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AN ECONOMIC ANALYSIS OF FLUE-CURED TOBACCO IN NEPAL

Ganesh P. Rauniyar

HMG-USAID-GTZ-WINROCK PROJECT
STRENGTHENING INSTITUTIONAL CAPACITY IN THE
FOOD AND AGRICULTURAL SECTOR IN NEPAL

Foreword

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AN ECONOMIC ANALYSIS OF FLUE-CURED TOBACCO IN NEPAL

Ganesh P. Rauniyar*

ABSTRACT

This study was undertaken to investigate factor productivity and factor intensity of land, labor and capital across various measures of the farmer's operation. Further, the study attempted to investigate the Tobacco Development Company's recommendations on curing-barn capacity. The study covered fifty flue-cured variety (FCV) tobacco growers in Sarlahi district of Nepal in 1976/77. Due to data limitations, average products rather than marginal products were used as indicators of efficiency. It was found that barn size does not materially affect factor-productivity or average value product. Cost analysis revealed no evidence that one barn or farm size performs better than another with respect to any of the cost-output ratios, except that capital-output ratios are lower for large barn or farm groups. No association was observed either between barn size and unit firewood consumption in curing, or between barn size and the amount of non-gradable tobacco leaves. The study gives no support to the hypothesis that loading tobacco curing barns beyond TDC's recommendation on capacity use increases the amount of non-gradable leaves. There appear to be possibilities of higher capacity utilization, especially in medium and large barns for curing without significant increase in the amount of non-gradable tobacco leaves.

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INTRODUCTION

Cigarette tobacco was introduced in Nepal with Russian collaboration by the establishment of the Janakpur Cigarette Factory (JCF). His Majesty's Government (HMG) established the Tobacco Development Company (TDC) in 1971/72 to improve the quality and quantity of tobacco. The TDC presently provides extension services to cigarette tobacco farmers, provides credit through the Agricultural Development Bank (ADB), conducts field research trials and procures flue-cured varieties (FCV) and sun-cured varieties (SCV) of tobacco from the farmers.

A decline in total production of tobacco from 1964/65 to 1966/67 was apparently associated with the low price paid by JCF for the farmer's produce. In 1967/68, even though there was a notable increase in area planted, production was only slightly higher than in the previous year, due to adverse weather conditions. Low yields in 1972/73 were due to hailstorms, followed by a further decline in 1973/74 which was associated with heavy rainfall during the seedling and transplanting stages. FCV tobacco is highly intolerant of excess water conditions in the field which resulted in late planting, and fewer acres being planted in 1973/74 (TDC, 1974). There was a continuous rise in average yield of FCV tobacco from 1966/67 to 1976/77, except in 1973/74. The annual increase in area averaged 8 percent in the 13-year period between 1964 and 1976.

Several issues are important in an economic analysis of FCV tobacco production in Nepal:

- Factor productivity and factor intensity;
- The distribution mechanism for firewood and its effects on cost;
- TDC's policies on the size of curing barns.

First, factor productivity and factor intensity of land, labor and capital across various measures of the farmer's operation were investigated. Two separate analyses were needed; one for classifying farms by acreage in tobacco, the other by size of their curing barns. The purpose of these analyses was to determine efficiency in farm size or barn size operation.

Curing accounts for an important fraction of total costs, and firewood makes up a large part of curing costs. Since no substitute energy source is readily available, recent increases in the cost of firewood have been problematic. Traditionally, farmers obtained wood directly from the forests, paying only a nominal charge if any and treating the forest as common property. As is often true of any common resource in the face of sufficient demand, forests were exploited at rates greater than optimal, resulting in a denuded forest and considerable soil erosion. Farmers paid less than the marginal social cost for wood, and so more wood than under a socially optimal regime was used.

In an effort to protect forest resources, TDC has specified, since 1975, that registered farmers must purchase wood only from the state fuel corporation, Indhan Sansthan. This corporation has sought to induce optimal rates of logging by setting a price more reflective of social cost. Many farmers have avoided incurring these higher costs by drawing on old stocks of wood, or cutting mango wood from orchard operators. Mango orchards are limited and take some years to replenish, and drawing down inventories is obviously only a temporary solution; eventually, farmers must face the higher price.

TDC's recommendations on curing barn capacity were investigated since actual capacity use deviated from these recommendations. Association between barn size and quality of the product was assessed and it was attempted to determine if over-capacity utilization of curing barns resulted in badly cured tobacco.

