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IN THE FIELD

A case study of cash cropping in Nepal: Poverty alleviation or inequity?

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Abstract. Agricultural commercialization as a mechanism to alleviate rural poverty raises concerns about small land-holders, non-adopters, and inequity in the distribution of benefits within transforming economies. Farm gross margins were calculated to assess the economic status and impact of cash cropping on the economic well-being of agrarian households in the Mid-hills of Nepal. On an individual crop basis, tomatoes and potatoes were the most profitable. On a per farm basis, 50% of the households with positive farm gross margins grew at least one vegetable crop, while only 25% of households with negative farm gross margins included vegetable crops in their rotation. Farmers have been hesitant to produce primarily for the market given the rudimentary infrastructure and high variability in prices. Farmers reported selling more crops, but when corrected for inflation, gross revenues declined over time. The costs and benefits of developing markets have been unevenly distributed with small holders unable to capitalize on market opportunities and wealthier farmers engaging in input intensive cash cropping. Farms growing vegetables had an average gross margin of US$137 per year compared to US$12 per year for farms growing only staple crops. However, the area under production is small and, while vegetable production is likely to continue increasing, sensitivity analysis and scenarios suggest high variability and limited short-term impact on poverty alleviation.

Key words: Agriculture, Cash crops, Gross margin, Household economics, Market inequity, Nepal, Poverty

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Introduction

Cash cropping has been promoted by development specialists as a mechanism to alleviate rural poverty in countries such as Nepal. Programs have capitalized on existing transportation networks, the proximity to urban centers or niche markets (Carson, 1992; Panday, 1992). But there are concerns that agricultural commercialization by-passes the poor. The cash and land quality requirements of capital intensive farming may limit the capacity of poorer farmers to invest, while the risks associated with yield and price variability may limit their willingness to participate in commercial production (Quiroz and Valdes, 1995; von Braun, 1995; Reardon and Vosti, 1997).

Both the Agricultural Perspective Plan (APROSC, 1995) and the ninth National Plan (HMG, 1998) of Nepal promote the intensification of agriculture and increased cash crop production. In the Mid-hills of Nepal near Kathmandu, potato and tomato production have increased dramatically in the last 10 years (Brown and Shrestha, 2000). But, vegetable production is demanding of soil, water, and human resources. A systematic assessment of cash cropping is required to determine the impact on household well-being. The aims of this paper are five-fold: 1) to determine the relative profitability of vegetable production in the Mid-hills of Nepal; 2) to assess the economic impact of incorporating vegetables into the dominant cropping patterns; 3) to analyze the variability between households; 4) to assess the impact of fluctuations in price; and 5) to evaluate temporal changes in household well-being with the incorporation of vegetable production.

Study area

The Bela watershed, located 40 km east of Kathmandu (Figure 1), is somewhat unique in the Mid-hills due to its proximity to markets in Kathmandu, nearby road access, and local infrastructure for storage and handling. The watershed covers 1930 hectares in area and is dominated by rainfed agriculture (42%), degraded forests (32%), rangeland (11%), and irrigated agriculture (10%). Double and triple annual crop rotations are applied where irrigation water is available and rainfed agriculture is expanding onto steep, upland slopes. Cropping intensities have increased from an average of 1.3–1.6 crops per annum in the 1980s to 2.2–2.7 in the 1990s (Brown and Shrestha, 2000). Rainfed maize-wheat and irrigated potato/tomato-rice-wheat are the main rotations in this watershed.

The region is under intense pressure to meet the food demands for its growing population, and cash crop production is expanding rapidly. Seventy percent of the households surveyed reported growing vegetables on some of their irrigated land and the area under vegetable production more than doubled from 1989 to 1996 (Brown and Shrestha, 2000). With the introduction to Nepal of high yielding crop varieties in the 1980s and cash crops in the 1990s, agrochemical use increased. From 1994 to 2000, fertilizer application on intensively managed irrigated fields more than doubled (von Westarp, 2002).

Methods

The relative profitability of agricultural production between farms provides a mechanism to compare the economic status of farming households with diversified cropping systems. An indication of the profitability of each farm can be obtained by computing gross margins, defined as total returns less total variable costs (Rossiter,

