

FORESTRY PLANNING AND DEVELOPMENT PROJECT

CONSULTANCY REPORT

WOOD CONSUMPTION SURVEY
IN THE FLUE-CURED VIRGINIA TOBACCO INDUSTRY
IN PAKISTAN

By

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Under Contract to:
Winrock International
58 Margalla Road, F 7/2
Islamabad, Pakistan

for the
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WOOD CONSUMPTION IN THE FLUE-CURED VIRGINIA
TOBACCO INDUSTRY IN PAKISTAN



GOVERNMENT OF PAKISTAN

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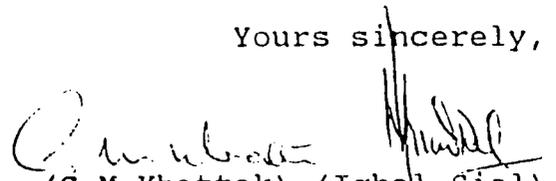
Dear Dr. Hatch,

Please refer to your letter of 22 May, 1990.

We are enclosing the report of our consultancy "Wood Consumption in the Flue-cured Virginia Tobacco Industry in Pakistan".

We are also enclosing the original questionnaires used for collecting the information.

Yours sincerely,


(G.M. Khattak) (Iqbal Sial)

Dr. Charles R. Hatch
Chief of Party
Forestry Planning & Development Project
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Islamabad

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LIST OF ABBREVIATIONS

FATA	Federally Administered Tribal Area
FCV	Flue cured virginia
LTC	Jackson Tobacco Company
NWFP	North West Frontier Province
PTC	Pakistan Tobacco Company
PTI	Premier Tobacco Industries
SCI	Sarhad Cigarette Industries
STC	Souvenir Tobacco Company
UTI	United Tobacco Industries
ULTC	Universal Tobacco Company

EXECUTIVE SUMMARY

Flue-cure virginia tobacco is grown over an area of 11700 hectares in Peshawar, Hazara and Malakand Civil Divisions of North West Frontier Province of Pakistan, producing about 24.8 million kg of cured tobacco leaves. The tobacco leaves are flue-cured in small-sized, wood fired traditional barns. Twelve tobacco companies maintain 36 purchase depots scattered throughout the tobacco growing area. Every tobacco grower gets himself registered with one or more tobacco companies who are bound by agreement, executed each year, to purchase the stipulated quantity of cured leaves from the producers, at a minimum price announced in advance. Each tobacco company maintains lists of their agreement holders, for each of their purchase depots. During the 1990 tobacco growing season, 9915 FCV tobacco growers were registered with various tobacco companies. A random sample of 98 tobacco growers was drawn out of these registered FCV tobacco growers. Out of these 83 respondents could be interviewed, the remaining 15 being untraceable.

Based on the results of the interviews with the respondent tobacco growers, it was estimated that, on an average, about 77000 tonnes of firewood are consumed annually in curing FCV tobacco. Acacia modesta, A. nilotica, Morus alba and Dalbergia sissoo constitute 84 percent of firewood used in FCV tobacco curing. Tobacco growers seem to prefer firewood obtained from Acacia modesta, A. nilotica, Olea ferruginea and Morus alba. Their preference appears related to the high specific gravity of these species.

In 1990, on an average, our respondents paid Rs 46, 44 and 30 per 40 kg of firewood in Mardan - Charsadda, Baffa, and Buner - Swat, respectively. The price of firewood used in curing FCV tobacco has increased by 12 to 42 percent during the last three years. The cost of firewood accounts for 43 percent of the total cost of curing FCV tobacco.

Eighty percent of the firewood consumed in tobacco curing originates from the Punjab, of which 36 percent, mainly Acacia modesta, emanates from the forest lands of Attock District; and 44 percent from the farm lands. The remaining 20 percent is produced locally: 16 percent from agricultural lands; 3 percent, mainly Quercus ilex, from FATA; and 1 percent from forest/waste lands.

1. INTRODUCTION

1.1 History

Tobacco was brought to India by the Portuguese about 350 years ago, in the reign of Emperor Akbar. Virginia tobacco was experimentally grown at the Agricultural Research Station, Tarnab in 1912. Its cultivation started in 1948, initially over about 8 ha, and gradually spread to 32374 ha in 1971. In 1972 it plummeted to 9810 ha due to the separation of Bangladesh from Pakistan but the very next year recovered to 14334 ha (Anon 1977). Table 1 gives the area, production, and yield of flue-cured virginia (FCV) tobacco since 1980-81 (Anon 1988).

Table 1 Area, production and yield of FCV tobacco in Pakistan

Year	Area (000 ha)	Production (million kg)	Yield (kg/ha)
1980-81	14.3	24.6	1724
1981-82	15.5	28.6	1846
1982-83	14.7	25.0	1706
1983-84	15.7	33.6	2149
1984-85	17.3	35.3	2044
1985-86	15.0	32.0	2135
1986-87	12.2	25.8	2120
1987-88	11.9	24.8	2089
1988-89	11.0	23.8	2168
1989-90	11.7	24.6	2094
Average for the past 4 years	11.7	24.8	2118

The table indicates that for the past four years the area appears to have been stabilized at about 11700 ha and the production and yield per hectare, at 24.8 million kg and 2118 kg, respectively.

1.2 Cultivation

Flue-cured virginia (FCV) tobacco is prepared from the leaves of Nicotiana tabacum, originating perhaps in Brazil or Central America (Hawks and Collins 1983). Tobacco needs at least 120 frost free days for its maturity and is grown on a wide variety of soils in about 75 countries. In Pakistan, FCV tobacco is grown in Peshawar, Hazara, and Malakand Civil Divisions of North West Frontier Province (NWFP).

1.2.1 Nursery preparation

For making seed beds, start in October, with irrigation and the removal of weeds and stubble. Plough, plank, and plough again with rotivator to get a fine tilth. Make beds east-west; 20 m long, 0.8 m wide, raised 15 cm above ground; about a meter apart. Sterilize soil using Methyl Bromide at 0.5 kg/10 m². In soil of low fertility, top dress with NPK 10:20:20 @ 4 kg/14 m² mixed in the top 5 cm of soil. Mix 1.5 gm tobacco seed with silt or fine sand and broadcast uniformly over a 20 x 0.5 m seed bed. Cover with a thin layer of straw and irrigate using sprinkler irrigation to keep soil continuously moist. Cover with polythene during night to protect from cold. Seedlings would be ready for transplanting when about 15 cm tall and of pencil thickness (Khan, A 1987).

1.2.2 Land preparation for transplanting

Start land preparation in November, immediately after removal of the preceding crop in rotation. Plough deep, three or four times,

plank for breaking clods, and cultivate again with a rotivator to obtain a fine tilth (Khan, B 1987). Place fertilizer either deep enough or to the side of the row so that it is at least 10 cm away from the roots of the transplanted seedlings. Fertilizer may also be applied as a side dressing, ten days after transplanting (Hawks and Collins 1983).

1.2.3 Transplanting

Transplant seedlings 15 cm apart on 30 cm high ridges giving a plant population of about 18000 per ha at the first inter-cultivation. Irrigate immediately. Repeat irrigations at intervals of 4-5 days. Intercultivate 4-5 times during the growing season for weed control and soil aeration. Control bud-worms, cut worms and aphids (Khan, B 1987).