METHODOLOGY AND PROCEDURES

Sampling and Data Gathering

Sarlahi District is one of four FCV tobacco growing districts (Mahottari, Sarlahi, Dhanusha and Siraha). Even though FCV tobacco has been grown in Nepal for 15 years, existing data provide only annual production figures. Thus, in the absence of time series data, a cross-sectional design was chosen. The data for the sample covers the nine months period July-March of the cropping year 1976/77.

Even though a large number of non-registered farmers existed, they could not be identified, and thus only 167 registered farmers were counted in the population. They included 16 small, 81 medium, and 70 large barn size farms. Stratified random sampling was done based on geographical distribution by panchayat. The sample covered all 14 FCV tobacco growing panchayats of Sarlahi district. A questionnaire in Nepali was used to collect information on FCV tobacco cultivation in the project area, by interviewing the 50 sample farmers.

Measurement of Efficiency

The relative efficiency of barn size and farm size, according to the acreage of tobacco planted, were determined in order to investigate the efficiency of production and economies of size. Barns were classified as small (125 m3), medium (138 m3) and large (180 m3). Farm sizes were classified as small (0.5-2.0 bighas), medium (2-4.5 bighas) and large (4.5-10 bighas). (One bigha is 0.68 ha.)

Heady and Dillon (1961) note that average products are frequently used as measures of efficiency due to lack of marginal product data. However, these average products have no strict validity as indicators of resource use efficiency. An average product ratio implicitly assigns responsibility for total output to the factor in question, whereas marginal products of all factors are interlinked. Average factor productivity was calculated using the weighted (by grade) average revenue at each farm. Thus, this measure of average productivity indicates "average practice" rather than the best practice (Johansen, 1972).

Two kinds of analyses were carried out: productivity analysis and total revenue analysis. Productivity analysis includes only self-produced FCV tobacco by a farmer. Analogous analysis was done taking into account total revenue in order to include two other sources of revenues: curing other farmers' tobacco; and selling choor (non-gradable tobacco leaves) which were not considered in factor productivity analysis.

Cost analysis was done to investigate factor intensity and economies in barn size or farm size operations and curing cost. Not all farms hired bullocks or a tractor. Shadow rates were used to evaluate these costs, as well as

land and labor costs. The opportunity cost of land was determined by asking the farmers how much they could get if they rented out land to others for one tobacco season rather than cultivating it themselves. Labor cost included payment of wages to occasional, permanent and family laborers. Materials cost included payment made for the purchase of seeds, fertilizers, chemicals, firewood and packing materials. Capital cost included the depreciation of investment on barn house and barn materials. Total cost included fixed costs in addition to variable costs. Growing cost included costs incurred from the seeding to the preharvest stage of tobacco growing. A straightline method was used for computing depreciation on capital goods. Total revenue received by a farmer was composed of revenue from the sale of his tobacco, revenue obtained by curing others' tobacco and revenue from the sale of non-gradable tobacco leaves.

ANALYSIS OF RESULTS

Survey data revealed that the average daily wage rate per farm laborer (for eight hours work) varied from Rs.5-9 (Rs.12 = US$ 1.00). The weighted average interest rate charged by ADB (14 percent) and other sources (30 percent) was estimated to be approximately 20 percent per year. The opportunity cost of land was estimated to be Rs.1,000 per bigha (0.68 ha) per tobacco season. Characteristic data of the 50 sample farmers are presented in Table 1.

Table 1. Input and Output Levels by Barn Size and Farm Size

	Barn Size			Farm Size		
	Small	Medium	Large	Small	Medium	Large
Number of farms	5	25	20	14	22	14
Land (bighas)	2.20	3.96	3.84	1.51	3.59	6.14
Labor (mandays)	779	1,209	1,265	614	1,179	1,827
Capital (Rs)	3,394	3,338	3,377	3,428	3,360	3,289
Total cost (Rs)	19,019	25,908	24,665	18,247	23,590	33,529
Variable cost (Rs)	13,425	18,632	17,450	12,752	16,639	24,696
Quantity cured (own production, kg)	2,137	3,205	2,650	1,694	2,720	4,305
Quantity cured (own +custom curing, kg)	5,319	4,427	4,397	4,043	4,386	4,994
Total Revenue (Rs)	35,265	40,595	36,181	27,653	36,680	51,911

Source: Survey data

Factor Productivity Analysis of Self-Produced Tobacco

As discussed in the previous section, the average factor productivities were used as the measure of efficiency in the absence of marginal productivity data. The ratios of output to input of land, labor and capital were computed for each farm and the mean of these ratios appears in Table 2.

