wheat production function had expected signs in both regions. Fertilizer had a significant contribution in both regions consistent with the observation that farmers have recently increased the use of fertilizer with improved varieties of wheat in the hills, as has been done in the terai for a long time. Bullock labor was more important in the hills than in the terai. Land, family labor and hired labor had significant impacts on wheat production in the terai, while both types of labor were unexpectedly insignificant in the hills. In the terai, large wheat farms (DL) were not significantly different from small ones in technical efficiency (there were only small wheat farms in the hills).

Table 2. Production Function Estimates for Rice, Wheat, and Sugarcane, Terai (Bara) Region

Independent variables	Rice N = 205	Wheat N = 200	Sugarcane N = 156
Land: L	0.382***	0.451***	0.407***
	(0.051)	(0.050)	(0.071)
F Labor: NF	0.228***	0.126**	0.097
	(0.054)	(0.062)	(0.099)
H Labor: NH	0.172***	0.196***	0.229***
	(0.034)	(0.037)	(0.062)
Capital: K	0.055***	0.040**	0.034
	(0.016)	(0.019)	(0.030)
Bullock: B	0.047	0.014	0.001
	(0.039)	(0.042)	(0.036)
Fertilizer: F	0.037*	0.153***	0.057**
	(0.020)	(0.034)	(0.028)
Education: E	0.011	0.008	0.006
	(0.010)	(0.011)	(0.019)
Extension: X	0.004	-0.039	-0.052
	(0.029)	(0.036)	(0.077)
Age: A	0.025	0.056	0.110
	(0.089)	(0.106)	(0.172)
Machine: M	0.013	0.019	0.077*
	(0.019)	(0.021)	(0.041)
DL	0.238***	0.225	0.532*
	(0.080)	(0.167)	(0.274)
EX	-0.000	0.001	0.001
	(0.004)	(0.005)	(0.009)
Constant	-2.339	-3.809	-0.958
	(0.531)	(0.512)	(0.747)
R^2	0.8566	0.8507	0.7955
$\bar{R}^2$	0.8477	0.8411	0.7784
F	95.6	88.8	46.4

Numbers in parentheses are standard errors of the estimates.

* Significant at the 10 percent level
** Significant at the 5 percent level
*** Significant at the 1 percent level

Table 3. Production Function Estimates for Rice, Wheat, and Maize, Hill (Gorkha) Region

Independent variables	Rice N = 149	Wheat N = 100	Maize N = 149
Land: L	0.183*** (0.050)	0.311*** (0.082)	0.205*** (0.072)
F Labor: NF	0.050 (0.063)	0.147 (0.122)	0.160 (0.099)
H Labor: NH	0.021 (0.018)	0.050 (0.044)	0.018 (0.033)
Capital: K	0.099*** (0.040)	-0.011 (0.065)	0.195*** (0.062)
Bullock: B	0.535*** (0.058)	0.379*** (0.086)	0.304*** (0.093)
Fertilizer: F	0.005 (0.020)	0.134*** (0.033)	0.048 (0.047)
Education: E	0.012 (0.011)	-0.004 (0.019)	0.022 (0.017)
Extension: X	0.095 (0.019)	0.043 (0.133)	0.212 (0.215)
Age: A	0.141 (0.120)	-0.031 (0.211)	-0.150 (0.187)
DL	0.151 (0.130)	- -	- -
EX	-0.009 (0.012)	-0.000 (0.018)	-0.004 (0.003)
Constant	-2.310 (0.568)	-3.024 (1.090)	-2.227 (0.966)
R^2	0.8092	0.7358	0.5375
$\bar{R}^2$	0.7939	0.7094	0.5040
F	52.8	27.9	16.0

Numbers in parentheses are standard errors of the estimates.

* Significant at the 10 percent level
** Significant at the 5 percent level
*** Significant at the 1 percent level

The signs of most of the coefficients of the sugarcane production function in the terai and of maize in the hills were expected. As with rice, fertilizer significantly contributed to sugarcane production in the terai, while it did not have a strong impact on maize production in the hills. Bullock labor was an important contributor to maize production in the hills, while machine use had a significantly positive contribution to sugarcane production in the terai. This may be because sugarcane producers use tractors for land preparation while maize growers in the hills use only bullocks. Hired labor was more important in sugarcane production in the terai, and family labor was more crucial in maize production in the hills. Land significantly contributed to both sugarcane and maize production. The larger sugarcane farms were more technically efficient than their smaller counterparts.