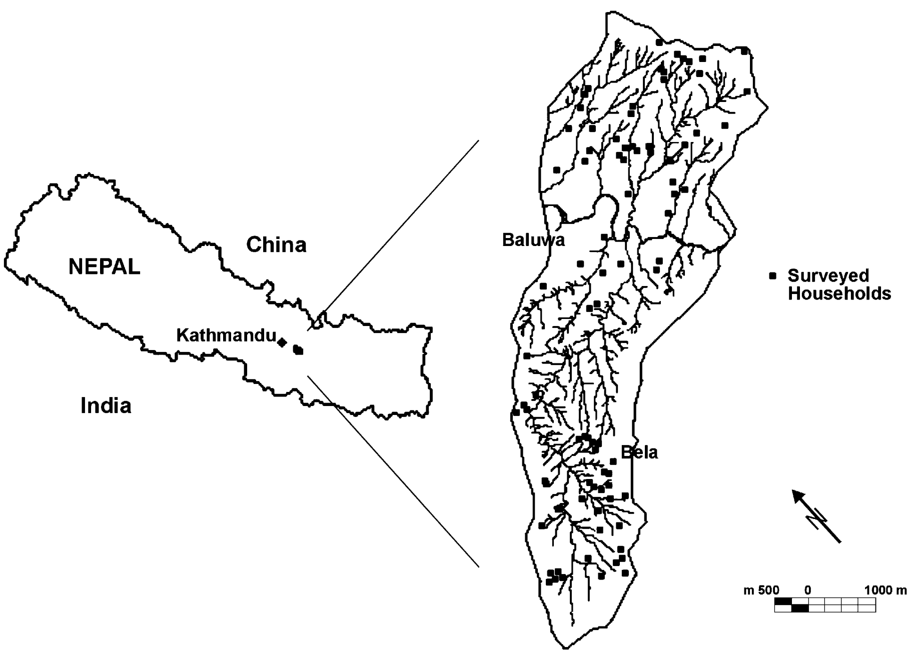

Figure 1. Household surveys locations, Bela watershed, Nepal.

1995). Total returns are equal to the value of all crops produced (including crop residues), irrespective of whether the crop is sold. Total variable costs include: the purchase of seed, fertilizer, and pesticides; hiring oxen; and all labor involved in cultivation activities. Labor includes the time spent in planting, irrigation, fertilizing, spraying, weeding, harvesting, transportation, and selling, and includes the opportunity cost of family labor. The gross margin can thus be viewed as the return to fixed costs (land and livestock) and management.

Gross margin analysis, in this context, focuses on production or income with respect to agriculture. As it does not take into account the time value of money, gross margins are not sensitive to interest rates, and are a good first approximation of financial feasibility (Rossiter, 1995). In an agrarian economy where other sources of income are limited, gross margins provide a good approximation of economic well-being. It is also a full-cost accounting approach as family labor is included. Gross margins, however, do not contain any analysis of fixed costs such as land and assume operating capital and labor availability do not constrain crop selection. Factors considered by farmers to contribute to well-being (e.g., livestock, labor) are only considered through their economic contribution and not through spiritual, health, or other values (Robb, 1998; Watson, 1999). Neither are they considered production constraints. As such, this analysis focuses on comparing the economics of staple and cash cropping between small, medium, and large land holders.

Household surveys

Detailed surveys were conducted with 85 households in the Bela watershed (Figure 1) to compile information from the farmers about their production systems. A watershed was used as the integrating unit for biophysical and socio-economic factors. Households were selected based on land use (irrigated and rainfed agriculture) and the dominant cropping systems, which vary with elevation and aspect (Brown, 1997). For each crop grown on irrigated and rainfed land, farmers indicated the amount of land farmed (ha), crop production (kg), seed use (kg), fertilizer (kg), pesticide (g or ml), oxen use (days), and total labor (days). Selling price and costs of inputs were then used to calculate returns and variable costs for each crop. For crops grown under a share-cropping arrangement, 50% of the total returns and variable costs were credited to both the tenant and landlord. Total gross margins from cultivation activities for each household were obtained by summing returns minus variable costs for all crops.

In addition, 27 household surveys conducted in the watershed by Kennedy and Dunlop (1989) were repeated in 1996. The men and women farmers interviewed in 1989 were asked the same questions in 1996 to assess changes in cropping systems, market oriented production, and chemical inputs.

Results and discussion

Production returns, variable costs, and gross margins for individual crops and totals on irrigated and rainfed land are summarized in Figures 2 and 3, respectively. Note that individual farms will contain a mix of both irrigated and rainfed land. Gross margin analysis is conducted first for individual crops and then for irrigated and rainfed land. Finally, it is aggregated by farm (Figure 4).

Total returns

Calculation of the total returns from crop production are summarized in Table 1. For each crop the median area cultivated is listed. Crop production (kg) represents grain or vegetable components and does not include crop residues. Estimates of crop residues were obtained by multiplying the grain or vegetable production by the ratio of residues to crop. A ratio of 1.25 was used for rice, and 1.22 for maize and wheat (Aldrich et al., 1975; Cox et al., 1985; Grist, 1986). Selling price is the local market value of the crops for the year of the study and does not include the value of crop residues. The value of crop residues is included separately as it represents the opportunity cost of residues for animal fodder or soil amendment. Residues are valued at roughly 5–10 rupees per basket (25 kg) or US\$0.005 kg^{-1}.Therefore, for farmer “A” producing 1236 kg of monsoon rice on 0.36 ha, the total returns can be calculated as follows:

$$[(1236 \text{ kg} \times \$0.13 \text{ kg}^{-1}) + (1236 \text{ kg} \times 1.25 \text{ residue: grain}) \times \$0.005 \text{ kg}^{-1}]/\ 0.36 \text{ ha} = \$468 \text{ ha}^{-1}.$$