1.2.4 Topping and suckering

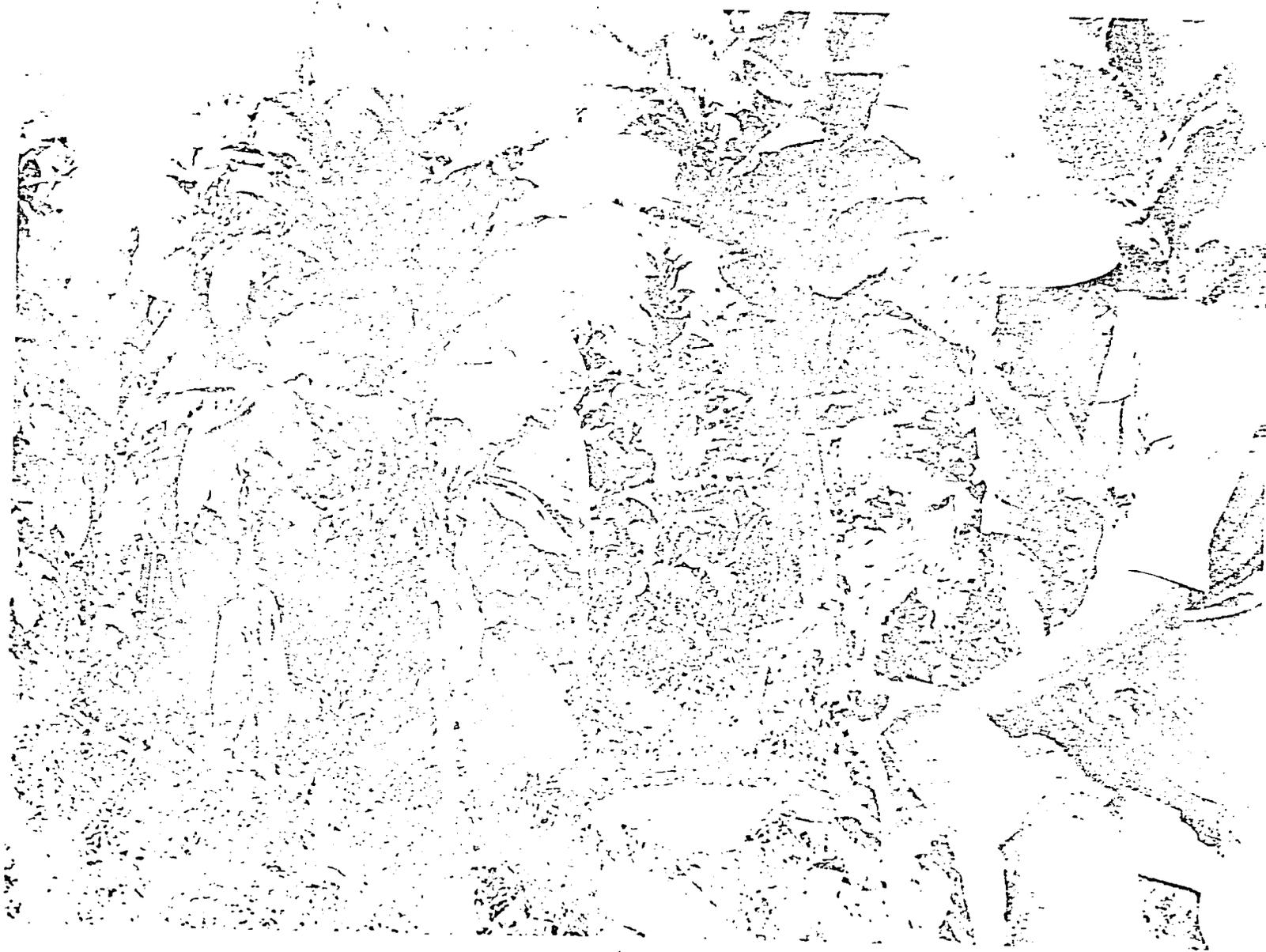
Remove apical inflorescence just before its flowers open (topping). Also remove suckers which appear after topping, either manually or chemically. Topping and suckering increase root growth; prevent lodging; and increase leaf weight, body, and alkaloid and sugar contents, giving a superior cured leaf (Hawks and Collins 1983).

1.3 Harvesting

To obtain tobacco of high quality, harvest only physiologically mature leaves. According to Hawks and Collins (1983) yield and price of cured leaf decreases considerably if the leaves are picked



Mature tobacco



Leaf picking

even a week earlier or later than full maturity. Therefore, use trained workers for leaf harvesting, capable of assessing leaf maturity correctly.

Under normal conditions of climate, soil fertility, and irrigation, 2-4 leaves mature per plant, every 7-10 days, over a harvesting period of 5-7 weeks. In NWFP, however, tobacco growers may pick as many as 5 leaves per plant at a time just to fill the barn (Hashmi 1987). For leaf picking, divide the plant into five height levels and at each picking, harvest leaves of a particular level only from each plant. This is necessary because leaves of various height levels vary in stage of maturity, heat requirement in the barn, quality of cured leaf and its price. Start picking early in the morning and stop before mid day. Avoid picking when leaves are either over-turgid due to recent irrigation, or not turgid enough due to moisture stress. Carry immediately to shade and keep in small heaps covered with moist sacking. Transport expeditiously to tying shed. Avoid bruising or scratching which will show up as brown stains on cured leaves and reduce their quality and price.

1.4 Leaf tying

Tie leaves to jantar (Sesbania bispinosa) sticks as soon as they reach the tying shed to prevent heating which will occur if leaves are kept heaped for long. Space leaves uniformly on the sticks, neither so close that air flow through them is retarded, nor so far apart to cause the browning of leaves through over-ventilation. As



Leaf tying

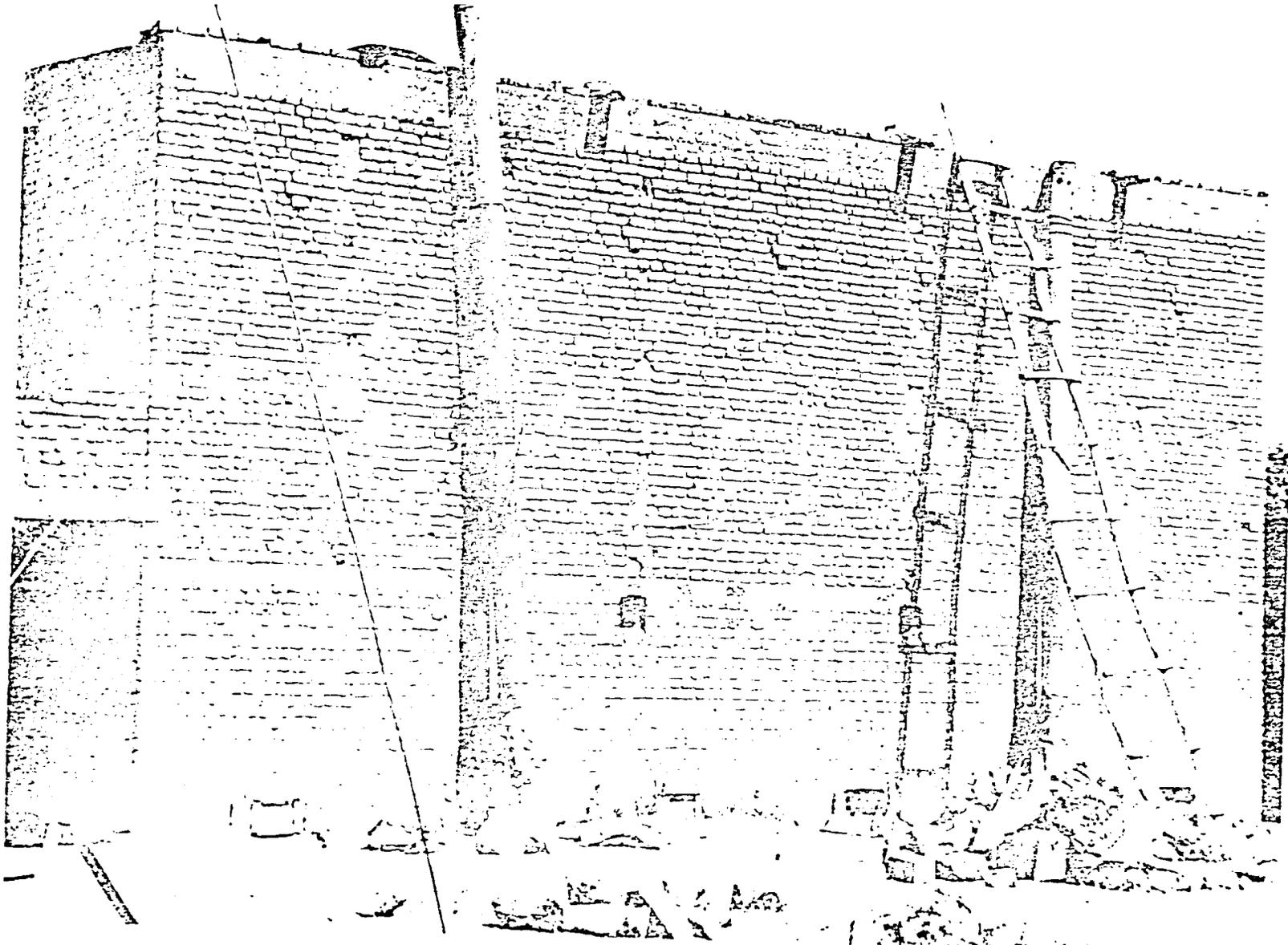
far as possible, fill the barn with leaves from the same plant level.

1.5 The curing barn

In order to provide the correct environment for leaf curing during each stage, the barn should be so constructed that it is possible to control air temperature, air moisture and air movement inside it.

In Pakistan tobacco barns are ordinary rooms with an entrance door on one side and a wood burner with exhaust pipe on the opposite side. The standard size of barn is 16 x 16 x 16 feet but all sorts of variations are encountered in the field. The walls of about 95% of the barns are made of mud. Burnt bricks are used in very few cases. The roofs are made of thatching, except in Manshira where galvanized iron sheets are used in some cases to keep out the heavy rains. The walls and roofs are mud plastered each year before the start of curing season.

Air temperature inside the barn is raised by burning wood in the burner, which is installed at the ground level in the middle of the wall opposite the entrance door. Heat is distributed inside the barn through a system of metal flues installed at a height of one foot from the floor. The amount of heat required to hold a given temperature is determined by the following factors:



Brick barn



Battery of adobe and brick barns

- amount of fresh air entering the barn;
- temperature of fresh air;
- amount of water being evaporated from the leaves;
- state of insulation of the barn; and
- the volume and temperature of tobacco in the barn.