Marginal Productivity

The marginal value products (MVPs) of factor resources computed from production function estimates and their respective prices are presented in Tables 4 and 5. Except for rice in the terai, fertilizer was under-used in all crops in both the terai and hill regions. Consequently, there is scope for increased crop production in Nepal through increased use of resources to improve the fertility levels of the soils. While hired labor was over-used in rice in the terai, and rice and maize in the hills, it was under-used in wheat and sugarcane in the terai and in wheat in the hills. A majority of wheat and sugarcane growers in Nepal cultivate improved varieties, which requires more labor for weeding, irrigation and other operations. Apparently sugarcane and wheat growers have not yet used the optimum amounts of labor for these operations, and production of these crops may be raised by increased labor use. Increased use of bullocks can raise rice, wheat, and maize output in the hills, while bullocks have already been over-used in the terai crops.

The return on investments in area expansion was lower than the opportunity cost of capital in both the terai and hill regions. The return on such investments in the hills was about a half of that in the terai. The limited new area that can be brought under cultivation and the

low return on investment on farm expansion indicate that crop production increases will have to come from yield improvements and crop intensification rather than from area expansion. The marginal productivity of capital, which was defined as the flow of investment made in livestock and farm equipment, was lower than its opportunity cost. As most of the equipment used by farmers in both regions -- particularly in the hills -- was traditional, the over-dependence on traditional farm equipment should be reduced, and increased use of improved tools should be emphasized.

Table 4. Marginal Value Products, Terai Region

Input	Unit	Price/Unit (Rs.)	Marginal value product (Rs)		
			Rice	Wheat	Sugarcane
Fertilizer	Kilogram	2.27	1.70	3.13	3.25
Hired labor	Days	5.44	4.95	11.57	9.15
Bullock	Days	15.83	5.70	1.85	0.25
Land	Rs.	0.12	0.06	0.07	0.09
Capital	Rs.	1.00	3.29	0.75	0.53
Family labor	Man-years	-	393.61	67.22	52.73
Education	Years	-	98.75	22.19	16.31
Machine	Hours	45.00	27.52	7.61	84.39

Table 5. Marginal Value Products, Hill Region

Input	Unit	Price/Unit (Rs.)	Marginal value product (Rs)		
			Rice	Wheat	Maize
Fertilizer	Kilogram	2.39	3.68	5.90	34.67
Hired labor	Days	6.10	3.18	6.44	3.75
Bullock	Days	14.35	72.55	32.53	28.74
Land	Rs.	0.12	0.03	0.03	0.02
Capital	Rs.	1.00	0.66	-0.01	0.50
Family labor	Man-years	-	28.85	16.11	35.41
Education	Years	-	32.65	-2.06	22.88

While the marginal productivity of family labor was positive in both regions, its contribution to crop output was much higher in the terai than in the hills. Farms are much bigger and the use of improved innovations is also greater in the terai than in the hills. Thus, the higher contribution of family labor in the terai does not necessarily mean that the terai farmers are more productive than their hill counterparts. Instead, it implies that family members in the terai can operate on larger and technologically better farms and there is an urgency to improve the farming technology and off-farm employment opportunities in the hills region. Education generally had a positive contribution to output in both regions.

This production function analysis suggests that increased use of fertilizer and other innovations has great potential for increasing the yields of crops in both the terai and the hills. Increased labor use can contribute to higher crop output in the terai, as can increased bullock use in the hills. The crop producers' tendency to over-use traditional farm tools and equipment should be discouraged by helpingthem to introduce improved and efficient tools. Returns on farm expansion are quite

low and farmers should be encouraged to make investments to improve land quality rather than in area expansion. While the contribution of education to individual crops is small and non-significant, its role in total farm production is important (Pudasaini 1983).

PRICE RESPONSIVENESS

A restricted profit function model directly yields output supply and input demand functions (Lau et al 1979; Pudasaini 1983a). Consequently, a restricted profit function was estimated in this study, and the following two functions were directly derived from it:

T The output supply function is:

(2) $\ln Y = \ln a_0 + \ln (1 - a_1 - a_2 - a_3) + a_1 \ln P_N + a_2 \ln P_B + a_3 \ln P_F + a_4 \ln L + a_5 \ln K + a_6 \ln NF + a_7 \ln A + a_8 E + a_9 X - (a_1 + a_2 + a_3) \ln P + a_{10} DL$

where

P = price of output (rice, wheat, maize, or sugarcane)

P_N = price of hired labor (NH);

P_B = price of bullocks;

P_F = price of fertilizer;

a and a_0 = constants;

and the typical factor demand function, say for hired labor is:

(3) $\ln NP = a_0 + \ln (-a_1) + (a_1 - 1) \ln P_N + a_2 \ln P_B + a_3 \ln P_F + a_4 \ln L + a_5 \ln K + a_6 \ln NF + a_7 \ln A + b_8 E + a_9 X + (1 - a_1 - a_2 - a_3) \ln P + a_{10} DL$

Output supply and input demand elasticities were then derived by differentiating (2) and (3) with respect to the price of output and the prices of variable inputs respectively.