Total returns on a per hectare basis are greatest for tomatoes and potatoes, grown on both irrigated and rainfed fields (Figure 2a). Median returns for tomatoes, potatoes, and wheat on irrigated land are higher than the returns from the same crops grown under rainfed conditions, indicative of the greater production potential of irrigated lands. The variability in total returns per hectare is high between farms and may be related to farmer knowledge, marketing skills, soil quality, or data irregularities. Returns to the farming household from a particular crop are dependent on the returns per hectare and the area under cultivation (Table 1). For irrigated land, tomatoes and potatoes have the highest total returns, but rice grown during the monsoon is also an important crop as a relatively large amount of land is under rice cultivation. For rainfed land, tomatoes and maize make up the greatest proportion of total returns

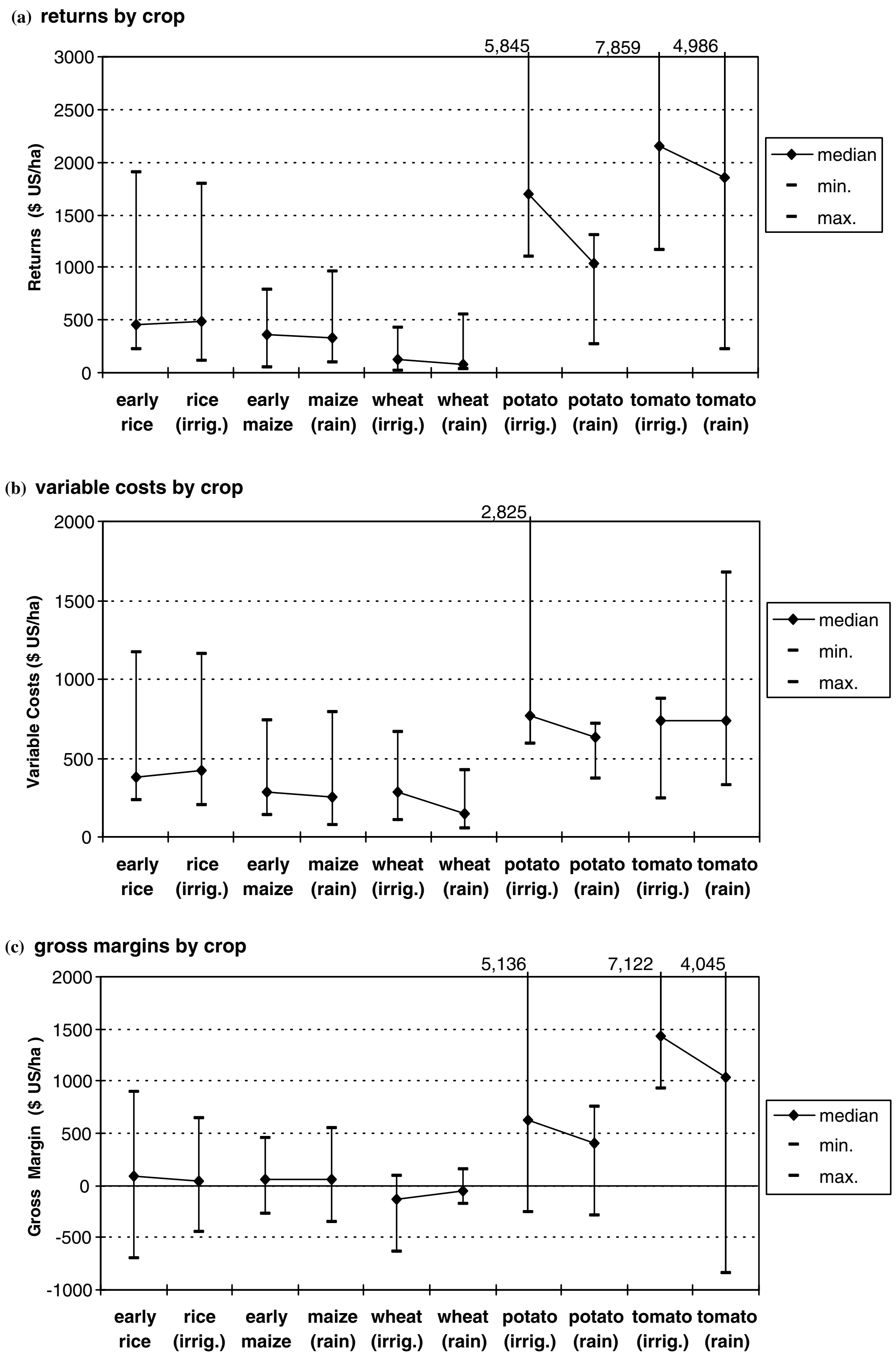

Figure 2. Total returns, variable costs and gross margins for individual crops.