A thermometer is installed inside the barn near the back wall at eye level so that it can be read from outside through a small porthole.

Air movement inside the barn is controlled by natural ventilation. For this purpose a set of four ventilators is provided at the bottom of the barn, one on either side of the entrance door, and one on either side of the burner. Another ventilator is provided in the center of the roof. Air flow through the barn is regulated by opening or closing these ventilators. Relative humidity inside the barn is regulated by increasing or decreasing ventilation. As more fresh air is drawn into the barn, the relative humidity decreases if the same inside temperature is maintained.

Internally the barn is divided into five vertical and four horizontal tiers by installing rafters through the walls at uniform spacing. The 3.5 - 4 ft long jantar sticks to which leaves are tied are then placed 3-5 inches apart on these rafters at various levels so that the leaves hang vertically downwards. These sticks

are quite durable and last several years requiring the replacement of 10-20 sticks at each barn load.

A total of 1000 sticks are loaded in a standard sized barn, with the number of sticks gradually reduced upwards in order to facilitate air circulation, as follows:

Top	40x4	160
	45x4	180
	50x4	200
	55x4	220
	Bottom	60x4
Total		1000

Overloading the barn must be avoided as it prevents heat circulation and not only increases fuel consumption but also reduces the quality of the cured leaf. Some farmers slightly underload their barns (800 sticks), because in their experience, this improves the quality of the cured leaf and reduces the duration of curing by about two days thereby causing a saving of 150-200 kg of firewood per barn load.

1.6 Loading the barn

Load the barn in the shortest possible time, with physiologically mature leaves picked on the same day, and preferably of the same level on the plant. If it is absolutely unavoidable to cure leaves of different degrees of maturity in the same barn, place the least mature leaves at the upper levels of the barn and the most mature



Barn loading

at the lowest. After loading the barn, close the door and all the ventilators.

1.7 Curing

Curing is the process of gradual removal of water from the mature tobacco leaf under controlled temperature and humidity conditions, to enable the desired chemical and biological changes to occur in the leaf. At picking, the leaf contains about 80 - 90 percent water and 10 - 20 percent solids of which about 25 percent is starch. This starch must be converted to sugar through hydrolysis during the initial period of curing, known as the yellowing stage. In the yellowing stage only 20 - 30 percent of the moisture is removed in order to keep the leaf alive to enable its biological processes to continue. During this stage, chlorophyll breaks down and disappears, unmasking yellow pigments which impart the characteristic colour to the cured leaf. Simultaneously, though independently of the above process, starch is converted into sugar through the process of hydrolysis. Hashmi (1987) describes the following procedure followed for curing tobacco leaves in NWFP. It is generally patterned on Hawks and Collins (1983):

1.7.1 Leaf yellowing

After the barn is fully loaded, advance temperature inside the barn at the rate of 2° F per hour till a temperature of 100° F is reached. Open top ventilators enough to expel excess moisture. Keep relative humidity inside the barn at 90 - 95 percent. Maintain the

temperature of 100°F till all the leaves are dry. During this stage keep all ventilators closed or nearly so, to conserve energy. Gradually open ventilators when leaves in the lower tiers begin to dry, 12 - 15 hours before the completion of the yellowing stage; so that at the end of yellowing, humidity slowly decreases to 80 percent. Avoid over-ventilation to prevent excessive fuel consumption and drying of the leaves when still green. Leaf yellowing stage lasts for about 42 hours, ranging from about 40 - 50.

1.7.2 Leaf lamina drying

After the completion of leaf yellowing, raise temperature to 130°F at the rate of 2°F per hour. Simultaneously start opening ventilators gradually to reduce relative humidity to 60 percent. Maintain temperature at $130 - 135^{\circ}\text{F}$ till all leaf laminae are completely dry. This stage takes 36 to 40 hours for completion.

1.7.3 Vein drying

When leaf laminae are dry, raise temperature to 160°F at the rate of 2°F per hour and maintain till the main veins are dry, keeping relative humidity at 50-60 percent. Reduce ventilation during this period and close ventilators towards the end of the stage. Vein drying takes about 24 - 30 hours.

1.7.4 Cooling

At the completion of vein drying, turn off fire and open barn door and ventilators till the tobacco is at room temperature. The cooling stage lasts for about 12 hours.

1.7.5 Humidification

At the end of the cooling stage, close the barn and restart the fire to raise temperature inside the barn to 110^o F. Put moist gunny bags over the heating pipes inside the barn to increase humidity inside the barn. Maintain in this condition till leaf moisture content rises to 16 - 18 percent.

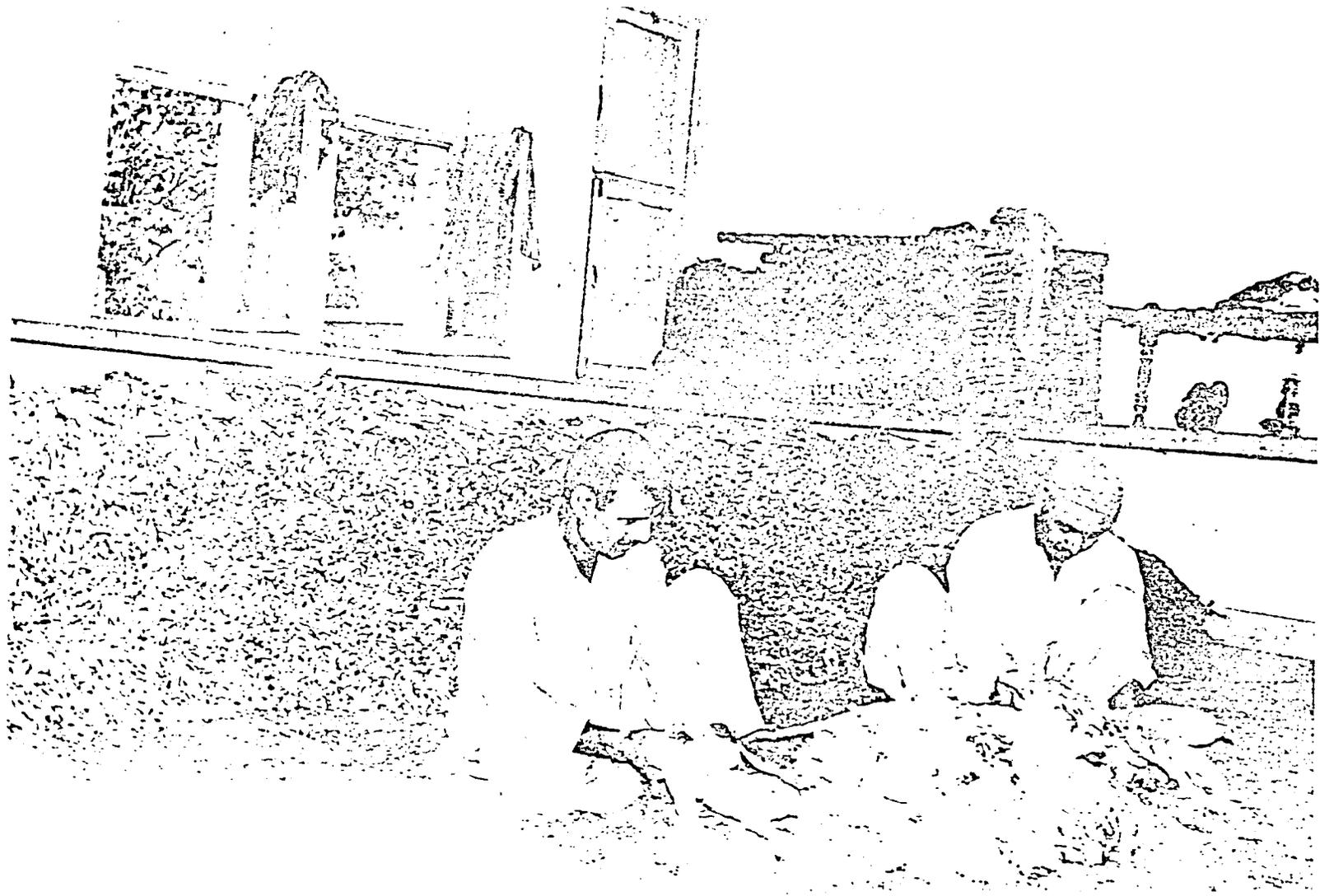
1.7.6 Energy saving

Adopt the following precautions to reduce the quantity of firewood needed for curing:

- Keep barn walls, floor and ceiling completely insulated.
- Seal even the smallest cracks. Also seal junctions of walls with ceiling and floor.
- Keep windcords of doors and ventilators perfectly tight.
- Keep burners clean.

1.7.7 General

After the curing process is complete, the barn is unloaded, the leaves untied from the sticks and stacked and covered with burlap to prevent loss of moisture, till they are graded, baled, and taken to the sale points for delivery to the tobacco companies.