Variable inputs (fertilizer, hired labor, and bullock) for rice were quite elastic with respect to their own prices in both the terai and hill regions (Table 6). They were even more responsive to changes in the rice price than to changes in their own prices. In other words, a

Table 6. Own and Cross-Price Elasticities of Output and Inputs for Rice

	Terai				Hills			
	P	P_N	P_B	P_F	PP	P_N	P_B	P_F
Y	0.815	-0.465	-0.349	-0.001	0.373	-0.198	-0.174	-0.001
NH	1.815	-1.465	-0.349	-0.001	1.373	-1.198	-0.174	-0.001
B	1.815	-0.465	-1.349	-0.001	1.373	-0.198	-1.174	-0.001
F	1.815	-0.465	-0.349	-1.001	1.373	-0.198	-0.174	-1.001

Y = supply of output; P = price of output; NH, B, and F are quantities of hired labor, bullock, and fertilizer; P_N, P_B, and P_F are money prices of hired labor, bullocks, and fertilizer.

Table 7. Own and Cross-Price Elasticities of Output and Inputs for Wheat

	Terai				Hills			
	P	P_N	P_B	P_F	P	P_N	P_B	P_F
Y	1.145	-0.308	-0.497	-0.340	0.565	-0.240	-0.451	0.126
NH	2.145	-1.308	-0.497	-0.340	1.565	-1.240	-0.451	0.126
B	2.145	-0.308	-1.497	-0.340	1.565	0.240	-1.451	0.126
F	2.145	-0.308	-0.497	-1.340	1.565	-0.240	-0.451	1.126

Table 8. Own and Cross-Price Elasticities of Output and Inputs for Sugarcane (Terai) and Maize (Hills)

	Terai				Hills			
	P	P_N	P_B	P_F	P	P_N	P_B	P_F
Y	1.428	-0.675	-0.530	-0.223	0.299	-0.039	-0.242	-0.018
NH	2.428	-1.675	-0.530	-0.223	1.299	-1.039	-0.242	-0.018
B	2.428	-0.675	-1.530	-0.223	1.299	-0.039	-1.242	-0.018
F	2.428	-0.675	-0.530	-1.223	1.299	-0.039	-0.242	-1.018

one percent decrease in the price of variable inputs increased demand for the inputs more than proportionately. But an increase in factor demand resulting from a one percent output price rise would be larger than that resulting from a one percent reduction in input price. The own-price elasticity of rice supply was less than unity, indicating that a one percent increase in output price raises rice output less than proportionately. The output price responsiveness of factor demand was higher in the terai than in the hills. The own-price elasticities of output supply and factor demand were also larger in the terai than in the hills, implying relatively higher price responsiveness in the terai. The higher price responsiveness in the terai may be because markets are relatively more developed and producers are less subsistent in the terai than in the hills. The cross-price elasticities of the variable inputs are small and negative, indicating that the inputs are weak complements.

Both wheat supply and factor demand were elastic with respect to their own prices in the terai (Table 7). Wheat supply was inelastic in the hills. Factor demands were elastic except for fertilizer which had an unexpected sign. As with rice, the elasticities of factor demands with respect to the wheat price were much larger than with respect to their their own prices. All the variable inputs (except fertilizer) were complements rather than substitutes in both regions. The own price responsiveness of wheat supply and input demand in the terai was greater

than in the hills. Furthermore, the own and cross-price elasticities were greater for wheat than for rice in both regions, indicating a greater output and input price responsiveness for wheat than for rice. This may be because wheat is marketed more than rice.

Sugarcane supply and input demand were highly responsive (elastic) to changes in their own prices (Table 8). However, input demands responded to changes in the sugarcane price much more than to changes in their own prices. While the maize supply was inelastic with respect to its own price change, its input demands displayed almost constant elasticities with respect to changes in the maize price. Similarly, the demand for maize inputs had almost constant elasticities with respect to changes in their own prices. The variable inputs used in both sugarcane and maize were more complements than substitutes. Of the crops considered in this study, sugarcane supply and input demand had the highest responsiveness to price changes. The high responsiveness of sugarcane may be because it is a cash crop and almost completely marketed.