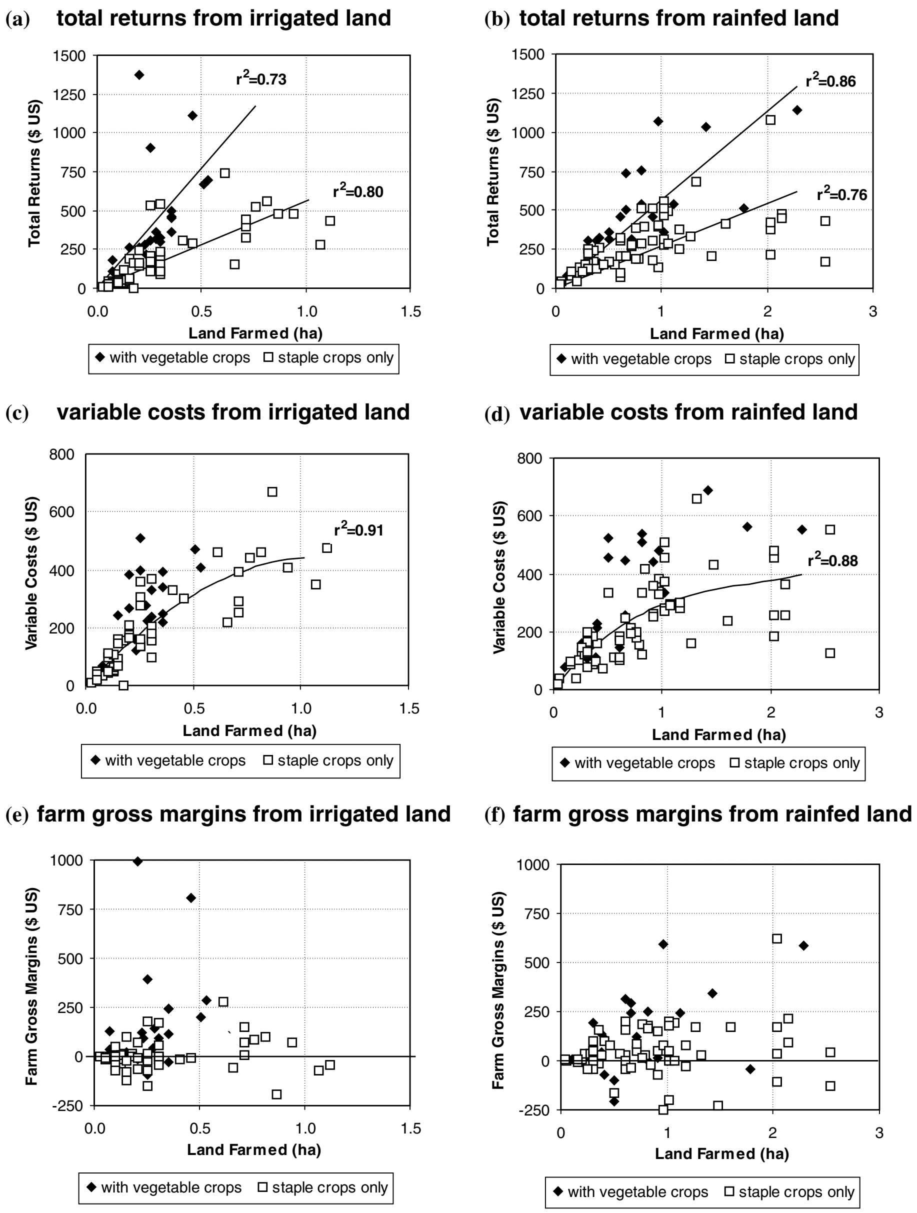

Figure 3. Total returns, variable costs and gross margins for irrigated and rainfed land.

reflecting the high returns per hectare of tomatoes and the large area under maize cultivation. Total returns from all crops on irrigated and rainfed land separated by households growing only staple crops and those which incorporate some vegetable production are shown in Figure 3a (irrigated) and 3b (rainfed). Best fit regression lines illustrate the significance of cash crops to total returns ($ per farm from all crops). For both irrigated and rainfed land, total returns increase faster with farm size for those households that produce some vegetables, and median returns are significantly greater. Returns on irrigated and rainfed lands where farmers grew at least one vegetable crop were $328 and $405, respectively compared to $143 and $205 where only staple crops were grown. The steeper rate of change in returns for vegetable producers suggests that small and medium scale producers may be able to capitalize on market opportunities.

Variable costs

The break down of variable costs for seed, chemical fertilizer, pesticide, oxen, and labor expenditures is listed in Table 2. The total variable costs are dominated by labor and oxen costs and represent the opportunity costs of alternative activities. Labor costs are based on local rates for unskilled farm labor ($0.82 per day) and the number of person days per crop. Labor costs are

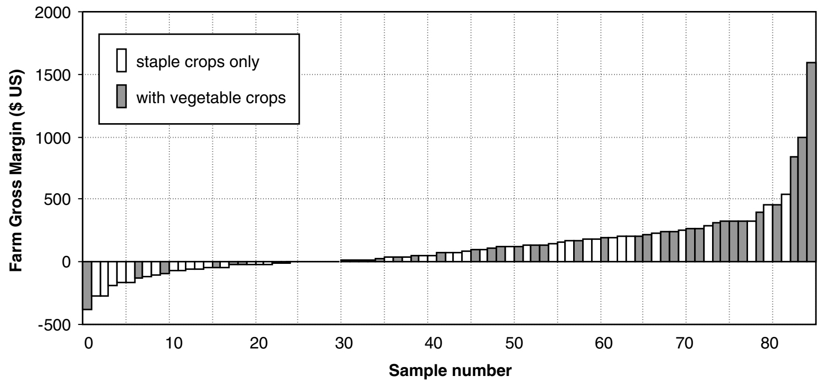

Figure 4. Annual farm gross margins from agricultural production (each bar represents an individual household).