Leaf grading



Tobacco bales ready for shipment

The process of curing takes 5 - 7 days. Curing starts during the first fortnight of June and ends by about the middle of August in Mardan - Charsadda plains taking 55 - 70 days. In mountainous areas of Mansehra and Swat, curing starts in the first week of July and ends by the 20th of August, taking about 52 - 86 days.

2. OBJECTIVE OF THE RESEARCH

The objective of this survey is to estimate the quantity of firewood used in the curing of FCV tobacco and to obtain information on various factors bearing on this subject.

3. SAMPLING DESIGN

The target population for this survey comprises all persons who grow and cure FCV tobacco. Since cigarette manufacturing companies are the sole purchasers of FCV tobacco, every producer is registered with one or more tobacco companies, who are bound by agreement, executed each year, to purchase the stipulated quantity of cured leaves from the producer, at a minimum price announced in advance. Each tobacco company maintains lists of their agreement holders, for each of their purchase depots. The tobacco growers in each of these lists were considered a population and a 1 percent random sample drawn from each list. If the number in any list was less than 50 no sample was taken. Table 2 gives the names of tobacco companies, location of their purchase depots, number of tobacco growers to be interviewed from each list, and the number actually interviewed.

Table 2 Names of tobacco companies, location of their purchase depots, number of agreement holders and sample size.

Sl. No.	Name of tobacco Company	Location of purchase depot	Number of agreement holders (1990)	Sample size	No. of respondents interviewed
1.	Pakistan Tobacco Company	Azimabad	651	7	7
		Baffa	734	7	6
		Buner	240	2	2
		Faujun	465	5	5
		Firdausabad	230	2	2
		Mandani	633	6	6
		Shergarh	768	8	8
		Tindodag	127	1	1
		Yar Hussain	696	7	7
		2.	Lackson Tobacco Company	Baffa	372
Sardheri	286			3	1
Mandani	361			4	2
Shergarh	523			5	4
Yar Hussain	405			4	4
3.	Premier Tobacco Industries	Charbagh	333	3	2
		Shergarh	1048	10	8
		Yar Hussain	976	10	8
4.	Souvenir Tobacco Company	Baffa	24	0	0
		Mandani	96	1	1
		Roshanabad	72	1	1
		Shergarh	143	1	1
		Yar Hussain	143	1	1
5.	United Tobacco Company	Lahore	48	1	0
		Shergarh	63	1	0
		Yar Hussain	36	0	0
6.	Saleem Cigarette Industries	Buner	15	0	0
		Shergarh	34	0	0
		Yar Hussain	48	0	0
7.	Sarhad Cigarette Industries	Yar Hussain	180	2	2
8.	Universal Tobacco Company	Shergarh	25	0	0
		Yar Hussain	50	1	1
9.	Imperial Cigarette Industries	Shergarh	10	0	0
		Yar Hussain			
10.	Frontier Cigarette Industries	Yar Hussain	10	0	0
11.	Paramount Tobacco Company	Yar Hussain	20	0	0
12.	United Tobacco Industries	Mandani	50	1	0
Total			9915	98	83



Interview

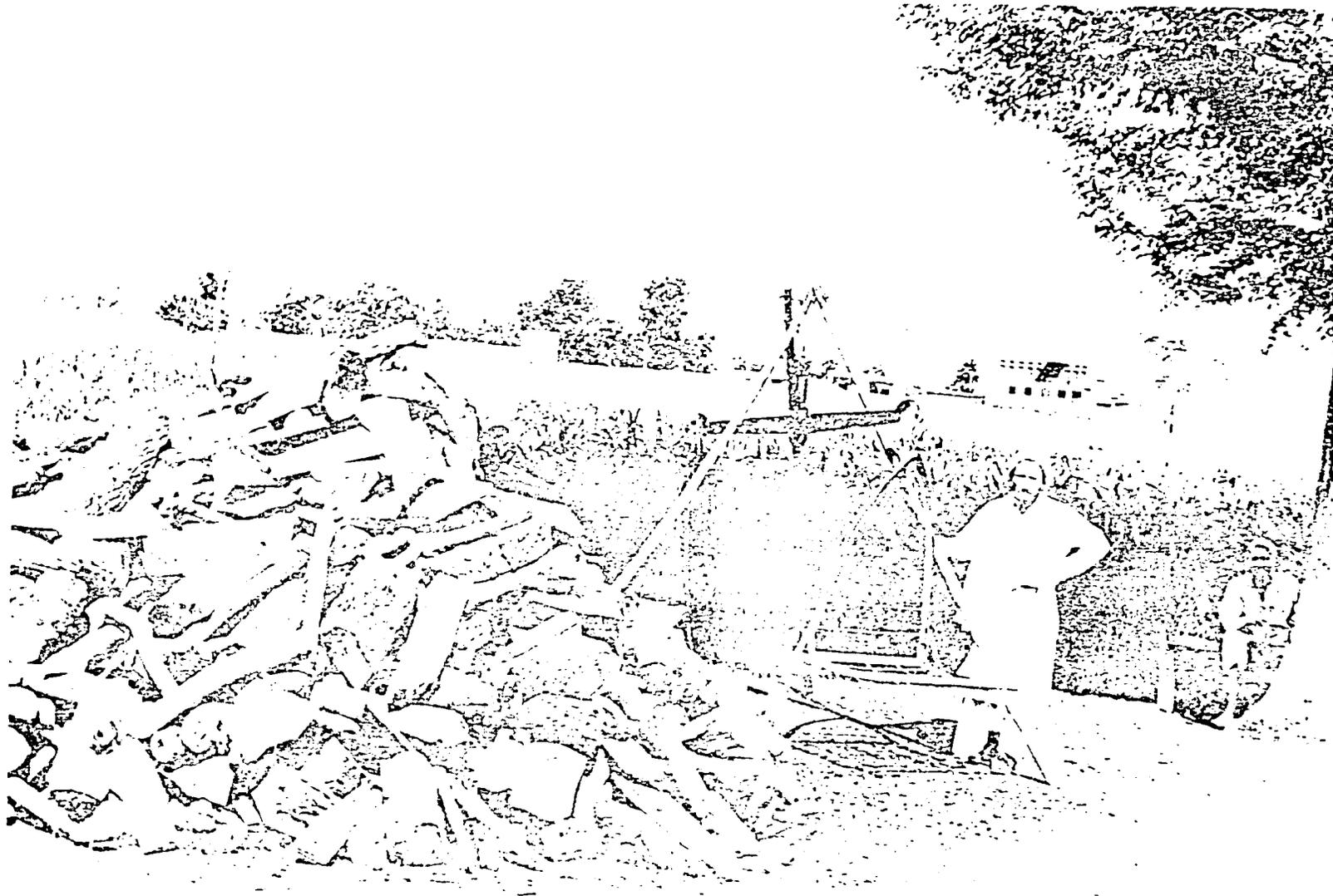
The summary information on sample size is given below:

Number of registered FCV tobacco growers	9915
Intended sample size	98
Number of respondents who could not be traced	15
Number of respondents actually interviewed	83
Number of respondents who grew FCV tobacco during 1990	78

Names and addresses of the FCV tobacco growers included in the sample are given in Appendix I. A specimen of the questionnaire administered to these growers is given in Appendix II. In order to investigate marketing of firewood used in tobacco curing, six firewood dealers (Appendix III), identified by our respondent tobacco growers, were also interviewed. A specimen of the questionnaire used for this purpose is given in Appendix IV.

4. FIREWOOD CONSUMPTION IN CURING FCV TOBACCO, 1990

Table 3 gives information on the number of barns owned by the respondents, number of times each barn was loaded during the curing season of 1990, the total quantity of firewood consumed in curing, and the area under FCV tobacco.