This analysis of price elasticities has three main results. First, output and input price responsiveness of crops in the terai, where farming is less subsistent and markets are better developed, are higher than in the hill region. Second, the price responsiveness of relatively more commercial crops (sugarcane and wheat) is higher than that of more subsistence crops (rice and maize). Third, both output supply and input demand are more responsive to changes in output prices than to changes in input prices.

CONSLUSIONS AND IMPLICATIONS

Crop yields have been low in Nepal from 1967/68 to 1982/83 period. While rice and maize yields have been declining in the mountain, hill, and terai regions since the mid-1970s, the wheat yields increased marginally in the hills and terai. The largest decline in yields occurred in the mountain region, followed by the hills and terai. Rice and maize production peaked in the mid-1970s and has stagnated or declined since then. Wheat area and production

have modestly increased throughout the period except in the mountains. Area expansion has been the main source of production increase, and the scope for future area expansion in the terai, hills, and mountains is quite limited. Consequently, a major impetus for increased production will have to come from yield improvements and crop intensification.

Fertilizer has positively and significantly contributed to crop production in both the terai and hill regions. Its impact has been more pronounced in the terai, where the HYVs, irrigation and other innovations have been used more than in the Hills. Increased introduction of fertilizer along with other innovations can substantially raise crop productivity. Greater use of human labor in the terai and bullock labor in the hills can raise crop production, but increased use of traditional tools and equipment (capital) and further area expansion will probably not boost crop production. Education's contribution to productivity is substantial when a farm enterprise as a whole is considered and its impact is much higher in the dynamic terai agriculture than in the traditional hill situation (Pudasaini 1982). Thus, increased introduction of modern innovations coupled with emphasis on skill-oriented educational programs for farmers offers better opportunity for increasing crop yields and production. Given the hilly terrain of most of the country, a crop-livestock based improved dry-farming system must be evolved and introduced along with irrigated farming to improve crop yields.

Both output supply and input demand are more responsive to changes in the price of output than to the price of inputs. Output supply as well as input demand are more price elastic in the terai than in the hills. In both regions, the price elasticities for crops that pass more through markets (sugarcane and wheat) are much higher than for the subsistence crops (rice and maize) that are more consumed at home. Two important implications emerge from these findings. First, policies that raise output prices will be more effective in improving crop productivity and production than policies that reduce input prices. Second, crop production should be made more modern and commercial by introducing modern innovations and improvements in marketing facilities to make these crops more price responsive.

Appendix 1. Area, Yield, and Production of Rice

A = Area (000 Hectares)
P = Production (000 Metric Ton)
Y = Yield (Metric Tons per Hectare)

Year		National	Mountain	Hill	Terai
1967/68	A	1154	17	169	968
	P	2127	40	408	1679
	Y	1.84	2.35	2.41	1.73
1968/69	A	1163	18	173	972
	P	2178	41	422	1715
	Y	1.87	2.28	2.44	1.76
1969/70	A	1173	18	175	980
	P	2241	42	434	1765
	Y	1.91	2.34	2.48	1.80
1970/71	A	1182	18	179	985
	P	2304	43	458	1803
	Y	1.95	2.39	2.56	1.83
1971/72	A	1253	18	183	1052
	P	2337	44	438	1855
	Y	1.87	2.45	2.39	1.76
1972/73	A	1140	19	178	943
	P	2010	44	438	1528
	Y	1.76	2.31	2.47	1.62
1973/74	A	1227	20	195	1012
	P	2416	45	482	1889
	Y	1.97	2.25	2.47	1.87
1974/75	A	1240	20	196	1024
	P	2452	42	482	1928
	Y	1.98	2.10	2.46	1.88
1975/76	A	1256	25	196	1035
	P	2605	54	504	2047
	Y	2.07	2.16	2.57	1.98
1976/77	A	1266	26	199	1041
	P	2386	57	503	1826
	Y	1.88	2.19	2.53	1.75

Year		National	Mountain	Hill	Terai
1977/78	A	1264	27	203	1034
	P	2283	56	474	1753
	Y	1.81	2.07	2.33	1.70
1978/79	A	1263	27	203	1033
	P	2339	57	479	1803
	Y	1.85	2.11	2.36	1.75
1979/80	A	1254	26	202	1026
	P	2060	51	410	1599
	Y	1.64	1.96	2.03	1.56
1980/81	A	1377	25	210	1142
	P	2464	47	458	1959
	Y	1.79	1.88	2.18	1.72
1981/82	A	1297	26	238	1033
	P	2560	50	549	1961
	Y	1.97	1.92	2.31	1.90
1982/83	A	1266	25	249	991
	P	1832	44	491	1397
	Y	1.45	1.76	1.97	1.31

Source: The Department of Food and Agricultural Marketing Services.