greatest for tomatoes and potatoes on a per hectare basis, but labor inputs to rice and maize are significant on a total cost basis ($ per household). The purchase of chemical fertilizers contributes significantly to the variable costs of rice and potatoes on irrigated fields, and maize on rainfed sites. Pesticides are generally a small expenditure with the exception of farms growing tomatoes on irrigated land, but application rates are highly variable between sampled farms. In addition to the costs mentioned above, 20% of the farmers apply micronutrients to their tomato and potato crops. For farmer "A" producing 1236 kg of monsoon rice on 0.36 ha, the variable costs can be calculated as follows:

$$[(16.8\ \text{kg seed} \times \$0.26\ \text{kg}^{-1}) + (105\ \text{kg fertilizer} \times \$0.20\ \text{kg}^{-1}) + 0\ \text{kg pesticides} + 7\ \text{oxen days} \times \$4.91\ \$\ \text{day}^{-1}) + (105\ \text{person days} \times \$0.82\ \$\ \text{day}^{-1})]/0.36\ \text{ha} = \$405\ \text{ha}^{-1}$$

Total variable costs for the dominant crops grown on irrigated and rainfed land are shown in Figure 2b. Costs are greatest for tomatoes and potatoes and somewhat higher on irrigated fields. The distribution of variable costs per hectare is skewed, and farms that reported the highest costs do not always report the greatest returns. Variable costs on irrigated and rainfed land separated by households growing only staple crops and those that incorporate some vegetable production are shown in Figure 3c (irrigated) and 3d (rainfed). Variable costs diminish with the amount of land farmed, suggesting that economies of scale exist. Cubic functions, which reflect these diminishing costs, are applied to data for households growing only staple crops and illustrate the decreasing costs with larger land holdings, and the higher variable costs on irrigated fields.

Farm gross margins

Gross margins for the main crops grown in the study region are shown in Figure 2c. On an individual crop basis, tomatoes and potatoes are the most profitable on both irrigated and rainfed land, although differences between farms are highly variable. Median gross margins for rice and maize are low, and gross margins for wheat are slightly negative. Farm gross margins from all crops on irrigated and rainfed land separated by households growing only staple crops and those that incorporate some vegetable production are shown in Figure 3e (irrigated) and 3f (rainfed). This analysis compares households growing different crops, and livestock products (milk, eggs, and meat) are not considered. The highest gross margins are noted for households growing vegetables as part of their rotation and households with greater land holdings. However, farms with negative gross margins include both vegetable growers and large landowners reflecting production, management, marketing, input, and/or pricing complexity.

Variability between households

The total farm gross margin (per household) was determined by summing total returns less variables costs for all crops grown on all the land farmed (irrigated plus rainfed) by a household. Farm gross margins, based on all crops grown by a household, ranged from −385 to 1593 dollars per annum (Figure 4). About 32% of the households surveyed had farm gross margins less than zero, and 55% had farm gross margins below $100 per year. Negative farm gross margins imply that households did not earn the opportunity cost of labor on their own farms and could earn more by working off-farm. Employment opportunities in the region, however, are limited. Median earnings from off-farm employment were only $101 per year per family, with brick making being the dominant activity, and 40% of families were not involved in wage earning activities.

Forty percent of households had gross margins in the $100–$500 per annum range, while 5% were above $500 per year. Overall, households that included a

Table 1. Total production returns (median values) for major irrigated and rainfed crops.

Crop	*n*	Area (ha)	Production (kg)	Price ($ kg^{-1})	Returns	
					Total $	$ ha^{-1}
Irrigated						
Early maize	23	0.10	325	0.11	39	361
Monsoon rice	69	0.25	964	0.13	119	481
Wheat	47	0.18	280	0.08	25	134
Tomato	10	0.10	620	0.35	219	2,152
Potato	16	0.09	477	0.28	133	1,531
Total	72	0.25			195	781
Rainfed						
Maize	84	0.71	1610	0.11	197	328
Wheat	40	0.31	385	0.08	35	80
Tomato	15	0.08	431	0.35	152	1858
Potato	9	0.10	239	0.28	67	1042
Total	85	0.71			292	411

Note: All prices in US$.

vegetable crop in their rotation (shown in Figure 4 by the dark bars), had higher farm gross margins than households growing staple crops only. About 50% of households with positive farm gross margins grew at least one vegetable crop, while only 25% of households with negative farm gross margins included cash crops in their rotation. These large variations in net income among farms are not unexpected in an emerging market, and have been noted in other studies (e.g., de Jager et al., 1998).

Sensitivity analysis

A sensitivity analysis was conducted by varying the prices of the main crops and inputs by 10% and recalculating the farm gross margins. The results shown in Table 3 indicate that farm gross margins are sensitive to changes in the price of labor and the market prices of maize and potatoes. A 10% increase in the price of labor resulted in a 22% decrease in the median farm gross margin, while a 10% increase in the price of fertilizer resulted in a 10% reduction in farm gross margins. A 10% decrease in the market price of maize and potatoes resulted in 24% and 16% decreases in farm gross margins for households growing maize and potatoes, respectively. Households growing tomatoes as part of their cropping sequence were not significantly impacted by a 10% change in the price of tomatoes as the area under cultivation was small.