Firewood sale depot

Table 3 Average firewood consumption per barn load of FCV tobacco in Pakistan

Purchase depot	Number of respondents	Number of barns	Number of barn loads	Fire wood consumption, 1990 (kg)	Area under tobacco, 1990 (ha)
Shergarh PTC	8	16	121	113640	18.21
Shergarh PFI	7	11	73	75600	9.21
Shergarh LTC	4	7	57	48840	6.48
Shergarh STC	1	3	26	31200	3.24
Shergarh UPTC	1	1	7	6000	1.01
Yar Hussain PFI	8	17	144	142950	17.60
Yar Hussain PTC	7	18	132	123050	17.66
Yar Hussain LTC	4	4	27	26220	4.20
Yar Hussain SCI	2	7	53	48000	5.26
Yar Hussain UPTC	1	1	9	9000	0.81
Yar Hussain STC	1	10	44	42500	8.09
Azimabad PTC	4	6	42	36800	6.48
Firdausabad PTC	2	3	23	19600	2.93
Faujun PTC	4	6	48	35200	5.26
Mandani PTC	6	10	66	65000	10.93
Mandani LTC	2	3	22	23200	2.63
Mandani STC	1	2	19	16000	3.04
Sardheri LTC	1	1	10	8000	1.01
Charbagh PFI	2	4	30	30000	3.32
Roshanabad STC	1	1	7	7000	0.81
Buffa PTC	6	36	282	253950	46.29
Buffa LTC	2	4	25	34000	4.55
Swat PTC	1	1	8	10000	1.01
Buner PTC	2	2	10	9750	1.52
Total	78	174	1285	1215490	181.54

The table yields the following relationships:

- 1) Average firewood consumption per barn per curing season 6986 kg (Bound on error of estimation¹= 523 kg; confidence coefficient = 0.95).
- 2) Average firewood consumption per ha 6695 kg (Bound on error of estimation¹= 440 kg; confidence coefficient = 0.95)
- 3) Average number of hectares to feed one barn 1.043

¹ Scheaffer et al 1986

These relationships provide two approaches to the calculation of annual firewood consumption in curing FCV tobacco:

4.1 Through total number of barns

Data in Table 3 indicate that the average firewood consumption per barn during the season was 6986 kg. This, multiplied with the total number of operational barns would give the total firewood consumption during a curing season (Table 4). Total number of barns can be estimated with the help of relationship (3) in the preceding paragraph, i.e., on an average, 1.043 ha is needed to feed one barn.

4.2 Through area under FCV tobacco

According to Table 3, on an average, 6695 kg of firewood was consumed during the season in curing the produce of one hectare of FCV tobacco. So the total firewood consumed can be worked out by multiplying the area (in hectares) under FCV tobacco with 6695 kg (Table 5).

Table 4 Estimation of firewood consumed in curing FCV tobacco using the total number of barns approach.

Year	Area under tobacco (ha)	Number of operational barns	Average firewood consumption per barn per curing season (kg)	Total annual consumption of firewood (tonnes)	Bound on error of estimation ² (tonnes)
1988	11871	11378	6986	79487	5186
1989	10971	10516	6986	73465	5186
1990	11744	11257	6986	78641	5186
Average annual consumption for the past 3 years				77198	5186

Table 5 Estimation of firewood consumed in curing FCV tobacco using the area approach

Year	Area under FCV tobacco (ha)	Average firewood consumption to cure the produce of 1 ha of FCV tobacco (kg)	Total annual consumption of firewood (tonnes)	Bound on error of estimation ² (tonnes)
1988	11871	6695	79476	4359
1989	10971	6695	73451	4359
1990	11744	6695	77626	4359
Average annual consumption for the past 3 years			76851	4359

² Confidence coefficient = 95%

4.3 Estimation of annual consumption of firewood in curing tobacco.

Table 4 and Table 5 give the following two estimates of the annual consumption of firewood in curing tobacco:

Approach	Average annual consumption (tonnes)	Bound on error of estimation ³ (tonnes)
Total number of barns	77198	5186
Area under tobacco	76851	4359

Thus, the estimated annual consumption of firewood in tobacco curing is about 77000 ± 5000 tonnes.

4.4 Adequacy of the sample size

The adequacy of sample size (n) was tested using the formula

$$n = \frac{t^2 * s^2}{E^2}$$

where t = value of t for 77 d.f. and 95% confidence coefficient
 s^2 = variance of the mean
 E = permissible error (10% of the mean)

The value of n for the two approaches used worked out as follows:

Approach	Value of n at 95% confidence coefficient
Total number of barns	44
Area under tobacco	34

³ Confidence coefficient = 95 percent

Thus the number of samples taken in this study (78) proved more than adequate.

5. TREE SPECIES USED AS FIREWOOD IN FCV TOBACCO CURING

5.1 Contribution of various species

Table 6 gives the percentage of various species consumed as firewood in curing FCV tobacco, as stated by our respondents.

Table 6. Proportion of various species consumed as firewood in curing FCV tobacco in Pakistan

Species	Percent of total			3 years ¹ average	Specific ⁴ gravity (gm/cm ³)
	1988	1989	1990		
<i>Acacia modesta</i>	36.2	36.7	38.2	37.0	0.963
<i>A. nilotica</i>	29.5	30.7	20.9	27.0	0.745
<i>Morus alba</i>	7.8	9.2	14.7	10.6	0.723
<i>Dalbergia sissoo</i>	12.0	5.5	8.9	8.6	0.819
<i>Zizyphus mauritiana</i>	2.4	4.9	3.6	3.7	0.716
<i>Populus spp.</i>	2.4	4.0	3.7	3.4	0.414
<i>Quercus ilex</i>	2.9	2.2	4.1	3.0	0.939
<i>Olea ferruginea</i>	0.9	2.2	1.1	1.4	1.100
Old plum trees	2.9	-	1.2	1.3	0.617
<i>Alnus nitida</i>	1.2	1.1	1.3	1.2	0.380
<i>Platanus orientalis</i>	0.3	1.0	0.4	0.6	0.586
<i>Pinus roxburghii</i>	0.3	0.5	0.2	0.4	0.530
<i>Melia azedarach</i>	0.4	0.5	0.3	0.4	0.628
<i>Mallotus philippinensis</i>	0.5	0.3	0.2	0.3	(No information)
<i>Celtis australis</i>	0.1	0.3	0.3	0.3	-do-
<i>Salix spp.</i>	0.0	0.6	0.0	0.2	0.491
<i>Ailanthus spp.</i>	0.1	0.2	0.1	0.2	0.681
<i>Eicus spp.</i>	0.1	0.1	0.1	0.1	(No information)
<i>Tamarix spp.</i>	0.0	0.0	0.2	0.1	0.682
Wild apricot	0.0	0.0	0.4	0.1	-do-

⁴ Source: Ayaz 1981

Table 6 indicates that the four most important species used as firewood for tobacco curing are:

Species	Percent contribution	Specific gravity (gm/cm ³)
<u>Acacia modesta</u>	37	0.963
<u>Acacia nilotica</u>	27	0.745
<u>Morus alba</u>	11	0.723
<u>Dalbergia sissoo</u>	9	0.819

They account for 84 percent of the firewood used in curing tobacco.

The five species used to a much lesser extent are:

Species	Percent contribution	Specific gravity (gm/cm ³)
<u>Zizyphus mauritiana</u>	4	0.716
<u>Populus spp.</u>	3	0.414
<u>Quercus ilex</u>	3	0.939
<u>Olea ferruginea</u>	1	1.100
<u>Old plum trees</u>	1	0.617
<u>Alnus nitida</u>	1	0.380

5.2 Farmers' preference for various species

Table 7 compiled from the replies of our respondents indicates the preference given by them to various species for use as firewood in curing FCV tobacco.

Table 7. Species preference of tobacco growers in Pakistan for firewood used in curing FCV tobacco

Species	Percentage of farmers giving the species indicated preference			
	1st	2nd	3rd	4th
<u>Acacia modesta</u>	62	20	3	-
<u>Acacia nilotica</u>	8	29	37	7
<u>Olea ferruginea</u>	24	30	10	-
<u>Quercus ilex</u>	3	5	11	-
<u>Morus alba</u>	-	8	13	18
<u>Dalbergia sissoo</u>	-	2	2	10
<u>Zizyphus mauritiana</u>	-	-	-	8
<u>Prunus spp</u>	-	-	2	-
<u>Mallotus philippinensis</u>	-	-	2	-
Any dry firewood	3	2	10	33
None	-	4	10	24

5.2.1 As brought out by Table 7, tobacco growers seem to prefer firewood of the following species, in the given order:

Species	Specific gravity (gm/cm ³)
<u>Acacia modesta</u> (Phulai)	0.963
<u>Olea ferruginea</u> (Olive)	1.100
<u>Acacia nilotica</u> (Kikar)	0.745
<u>Morus alba</u> (Mulberry)	0.723

The order of preference appears related to high specific gravity. The species of high specific gravity are preferred by the tobacco growers because they burn longer. Once the burner has been loaded, the farmer can do other chores till it is necessary to replenish the burner. Phulai has been reported to burn readily, even when green, and the ashes retain heat for a long time.

5.2.2 Though olive is a preferred species, it accounts for only 1 percent of the wood used in curing. This is due to its scarcity in the market.

5.2.3 Though shisham is not rated as a preferred species by tobacco growers, it still contributes about 9 percent of the firewood used in curing, because of its ready availability.

5.2.4 The remaining species used in curing either come mixed with the main species (e.g. tamarisk, fig etc.), or occur on farmlands, and are used not by preference, but because they are easily available (e.g. poplar, Alnus and fruit trees etc.).

5.2.5 In Buner, Celtis, Mallotus, and chir-pine are the main species, because they grow in the area. Alnus is specific to Hazara, for the same reason.

6. THE PRICE OF FIREWOOD

6.1 Mardan-Charsadda plains

Table 8 gives the prices of firewood paid by the respondents in the Mardan - Charsadda plains during 1988, 1989 and 1990. The results indicate that the firewood prices in the area increased by about 12 percent annually during the period.