It was found that small barns and small farms produced the greatest output per unit land and the highest average value product of land. The highest output-labor ratio was observed on small farms and medium barns. Small farms could utilize the limited land and labor inputs relatively more intensively, thereby yielding higher revenue. Large farms have the greatest output-capital ratio and the highest average value product of capital. This suggests the possible existence of economies in capital use.

An equal-means test (Mood and Carybill, 1963) was performed for barn sizes and farm sizes in pairs to see whether different barn size/farm size combinations led to significantly different factor productivities and average value products. The resulting 't' statistics suggested that neither factor productivity ratios nor average value products of these factors differed significantly across barn sizes. Hence, barn size did not matter.

A similar result was obtained for labor productivity and land productivity and its average value products across all farm sizes. The average value products of land, labor and capital exceeded their respective opportunity costs. Note, however, that in the absence of marginal productivity estimates, one can draw no conclusions on the desirability of expanding or contracting the use of each input.

Factor Productivity Analysis of Total Revenue

In the foregoing productivity analysis, only the amount of self produced and cured FCV tobacco by each farmer was considered. In addition, farmers earned from two other sources as well--curing other farmers' green leaves, and the sale of choor. Ratios of revenue-factor costs were computed from survey data and their means appear in Table 2.

Table 2. Factor Productivity, Revenue-Factor Cost, and Cost-Output Ratios**

Mean Ratios	Barn Size			Farm Size			All
	Small	Medium	Large	Small	Medium	Large	
Output/Land (kg/bigha)	982	779	885	1076	761	770	852
Output/Labor (kg/manday)	2.65	2.76	2.31	2.79	2.38	2.63	3.61
Output/Capital (kg/Rs)	0.67	0.97	0.79	0.49	0.81	1.62	0.95
AVP* of Land (000 Rs/bigha)	11.2	10.1	8.9	12.4	8.6	9.3	9.9
AVP* of Labor (Rs/manday)	30.4	31.4	25.7	32.3	27.1	30.2	24.4
AVP* of Capital (Rs/Rs)	7.74	10.96	9.07	5.26	11.00	18.59	11.52
Revenue/Land Cost	14.64	9.16	9.35	12.10	6.68	4.42	7.56
Revenue/Labor Cost	7.32	4.91	4.96	7.00	4.89	4.83	5.46
Revenue/Capital Cost	11.03	12.37	10.86	8.14	11.00	16.17	11.65
Capital/Output (Rs/kg)	2.57	2.17	1.97	3.54	1.82	0.90	2.04
Labor/Output (manday/kg)	0.45	0.65	0.56	0.57	0.62	0.59	0.60
Land Cost/Output (Rs/kg)	1.80	2.34	2.28	1.80	2.12	2.79	2.22
VGC*/Output(Rs/kg)	3.04	4.47	3.69	3.67	4.06	4.23	4.00
TGC*/Output(Rs/kg)	4.41	6.55	5.49	4.98	6.19	6.42	5.92
VC*/Output(Rs/kg)	8.72	9.62	8.54	12.11	8.02	7.82	9.11
TC*/Output(Rs/kg)	12.73	13.86	12.33	16.98	11.93	11.18	13.13
VCC*/Output(Rs/kg)	1.24	1.99	1.63	1.54	2.07	2.03	1.91
TCC*/Output(Rs/kg)	1.91	2.98	2.49	2.16	2.59	2.91	2.64

Source: Survey data. *AVP = average variable product; VGC = variable growing cost; TGC = total growing cost; VC = variable cost; TC = total cost; VCC = variable curing cost; TCC = total curing cost. **Each ratio reported is the mean of the ratios calculated for each farm in the respective class; therefore, the capital-output ratio is not exactly equal to the inverse of the output-capital ratio.

Except for capital, all the ratios were highest for small barn size as well as for small farm size. Tests of equality were done on the values of each ratio for all possible pairs of barn size and farm size.

With respect to the size of the barn, the statistical analysis revealed that only the revenue-labor cost ratio of enterprises with small barns was significantly different from medium and large barn enterprises. However, with respect to the size of the farm, all differences in the observed ratios were statistically significant, with the exception of differences in land and labor cost, respectively, between medium and large farms.

Cost Analysis

Cost analysis was performed to investigate possibilities of economies in barn or farm size operation with respect to cured tobacco production, including growing costs of tobacco as well as curing costs. From the survey data, average cost figures were calculated for each farm. Means of these ratios appear in Table 2.