In addition to the sensitivity analysis, three probable scenarios were run: 1) an increase in fertilizer price; 2) international potato price fluctuation; and 3) valuing family labor at 75% of unskilled labor. Since 1972, fertilizer pricing has been fixed by the Agricultural Inputs Corporation, and transportation costs to the hills have been subsidized. In 1993, the Nepali government eliminated a major portion of the subsidy on most fertilizers, and the price increased by 27%. In 1999, urea based fertilizer subsides were removed, and the Agricultural Inputs Corporation's monopoly on the fertilizer market was abolished. While the Nepali government no longer provides direct subsides on agricultural inputs, concessionary rates are provided to small or marginal farmers in the hills where there is no motorized vehicle access (HMG, 2002). The impact of a significant change in fertilizer price today would be considerable. A 27% increase in fertilizer price would result in an estimated 26% reduction in the profitability of potatoes and a 43% reduction in farm gross margins, if the same amount of fertilizer were applied. Dramatic changes in

Table 2. Variable costs (median values) for seed, chemical fertilizer, pesticide, oxen, and labor.

Crop	*n*	Seed ($)	Fertilizer ($)	Pesticides ($)	Oxen ($)	Labor ($)	Variable costs	
							Total $	$ ha^{-1}
Irrigated								
Early maize	23	1	5	0	10	14	39	155
Monsoon rice	69	3	20	1	24	49	105	414
Wheat	47	4	10	0	20	16	54	281
Tomato	10	3	5	219	15	45	75	741
Potato	16	14	18	3	12	21	74	775
Total	72						179	675
Rainfed								
Maize	84	5	41	0	29	65	167	254
Wheat	40	4	3	0	24	16	50	146
Tomato	15	3	5	6	5	24	41	735
Potato	9	13	10	3	10	20	57	562
Total	85						218	305

Note: All costs in US$.

Table 3. Sensitivity analysis for farm gross margins.

Variable	n	Percentage change	Median farm gross margin		
			Initial value (US$)	Change	
				US$	%
Change in price of inputs (all producers)					
Fertilizer	85	+10	77	−8	−10
		+27	77	−33	−43
Labor	85	+10	77	−17	−22
Change in market price (producers of specific crops only)					
Maize	84	−10	75	−18	−24
Rice	69	−10	77	−4	−5
Tomato	24	−10	223	−10	−4
Potato	24	−10	123	−20	−16
		+100	123	+88	+58
Percentage of change in area under production					
Maize	84	+10	75	+3	+4
Rice	69	+10	77	+1	+1
Tomato	24	+10	223	+13	+6
Potato	24	+10	123	+5	+4

profitability associated with jumps in input pricing are not unforeseen in developing economies particularly with changes in government policy such as the removal of subsidies under structural adjustment policies (Gladwin et al., 2001).

In 1998, the market price of potatoes in the Mid-hills doubled as a result of blight in the Terai. If the same area of potatoes were cultivated, households growing potatoes would see a three-fold increase in the profitability of potatoes and a 58% increase in farm gross margin. With trade liberalization, greater price volatility is anticipated as domestic prices follow international prices more closely (Quiroz and Valdes, 1995). Nepal's open southern border with India dictates that free-market pricing is largely determined by the Indian border price, and the volume of off-season vegetables exported to India is estimated to be greater than official statistics suggest (Upadhyaya, 1999; Chapagain, 2001).

Changing the area under production had a limited impact on aggregate farm gross margin. A 10% increase in the area under rice, maize, potato, or tomato production (assuming the area under production for all other crops remained the same) resulted in increases in farm gross margin ≤6%. This is indicative of the low median gross margins for rice and maize (Figure 2c) and the small area under potato and tomato production (Table 2).

Initial family labor costs were set equivalent to unskilled labor at $0.82 per day to facilitate the comparison to off-farm employment. However, the value of household labor (largely female) is not perceived as equivalent to non-farm labor in household decision making (largely male), partially in response to limited off-farm employment opportunities (Brown, 1997). In addition, the value of unskilled female labor is approximately three-quarters of the value of unskilled male labor in the market. Valuing family labor at 75% of unskilled labor resulted in a 23% increase in farm gross margins and an 8% increase in the number of profitable farms. How family labor is valued will influence decision making particularly for labor-intensive vegetable crops. In addition, there is a significant opportunity cost involved in increasing women's workloads.

Farm gross margins, farm size, and food security

Farming is the dominant livelihood activity in the watershed. Wage employment both seasonally and locally is limited, and money sent home by family members working outside the watershed is also limited (median = $0/year). Farm gross margins for individual households, thus, provide an appropriate indicator of economic well-being as salary, pension, and other non-farm income do not contribute significantly to livelihoods.