Table 8 Average prices of firewood paid by the respondent tobacco growers of Mardan - Charsadda plains during 1988-1990

Year	Mean price paid (Rs/40 kg)	Standard deviation	Number of respondents
1988	36.90	6.57	59
1989	41.28	4.00	59
1990	46.22	4.67	75

6.2 Baffa (Mansehra)

Table 9 gives the prices of firewood paid by our respondents in Baffa (Mansehra) for firewood imported from the Punjab and obtained from local sources during 1988-1990.

Table 9 Average prices of firewood paid by the respondent tobacco growers in Baffa (Mansehra) during 1988-1990

Year	Firewood imported from Punjab			Firewood obtained from local sources		
	Mean price paid (Rs 40/ kg)	Standard deviation	Number of respondents	Mean price paid (Rs 40/ kg)	Standard deviation	Number respondents
1988	No information			24.10	3.42	7
1989	31.75	4.13	4	25.50	5.60	4
1990	44.31	6.75	7	36.27	8.21	6

Thus, from 1988 to 1990, the price of firewood for curing tobacco in Baffa (Mansehra) increased by 40 percent for firewood imported from the Punjab, and 42 percent for that obtained from local sources.

The firewood imported from the Punjab is of better quality, because it is dry and comprises preferred species such as phulai and kikar. Firewood from local sources is generally green and often loses half the weight by the time it is burnt in barns.

6.3 Buner - Swat

Table 10 gives the prices of firewood paid by our respondents during the period 1988 - 1990.

Table 10 Average prices of firewood paid by the respondent tobacco growers in Buner - Swat area during 1988 - 1990.

Year	Mean price paid (Rs 49/kg)	Standard deviation	Number of respondents
1988	21.33	3.46	3
1989	33.47	1.39	3
1990	29.87	8.81	3

The price of firewood in Buner - Swat area is comparatively lower than other areas, because the firewood is generally obtained from trees cut illicitly from forest/waste lands without paying anything to the owners. This practice is particularly prevalent in Buner. The increase in price from 1988 to 1990 is 40 percent.

6.4 Miscellaneous observations

6.4.1 Firewood prices in the plains of Mardan - Charsadda are higher than those in the mountainous areas of Mansehra and Swat-Buner because of the availability of locally grown firewood in the latter two localities.

6.4.2 The prices are for all the species used in tobacco curing. There is little variation in price because of species.

6.4.3 Tobacco growers normally purchase firewood for curing on credit and pay the amount due when they receive payment from tobacco companies for their produce. This takes about 2 - 3 months. Firewood dealers charge 6 - 7 percent higher price if the purchase is on credit, compared to purchase on cash. When firewood is purchased on credit, the dealer also often exploits the weak bargaining position of the purchaser by under-weighting, and mixing green wood, and firewood of inferior species in the lot. Most of our respondents were of the opinion that they would be able to obtain firewood much cheaper if they had the money to pay cash. A tobacco grower in Malakand, for example, saves about 40 percent on his firewood bill by paying cash and purchasing the wood 2 - 3 months before the curing season.

7. RELATIVE COST OF FIREWOOD IN TOBACCO CURING

From the information obtained from the respondents, average cost of curing one barn load of FCV tobacco works out to Rs 2491 (Table 11). This includes cost of picking tobacco leaves, their carriage to the barn, tying, loading, curing, moistening, unloading, grading, baling, carriage to purchase depot and maintenance of barn. Average cost incurred on purchase of firewood for curing one barn load works out to Rs 1065. Thus, firewood accounts for 43

Table 11 Cost of curing one barn load of FCV tobacco and cost of firewood per barn load

Tobacco Purchase Depots	Average cost of curing Rs/barn load	Average cost of firewood Rs/barn load	Cost of firewood as % of total cost of curing	No. of respondents
Shergarh PTC	2495	1014	41	8
Shergarh PPI	2413	1046	43	7
Shergarh LTC	2300	853	37	4
Shergarh STC	2500	1350	54	1
Shergarh ULTC	2523	1007	40	1
Yar Hussain PPI	2255	1093	48	8
Yar Hussain PTC	2403	1064	44	7
Yar Hussain LTC	2879	1151	40	4
Yar Hussain SCI	2871	1195	42	2
Yar Hussain ULTC	2819	1160	41	1
Yar Hussain STC	1971	932	47	1
Azimabad PTC	2473	1031	42	4
Firdausabad PTC	2183	895	41	2
Faujuni PTC	2331	906	39	4
Mandani PTC	2255	1016	45	6
Mandani LTC	2569	1264	49	2
Mandani STC	2365	1011	43	1
Sardheri LTC	2312	920	40	1
Charbagh PPI	2350	1033	44	2
Roshanabad STC	2326	1200	52	1
Baffa PTC	3153	1356	43	6
Baffa LTC	3466	1383	40	2
Swat PTC	2138	1000	47	1
Buner PTC	2150	675	31	2
Overall average	2491	1065	43	78
Standard deviation	445.1	228.5		
Bound on error of estimation	100.8	51.7		



Transportation



Setting the price at purchase depot



Receiving payment

percent of the total production cost of FCV tobacco, i.e., from leaf picking to marketing.

8. SOURCES OF FIREWOOD

Table 12 gives the percentage of firewood used in curing tobacco emanating from various sources.

Table 12 Sources of firewood used in curing FCV tobacco in Pakistan

Source	Percentage
Punjab	80
Local agricultural lands	16
Federally Administered Tribal Areas	3
Local waste/forest lands	1

Of the 80 percent firewood that comes from the Punjab, 36 percent (mainly phulai) emanates from the forest lands of Attock District; and 44 percent from the agricultural lands. Of the 16 percent coming from local agricultural lands, about 3.5 percent is contributed by tree growth on the tobacco growers own fields and the rest is purchased mostly through middlemen.

9. MARKETING OF FIREWOOD

The following systems of marketing are used in firewood originating from various sources:

9.1 Imports from the Punjab

Figure 1 illustrates the marketing system which has developed for the import of firewood from the Punjab for use in tobacco curing in NWFP, according to various firewood dealers interviewed by us. The middlemen in NWFP purchase firewood from whole-salers in Mianwali, Kundian, Qaid Abad, Wan Bachran, Paikhel, Chakwal, Bhakar, Daria Khan, Talagang, Fatch Jang and Attock. The whole-salers in the Punjab, in return, purchase the firewood from the Forest Department or Afghan nomads (Kochis), who purchase standing trees from farmers and cut and transport them on their camels to the depots maintained by the whole-salers in the vicinity of railway stations. This process continues throughout the year. The firewood dealers in NWFP purchase this wood from the whole-salers on credit during April-May each year and transport it by rail to railway terminals in Mardan - Charsadda plain. If they do not get railway wagons, they transport the wood by truck via Kohat, although transport by trucks is more expensive. From the railway station the firewood is carried by trucks or tractor trollies to their sale-depots where it is sawn into sizes suitable for feeding into barn burners. The firewood purchased by the tobacco growers, from the sale-depots is transported to the curing barns by trucks or tractor trolley; mostly at the expense of the firewood dealers.

The firewood dealers gave the following break-up of costs incurred by them; and the rate at which they sell firewood to the FCV tobacco growers:

TREE GROWERS

MIDDLEMEN (1)

FOREST DEPARTMENT
AUCTIONS

WHOLE SALERS (2)

FIREWOOD DEALERS
IN NWFP (3)

FIREWOOD DEPOTS

TOBACCO GROWERS

Figure.1 Marketing system for the supply of firewood from the Punjab to the tobacco growers in NWFP (figures within parenthesis indicate the chain of middlemen).

Item	Amount (Rs/40 kg)
Cost of firewood billets	28.00
Loading into railway wagons	0.30
Railway fare	7.50
Unloading at railway terminals in Mardan-Charsadda	0.15
Octroi charges	0.40
Carriage from railway station to sale-depot	1.60
Taxes	0.63
Miscellaneous charges in transportation	0.25
Sawing	2.00
Loading into tractor trolley	0.17
Weighing	0.28
Carriage charges to the barn	0.56
Total cost to the dealer	41.84
Sale price at barn	45.00 to 46.00

(on credit, payable in 2-3 months)

9.2 Local production of firewood

Locally grown firewood may either come from the tobacco growers own farms or from neighboring farms or wastelands or forest lands.

9.2.1 Tobacco growers own trees

This is the cheapest source of firewood, but may not be the best, because choice species cannot be obtained, and the tobacco grower has to rely on whatever trees are growing on his farm. The trees are felled in October/November and the billets stacked near the tobacco barns. In April-May, these billets are split with axe into smaller sizes suitable for feeding in the barns.