It appeared that large barns and large farms incurred the least per unit capital cost. Small barns and small farms incurred least per unit labor and land cost. This may be because small farms and barns can use land and labor inputs more intensively, employing more family laborers who were willing to work long hours in the field. Their larger complements of capital per unit of output also suggested that labor and land should be more productive.

Small barns and small farms incurred least unit variable and total growing cost, as well as curing cost with respect to the output of cured tobacco. However, large barns and large farms incurred least unit variable as well as unit total cost of producing cured tobacco. Hence, post-curing costs with small farms or barns must be sufficiently high to offset these farms' advantages in growing and curing stages. This may suggest the possibility of diseconomies of barn size and farm size with respect to growing and curing costs of cured tobacco. Considering post-curing costs, it might also suggest possible economies in barn or farm size operation.

Tests of equality were done on the values of each ratio for all possible pairs of barn size and farm size. The resulting 't' statistics suggested that the null hypothesis of equality of means between pairs of ratios cannot be rejected at the 5 percent level of significance. The sample data gave no statistically significant evidence that one barn or farm size performs better than another with respect to any of the ratios computed, except that of capital on all farm sizes. Capital-output ratios were significantly lower for large barn and farm sizes.

Capacity Utilization of Curing Barns

Optimum barn size has not been experimentally determined for local conditions in Nepal. Broadly speaking, curing barns are classified as small (5mx5mx5m), medium (5.5mx5mx5m) and large (6mx6mx5m). For standard small, medium and large barns, the capacity is given in Table 3.

Table 3. Normal Capacity of FCV Tobacco Curing Barns

Barn Size	Volume (m^3)	Sticks per load	Green leaves /load	Green leaves /load	Dry leaves /load	Dry leaves (Kg/m^3)
Small	125	700	70,000	1,495	248	1.98
Medium	138	1000	100,000	2,135	354	2.57
Large	180	1100	110,000	2,349	390	2.16

Source: TDC
The ratio of green leaves to dry leaves is 1:6 by weight.

Earlier it was concluded that there did not exist any economies of size in the curing operation. Survey data revealed that 66 percent of total variable cost of the curing process was for firewood alone. Thus, in order to investigate possible economies across barn size in firewood consumption per unit of output (cured tobacco), the per unit firewood consumption of each barn was computed. Means were found to be 6.19 kg, 11.6 kg and 10.4 kg per kg of cured tobacco for small, medium and large barn farms respectively, but the differences were statistically not significant because of the small number of observations in the small barn size group. The sample data gave insufficient evidence that one barn size required a significantly different amount of firewood per unit of tobacco than another.

Table 4. Mean Capacity Utilization of Curing Barns

Barn Size	Capacity use (Kg/m3) TDC Recommendation	Actual
Small	1.98	5.00
Medium	2.57	2.85
Large	2.16	2.55

Source: Survey data.

Table 4 reveals that small barns were run above capacity by 152 percent, medium barns by 11 percent and large barns by 18 percent. This gives an indication of why small barns had consistently lower cost figures.

There was no evidence to lend support to the hypothesis that loading barns beyond TDC's recommended capacity increased the amount of damaged leaves. Quality of output represented by unit revenue had no association with small and large barn size and choor had no significant positive association with the amount of tobacco cured in excess of capacity. There appears to be sufficient capacity in medium and large barns for curing tobacco without increasing choor. Whatever loss was recorded as choor, there was no evidence of it being associated with above-capacity use of curing barns. Instead, it was largely associated with handling losses which could have been minimized by effective labor management on the farm during post-curing operations.

Further research is necessary to determine the optimum capacity recommendation for a curing barn. In addition, the question of the effect of above-capacity utilization on deterioration of tobacco quality should be investigated.

CONCLUSIONS

This analysis indicates that barn size does not materially affect factor productivity or average value product. The average value products of all factors exceeded their respective opportunity costs. Revenue data partially contradict productivity estimates due to inclusion of revenues from choor and from contract curing in the latter data. Cost analysis revealed no evidence that one barn or farm size performs better than another with respect to any of the

cost-output ratios dealt with in this study. However, capital-output ratios are lower for large barns and farms.

There is no significant association between barn size and per unit firewood consumption in curing. Additionally no relationship appears between barn size and amount of choor. The study gives no support to the hypothesis that loading barns beyond TDC's recommended capacity increases the amount of damaged tobacco leaves. There appear to be possibilities for higher capacity utilization especially in medium and large barns for curing without a significant increase in choor.

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