Total returns and gross margins for farms are related to both land holdings and household food security. Table 4 shows the percentage of households reporting that the land they farm was insufficient, marginal, or sufficient to meet their basic need requirements by categories of farm gross margins. About 45% of the households that reported insufficient production had farm gross margins < $0 per year, while 45% and 49% of marginal and sufficient households had gross margins > $100 per year. Of the households not able to meet their basic needs through agriculture, only 20% had per capita gross margins > $25. By comparison, 40% of households that were able to meet their basic needs

Table 4. Self-sufficiency from land farmed *versus* land ownership and farm gross margins.

Sufficient	n	Land ownership (ha per capita)	Farm gross margins (% households)			
			<$0 (%)	>$0 (%)	>$100 (%)	>$25 per capita (%)
No	11	0.13	45	55	27	20
Marginal	29	0.15	17	83	45	38
Yes	45	0.20	31	69	49	40

Note: All values in US$.

Table 5. Economic indicators by farm size.

Crop rotation	Farm category	Area (ha)	Farms %	Returns ($)[a]		Gross margins ($)[a]		Crops sold[a] (%)
				Total	per ha	Total	per ha	
Staple [b]	Small	<1	30	212	436	7	18	0
	Medium	1–2	16	526	395	26	23	14
	Large	>2	12	682	288	182	66	2
	Median	0.94		317	396	12	36	0
Vegetable [c]	Small	<1	16	425	804	135	372	0
	Medium	1–2	14	742	579	186	133	36
	Large	>2	12	786	648	104	63	49
	Median	1.02		667	701	137	153	3

[a] Median values.
[b] Staple crops only.
[c] Includes at least one vegetable crop in their rotation.

through agriculture had gross margins >$25 per capita. Households that were not able to meet their basic need requirements also had the lowest per capita land ownership, and none of these households had per capita gross margins above $33 per year.

Analyzing economic indicators by farm size (Table 5) reveals that while small landholders have the ability to produce vegetable crops, they lack the ability or desire to capitalize on market opportunities. In this dominantly Brahmin area, potatoes are a traditional food, but tomatoes are not, suggesting that production is intended for the market. Small scale farmers (< 1 ha) make up 53% of producers in the study area, and the proportion growing vegetables as part of their rotation is relatively similar – 16%, 14%, and 12% for small, medium, and large farms, respectively. Total returns and gross margins increase with farm size, but small farms growing vegetables are more efficient on a per hectare basis with significantly higher gross margins per hectare than medium or large farms. Ironically, small farmers often do not sell the cash crops they produce, suggesting economies of scale and/or economic constraints to marketing. Market infrastructure for vegetable production is rudimentary. Cooperatives are small-scale, and many farmers market their produce privately, either at local bazaars or in Kathmandu (Pathak, 1989; Chapagain, 2001).

Subsistence versus commercial production

A lack of capital is an important constraint to agricultural production in Nepal (Panday, 1992; Brown, 1997). Involvement in market-oriented production is one way a household can generate income. The amount and type of crops sold and purchased by farming households is indicative of their level of involvement in the market. Farmers sold a variety of crops (Table 6) including traditional staples (cereal crops) and non-traditional cash crops (vegetables). Only a small minority of farmers systematically produced for the market, but 45% of farmers derived some income from the sale of agricultural produce. Maize was sold by 38% of the households, followed by rice (26%) and wheat (14%). The majority of producers sold < 50% of the crop, suggesting that sales were surplus production. Only 6% of the surveyed households sold >50% of their total crop production (based on weight) and just 14% sold >25% of their total production. Tomatoes and potatoes were the main cash crops, with the largest amount sold on both a weight and revenue basis.

The amount of production sold versus land holdings is shown in Figure 5. Small producers (< 1 ha) maintain subsistence food production, while mid-size producers (1–2 ha) produce a mix of subsistence and commercial production, a combination likely to reduce risk, despite higher returns to land and labor from cash crops. Poorer households tend to participate less than richer households in capital intensive farming because

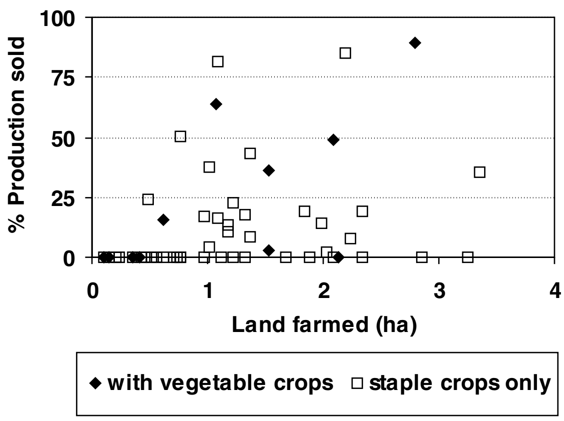

Figure 5. Participation in commercial agriculture by land holding.

Table 6. Crops sold by households.