The respondents relying on firewood from this source gave the following break-up of costs:

Item	Amount (Rs/40 kg)
Estimated market value of firewood (green)	15.00
Felling, conversion & transportation of billets to the barn	10.00
Sawing/splitting of billets	2.00
Total cost to tobacco grower	27.00

9.2.2 Trees purchased from neighboring tree growers

This marketing system either involves direct purchase of standing trees from neighboring farms or purchases through one or more middlemen. This is, however, not a common method of wood procurement and is resorted mainly to augment firewood supply from the tobacco growers' own farm. Trees are purchased in October; felled and converted into billets; and transported to the tobacco curing barn, where it is stacked for 5-6 months. Before burning, the billets are split into smaller pieces with axe. Our respondents reported average cost of Rs. 27 per 40 kg - the same as in the case of firewood obtained from the trees growing on tobacco growers own farm.

10. MISCELLANEOUS INFORMATION

10.1 Firewood requirement in FCV tobacco curing during the next three years

No major changes are likely to occur during the next three years either in the cropping patterns of N.W.F.P. or in the smoking habits of the people of Pakistan. Therefore, the average area under tobacco is expected to remain at about the current level during this period, i.e. about 11700 ha. Since no substitutes for firewood are likely to emerge in the near future, the average annual consumption of firewood in the FCV tobacco industry is likely to remain about 77000 \pm 5000 tonnes during the next three years.

10.2 Trials to find substitutes for firewood in the curing of FCV tobacco¹

10.2.1 Furnace oil

During the sixties, PTC conducted trials with furnace oil as fuel for curing FCV tobacco, instead of firewood. Furnace oil was however, found more expensive than firewood. In addition, it also involved heavy capital cost, because of the high cost of imported burners.

For both the above reasons, it will not be possible for furnace oil to replace firewood even in the future, because the price

¹ Information obtained from Pakistan Tobacco Co.

escalation of furnace oil and imported burners is much steeper than that of firewood.

10.2.2 Natural gas

During the sixties, PTC also tried natural gas as a substitute for firewood in tobacco leaf curing. Though natural gas was cheaper than firewood, it was uneconomical to provide piped gas to about 12000 tobacco barns scattered all over the rural areas of Peshawar, Hazara and Malakand Civil Divisions. Because this still holds and will hold in the future also, natural gas is not likely to replace firewood in tobacco leaf curing.

10.2.3 Liquified petroleum gas (LPG)

Elaborate trials were conducted by the entire tobacco industry in collaboration with the Pakistan Tobacco Board for three years in the early eighties on the use of LPG in the curing of FCV tobacco. LPG did not prove a cheaper substitute for fuelwood due to the heavy capital outlay required for importing commercial cylinders and establishing bulk storage depots in the tobacco growing areas for refilling the cylinders.

10.2.4 Bagasse briquettes

In early eighties, at the behest of PTC, a Japanese firm conducted trials in Japan for making briquettes out of sugar-cane bagasse sent to them from Pakistan. On the conclusion of the trials they fabricated a pilot plant which PTC imported and installed. However,

the experiment of using the briquettes for curing tobacco leaves was not successful and PTC had to write off a loss of over three million rupees incurred in this attempt.

10.3 Improving wood-burning furnace design for increasing its efficiency

Discouraged in its search for cheaper alternative fuels for tobacco curing than firewood, PTC started working on improving the design of wood-burning furnaces used in tobacco-curing barns, and in 1986 introduced in tobacco farmers a modified furnace design which was given the name of PTC jacket. The PTC jacket use 20% less firewood compared to the conventional furnace used in tobacco curing barns. PTC has so far installed one thousand jackets in the farmers barns.

10.5 Quantity of timber used in the construction of tobacco curing barns

About 70 cubic feet (cu.ft.) of timber are required in the construction of an average barn; about 63 cu.ft. in the construction of the roof and rafters used for hanging tobacco leaves in the barn, and about 7 cu.ft. for the fabrication of doors and ventilators. In the plains, poplar is used for the former; and shisham, mulberry, and willows for the latter, depending on the ease of availability at the concerned site. In the hills of Hazara and Buner, Chir-pine is used for doors and ventilators as well as for the roof and rafters. Based on the above quantities per barn, the amount of timber of various species consumed in construction of about 12,500 functioning and non-functioning barns is estimated to be as follows:

Species	11,000 barns (in the plains) (cu.ft.)	1500 barns (Hazara, Buner) (cu.ft.)	Total (cu.ft.)
Poplar	693,000	-	693,000
Shisham,mulberry etc.	77,000	-	77,000
Chir-pine	-	105,000	105,000
Grand total			875,000

Assuming that a barn is rebuilt after 50 years, the annual requirement of timber needed for barn construction would be about 17,500 cu.ft., most of it poplar. This is a liberal estimate considering that adobe barns last very long if they are mud plastered annually. Moreover, even when a barn is rebuilt, the timber from the old barn is frequently reused in the new one. This is because timber used in tobacco barns have a remarkably long life due probably to rapid fluctuations of temperature and humidity inside the barn during the process of curing which may be inimical to both wood destroying insects and micro-organisms.

10.6 Notified minimum prices and prices actually paid to growers

Table 13 gives the weighted average of notified minimum price and prices actually paid to growers for the 12 grades of FCV tobacco for the past ten years.

Table 13 Weighted average notified minimum prices and prices actually paid, for 12 grades of FCV tobacco, 1980 to 1989.

Year	Notified minimum price (weighted average for 12 grades) (Rs/kg)	Price actually paid (weighted average for 12 grades) (Rs/kg)
1980	6.70	8.05
1981	7.37	10.24
1982	8.11	10.15
1983	8.35	10.44
1984	8.64	12.00
1985	8.64	12.02
1986	8.90	12.04
1987	8.90	12.07
1988	9.45	12.35
1989	9.92	13.18

Source: Pakistan Tobacco Board, Tobacco Statistical Bulletin, 1989.

10.7 Amount of central excise duty and surcharge collected from tobacco and cigarettes.

Table 14 gives the amount of central excise duty and surcharge collected by Government from tobacco and cigarettes.

Table 14 Central excise duty and surcharge collected from tobacco and cigarettes.

Year	Amount (Rs. million)
1979-80	2825.9
1980-81	3359.4
1981-82	3698.4
1982-83	4160.9
1983-84	4992.9
1984-85	5340.7
1985-86	5139.5
1986-87	5652.0
1987-88	6828.9
1988-89	8208.1

Source: Pakistan Tobacco Board, Tobacco Statistical Bulletin, 1989.

10.8 Export of tobacco and cigarettes

Table 15 gives the quantity and value of tobacco and cigarettes exported during the past five years.

Table 15 Quantity and value of tobacco and cigarettes exported.

Year	Quantity exported		Value realized		Total
	Tobacco	Cigarettes	Tobacco	Cigarettes	
1984-85	0.58	1662	6.51	151.97	158.48
1985-86	0.59	2076	6.72	188.56	195.28
1986-87	0.55	2239	5.66	213.35	219.01
1987-88	0.46	3275	4.35	313.47	317.82
1988-89	0.47	141 ²	6.58	16.23 ²	22.81 ²

Source: Pakistan Tobacco Board, Tobacco Statistical Bulletin, 1989.

During 1988-89, the exports were to Afghanistan, China, Hong Kong, Iran, Dubai, Bangladesh, Belgium, U.K., Qatar and Saudi Arabia.

² Shortfall due to the Afghan war and its aftermath.

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APPENDIX I

Names and addresses of the respondent tobacco growers

Purchase depot	Tobacco grower	Father's name	Village
Pakistan Tobacco Company			
Azimabad	Umar Khan	Said Rahman	Jamal Garhi
"	Shahbaz Khan	Ibrahim Khan	Shakar Dand
"	Imyatullah	H. Asala	Kurai
"	Karim Shah	Ambar Shah	Kandary
"	Shah Mohammad	Kabir Khan	Batizji Qila
"	Inad Khan	Col. Abdul Wadood	Sherpao
"	Zahir Shah	Shahzad Gul	Amirabad
Buffa	Abdul Khaliq	H. Atta	Butla
"	Abdur Rashid	Mohammad	
"	Muhtaq	M. Sadiq	Buffa Doraha
"	M. Guresh	Abdul Hanan	Dhodial
"	Usman	H. Arsal	"
"	Chanzab	Ehoidad	Basti Piran
"	Fida M. Khan	Dilawar Khan	"
"		Ghari Khan	Bathimera
Buner	Mir Zaman	Rahat	Kerpa
"	Sad Akbar Khan	Abdul Charoor	Fajkata
Faujoon	Kar Khan	Sherin Khan	Jalbai
"	Mohammad Faiz	Sarfaroosh Khan	"
"	Faqir Taj	Hakim Khan	"
"	Raza Khan	Amir Khan	Rhnda
"	Muhtar Wali	Mohammad Wali	Jakai
Firdausabad	Khair Mohammad	Atta Mohammad	Maneri Payan
"	Qalandar Khan	Polali	Suleem Khan
Mandani	Shah Darya Khan	Qasim Khan	Toor Kamar
"	Mohammad Amin	Asif Khan	Chail
"	Wazir Mohammad	Saidan	Hisara
"	Ambar Khan	Ashraf Khan	Kay Mahal
"	Gul Polhan	Fazal Polhan	S. Laran Eilli
"	Mohammad Karim	Ahmed Gul	Fir Saddi
Shergarh	Zahir Shah	Ahmad Shah	Kopar
"	Mujahid Khan	Madad Khan	"
"	Bakht Polhan	Bakhtair	"
"	H. Amir Khan	Toor Lha	Padraga
"	Shah Zahir	Anwar Shah	"