Appendix 2. Area, Yield, and Production of Maize

A = Area (000 Hectares)
P = Production (000 Metric Ton)
Y = Yield (Metric Tons per Hectare)

Year		National	Mountain	Hill	Terai
1967/68	A	412	37	244	131
	P	745	68	472	205
	Y	1.81	1.84	1.93	1.56
1968/69	A	421	38	249	134
	P	765	71	482	212
	Y	1.82	1.87	1.94	1.58
1969/70	A	433	40	256	137
	P	795	74	500	221
	Y	1.84	1.85	1.95	1.61
1970/71	A	446	41	264	141
	P	834	78	525	231
	Y	1.87	1.90	1.90	1.64
1971/72	A	438	41	258	139
	P	759	77	457	225
	Y	1.73	1.88	1.77	1.62
1972/73	A	446	41	266	139
	P	823	76	510	237
	Y	1.85	1.85	1.92	1.71
1973/74	A	454	43	275	136
	P	808	77	509	222
	Y	1.78	1.79	1.85	1.63
1974/75	A	458	42	275	141
	P	826	78	516	232
	Y	1.80	1.86	1.88	1.65
1975/76	A	450	42	272	136
	P	748	77	491	180
	Y	1.66	1.83	1.81	1.32
1976/77	A	445	42	274	129
	P	798	78	506	214
	Y	1.79	1.86	1.85	1.66

Year		National	Mountain	Hill	Terai
1977/78	A	445	42	273	130
	P	739	69	451	219
	Y	1.66	1.64	1.65	1.68
1978/79	A	454	42	281	131
	P	743	70	463	210
	Y	1.64	1.67	1.65	1.60
1979/80	A	432	41	270	121
	P	554	56	359	139
	Y	1.28	1.37	1.33	1.15
1980/81	A	458	43	283	132
	P	743	68	454	221
	Y	1.62	1.58	1.60	1.67
1981/82	A	476	41	304	131
	P	752	64	474	214
	Y	1.58	1.56	1.56	1.63
1982/83	A	511	39	323	149
	P	718	57	434	227
	Y	1.41	1.46	1.34	1.52

Source: The Department of Food and Agricultural Marketing Services.

Appendix 3. Area, Yield, and Production of Wheat

A = Area (000 Hectares)
P = Production (000 Metric Ton)
Y = Yield (Metric Tons per Hectare)

Year		National	Mountain	Hill	Terai
1967/68	A	192	26	71	95
	P	204	33	89	82
	Y	1.06	1.27	1.25	0.86
1968/69	A	208	28	76	104
	P	232	35	99	98
	Y	1.12	1.25	1.30	0.94
1969/70	A	226	29	80	117
	P	265	38	108	119
	Y	1.17	1.31	1.35	1.02
1970/71	A	229	29	84	116
	P	193	29	82	82
	Y	0.84	1.00	0.98	0.71
1971/72	A	239	28	84	127
	P	224	30	94	100
	Y	0.94	1.07	1.12	0.79
1972/73	A	260	28	83	149
	P	312	25	95	192
	Y	1.20	0.89	1.14	1.29
1973/74	A	275	27	92	156
	P	309	25	98	186
	Y	1.12	0.93	1.07	1.19
1974/75	A	291	24	93	174
	P	331	21	99	211
	Y	1.14	0.88	1.06	1.21
1975/76	A	329	16	90	223
	P	387	18	107	262
	Y	1.18	1.13	1.19	1.17
1976/77	A	349	14	101	234
	P	362	12	114	236
	Y	1.04	0.86	1.13	1.01

Year		National	Mountain	Hill	Terai
1977/78	A	362	9	111	242
	P	412	12	134	266
	Y	1.14	1.33	1.21	1.10
1978/79	A	356	13	116	227
	P	415	12	143	260
	Y	1.17	0.92	1.23	1.15
1979/80	A	367	14	116	237
	P	440	13	140	287
	Y	1.20	0.93	1.21	1.21
1980/81	A	392	15	126	251
	P	478	15	145	318
	Y	1.22	1.00	1.15	1.27
1981/82	A	400	16	135	249
	P	529	17	181	331
	Y	1.32	1.06	1.34	1.33
1982/83	A	482	16	152	314
	P	661	17	197	447
	Y	1.37	1.06	1.30	1.42

Source: The Department of Food and Agricultural Marketing Services.

NOTE

1/ As a result of data availability, the production pattern analysis was carried out by dividing Nepal into three regions -- mountains, hills and terai -- while the rest of the analysis was done only for the hill and terai regions.

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