Crop sold	Percentage of households selling crops	Percentage of producers selling >50%	Amount sold (kg yr^{-1})			Crop sales (US$)
			Minimum	Median	Maximum	
Maize	38	28	0	0	2100	0–409
Rice	26	13	0	0	1920	0–229
Wheat	14	0	0	0	490	0–29
Tomato[a]	11	50	0	480	42,000	0–4296
Potato	8	43	0	190	4275	0–289
Mustard	4	67	0	0	93	0–22
Onion	1	100	–	52	–	16
Garlic	1	100	–	96	–	33
Total	45					0–4720

[a]One large tomato producer.

of cash and land quality requirements and because they are less able to absorb the risk associated with price fluctuations (von Braun, 1995; Reardon and Vosti, 1997). Households with greater inputs (e.g., fertilizer, pesticide, manure) had the highest total returns, suggesting a capital constraint to profitability.

Despite a high government priority on agricultural inputs, intensification, and cash crop production in the 8th and 9th National Plans (Adhikary, 1998; Chapagain, 2001) and in the Agriculture Perspective Plan (APROSC, 1995), farmers in the study area have been hesitant to produce primarily for the market. Current transportation and marketing systems are rudimentary. The high costs of inputs such as fertilizer, pesticides, and seed restrict opportunities for farmers with limited access to capital. Retail prices fluctuate both seasonally and from year to year. Vegetable yields are often erratic and small farmers are hesitant to plant a large proportion of their land in cash crops. Labor requirements may be increased dramatically and may be an important constraint limiting the amount of land under vegetable production. For example, tomato production requires 2–3 times more labor than rice (Villareal, 1980). From 1989 to 1996, farmers surveyed in the town of Baluwa ($n = 27$) reported selling more crops, but when corrected for inflation, gross revenues decreased by 6%. In 1989, Baluwa farmers reported a median gross revenue of $81 (corrected for inflation) compared to $78 in 1996 (Brown, 1997). Over the past 10 years, inflation has averaged 11% per annum (World Bank and UNDP, 1991) resulting in a reduction in the purchasing power of income derived from the sale of crops by local farmers.

Some research indicates that, when cash crops are produced for the market on small mixed, self-sufficient farms, actual consumption levels within the family go down (e.g., Dewey, 1981). Within the study area, households consume a significant proportion of their production and purchase a range of food products to supplement or complement the crops they grow (Table 7). Of the households producing tomato and potato crops, two-thirds consume some or all of their production. About 53% report buying additional food. Rice is the crop purchased most often (33% of households) followed by potatoes and maize. The largest amounts purchased are rice and maize on a weight basis and rice and tomatoes on an expenditure basis. Thirty-two percent of the farmers surveyed purchase but do not sell any crops, indicating their need to supplement subsistence food production. While changes in consumption levels are not reported, the limited involvement in markets suggests that household nutrition has not been significantly impacted by the introduction of vegetable crops at this point in time.

Table 7. Food products purchased by households.

Food product bought	Percentage of households n = 85	Amount bought (kg year^{-1})	Expenditure (US$)
Rice	33	0–700	0–192
Potato	26	0–380	0–124
Maize	15	0–560	0–59
Wheat	8	0–375	0–24
Mustard	6	0–124	0–27
Total	53		0–313

Conclusions

Farm gross margins provide a good measure by which to compare the economic status of households growing a variety of crops. Overall, households that included a vegetable crop as part of their rotation had higher farm gross margins supporting the hypothesis that cash crop production may help alleviate rural poverty. However, large variability was noted between households. About 24% of vegetable producers had negative aggregate gross margins (on a per farm basis). Farm gross margins were related to land ownership and food security, with the poorest households owning the least land and less able to meet their basic need requirements through farming. Income from the sale of crops was greatest for potatoes and tomatoes, but when sales were corrected for inflation, farmers saw little net change in purchasing power, even though, they reported selling more crops. Farm gross margins were also sensitive to price fluctuations, particularly labor costs and maize and potato prices. The potentially high variability in farm gross margins between years was evaluated through sensitivity analysis. Probable scenarios based on recent changes in fertilizer price and the market value of potatoes demonstrate a high level of uncertainty in cash crop production in the Mid-hills of Nepal.

With the increased demand for cash crops, the focus of local farmers has become the market, which is influenced internationally. Differences in land ownership, accountability between local and export markets, and a lack of control over markets, particularly for cash crops, have limited the participation of small-scale farmers in market production. In the case study watershed, mid-size producers were active in cash crop production, displayed higher gross margins, and sold a greater proportion of their production. The costs and benefits of the developing market have been unevenly distributed. Farmers with land holdings greater than one hectare were better suited to input intensive market production, resulting in greater local inequities within this community. Without vegetable production, the aggregate farm gross margin would be lower. With vegetable production, the average gross margin is slightly higher, but the variability between farms growing cash crops ($137/year) and those growing staple crops ($12/year) has resulted in greater inequity. Land ownership, cash availability to purchase inputs, and risk aversion appear to influence decision making, but constraints to small scale farmers' entry into the cash crop market need further investigation. Given the low area under production, cash cropping has not significantly impacted poverty at this point in time, and with the current administrative instability in Nepal, policies encouraging the expansion of cash cropping are likely to lack continuity. While vegetable production in this region is likely to continue increasing in the near future, price fluctuations, erratic yields, and inflation contribute to the high variability in household economic well-being.

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