Purchase depot	Tobacco grower	Father's name	Village
Shergarh	Inayat-ur-Rehman	Saifur-Rehman	Rhusal Garh
"	Bahim Gul	Rehman Khan	Landay Shah
"	Gulam Sakhi	Ibrahim	Ganjai
Tindodag	Mohammad Nawaz	Shuja Khan	Gul Muqam
Yar Hussain	Jamro Din	Ghaya-uddin	Jamra
"	Amir Hussain	Mohammad Yusuf	Qasam
"	Ghani Mohammad	Reza-ud-Din	Qasam
"	Mulla Mohammad	H. Waris Khan	Yar Hussain
"	Asghar Ali	Dur Jamail	"
"	Arab Ali	Azmat Khan	"
"	Abdul Kalam	H. Shams-ul-Qamar	"
Jackson Tobacco Company			
Baffa	Hushtaq	Baboo M. Afzal	Bir Kund
"	Sain	Muqarab	Landi Tot
"	Shehzad Mahmood	Zarin Khan	Banda Piran
"	Ali Khan	Izzat Khan	Tarangji
Sardheri	Jamshed	Awal Khan	Sheikhano Killi
"	Mumtaz Ali	Mohammad Zahir	Toro Hara
"	Abdur Rashid	Hakeem Khan	"
Mandani	Sharif Gul	Didar Gul	Bariband
"	Sher	Abdul Latif	Sahib Gul Mahal
"	Akbar Shah	Sher Azim	Kandi Maka
"	Mohammad Aslam	Akbar Khan	Tur Dher
Shergarh	Faqir Mohammad	H. Ghulam Jan	Shabbat Khail
"	Valli Mohammad	Dawa Jan	"
"	Bacha	Rhushal	Ghano Dheri
"	Jaji Bahadar	Mahamood	Jamal Garhi
"	Bacha Khan	Sher Mohammad	Serai
Yar Hussain	Halak Taj	Abdul Shakoor	Qasam
"	Hukam Khan	Durana	Soher
"	Sher Azam	Said Akram	Yar Hussain
"	Sher Jan	Ghaniullah	"
Premier Tobacco Industries			
Charbagh	Mohammad Jan	Yaqoob Khan	Saleem Khan
"	Fazul Lah	Fahmatullah	Aurangabad
"	Faiz Mohammad	Faiz Umar	Sprona

Purchase depot	Tobacco grower	Father's name	Village
Shergarh	Umer Said	H. Saiful Malool	Sahib Shah Killi
"	Asif Khan	Sultan	Tordher
"	Mohammad Younas	Mohammad Zaman	"
"	Hazrat Behman	H. Gul Behman	Moti Banda
"	Wazir Khan	H. Shamoon	Hosai
"	Gulab Khan	Shamroz Khan	Jalala
"	Mohammad Saleem	Mauroz Khan	Parkhu Dheri
"	Ansar Khan	Inzar Gul	Dhaki
"	Jurat Khan	Mira Khan	Shergarh
"	Ghulam Khan	Kooshi	Saidabad
Yar Hussain	Said Karim	Abdul Waheed	Sodher
"	Dilbar Shah	Bahadur Khan	Fala Banda
"	Bacha Gul	Hazrat Ullah	Qasam
"	Bahadur Khan	Amin Khan	Dakay
"	Said Bahar	Tawab Khan	Yakubi
"	Zasrud Khan	Essa Khan	Sodher
"	Imranullah	Nooran Shah	Ghazikot
"	Ahsad Ali	Said Tahir Shah	Yar Hussain
"	Sabir Khan	Borcoz Khan	Haik Nam
"	Umar Khan	Hubab Khan	Dagai
Souvenir Tobacco Company			
Bandani	Said Behmood	Hussain Mian	Dandao
Hawa Killi (Poshanabad)	Haroon Khan	Ajoon	Managi
Shergarh	H. Izat Khan	Morcha Khan	Morcha Killi
Yar Hussain	Sher Aman Khan	Humanyun Khan	Sokhta
United Tobacco Company			
Yar Hussain	Bakhtiar Ali	Rahman Wali	Lahor
Shergarh	Faqir	Hassan Khan	Badruga
Sarhad Cigarette Company			
Yar Hussain	Qudrat Shah	Rehmat Shah	Jaganath
"	Zahid Ali	Khan Bahadur	Dobian
Universal Tobacco Company			
Yar Hussain	Khaista Mohammad Sherbaz		Yar Hussain

Purchase depot	Tobacco grower	Father's name	Village
	United Tobacco Industries		
Mandani	M.Saleh	Haryan	Shergarh

APPENDIX II

Specimen of the questionnaire administered to the respondent tobacco growers

WOOD USING INDUSTRY OF PAKISTAN
WOOD CONSUMPTION SURVEY QUESTIONNAIRE
TOBACCO INDUSTRY

Serial No. _____
Date _____

1. Name and address of the farmer: _____

2. Year the tobacco curing was started (the firm was established): _____
3. Name of contracting tobacco company, 1990: _____
4. Name of tobacco company on which tobacco was actually sold, 1990: _____
5. Name and location of purchase depot: _____
6. Size and location of land holding (acres): _____
7. Number of barns owned: _____
8. Area under FCV tobacco (acres):
1988 _____
1989 _____
1990 _____
9. Number of loadings, 1990: _____
10. Annual production of cured leaves:
1988 _____
1989 _____
1990 _____

11. Quantity of wood used in curing (mds):

<u>Year</u>	<u>Phualai</u>	<u>Kikar</u>	<u>Shisham</u>	<u>Mulberry</u>	<u>Other (specify)</u>
1988					
1989					
1990					

12. Source of wood:

	Quantity (mcs)
1. Local	
i. Farm Land	_____
ii. State land	_____
2. Imported	_____

13. From whom is wood purchased _____

(Tree grower, forest auction, middleman, ownlands etc.)

14. If your primary supplier is an individual please give his name and address here: _____

15. How is wood delivered to your barn (please check all that apply):

_____ Railway.	_____ Water way.
_____ Truck.	_____ Push cart.
_____ Animal cart.	_____ Hand carried.
_____ Other (_____).	

16. Price paid for wood at the barn (Rs/md).

<u>Species</u>	<u>Rate</u>
Phulai	_____
Kikar	_____
Shisham	_____
Mulberry	_____
Other, specify	_____

17. Please describe any wood availability problems that you now have or expect to have next year.

18. What significant other materials are used in your barn.

19. Cost of production of cured leaves per barn, 1990.

<u>Item</u>	<u>Quantity/No.</u>	<u>Rate</u>	<u>Cost</u>
A. <u>Curing</u>			
i) Picking & carriage to shed	Contract/ _____	mandays	
ii) Cost of leaf typing (1000 sticks/barn)	20 sticks		
iii) Loading	Contract/ _____	mandays	
iv) Curing:			
a. Fireman			
b. Curer			
v) Moistening, unloading untying, grading, baling	Contract/ _____	mandays	
vi) Cost of baling material:			
a) Bag			
b) Bun			
c) Sutli			
vii. Miscellaneous (pipes etc.)			
a. Center pipe			
b. Cost of center pipe fitting			
c. Plastering			
B. <u>Cost of fuel</u>	_____	maunds	
C. Carriage/transportation to depot.			
Total (A + B + C)			

20. What is your gross annual value of sales in Rs. _____
21. Number of persons employed, 1990

<u>Category</u>	<u>Number</u>	<u>Period employed</u>	<u>Wage (Rs)</u>
Leaf Pickers			
Tiers			
Fireman			
Curer			
Loaders			
Graders			
Others, specify			
i.Center pipe fitting			
ii.Plastering			
iii.Timber harvesting, if any			

22. Please note any other relevant information from the interview not covered elsewhere in the questionnaire.

Supplementary questions.

- i. Length of curing season, 1990.
- a. Date of loading first barn. _____
- b. Expected date of unloading last barn. _____

- ii. What is your order of preference of fuel woods, if given free choice (indicate 4 species in descending order of preference with reason, if any).

<u>Species</u>	<u>Reasons</u>
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____

- iii. a. When did you buy your existing set of pipes? _____
- b. How long it is expected to last? _____
- c. What was its price? _____
- d. What was the cost of fitting? _____

APPENDIX III

Name and location of firewood dealers interviewed.

1. Suddam Khan, Takht Bhai, Mardan District.
2. Jah Mohammad, Hathian, Mardan District.
3. Ajmal Khan, Takht Bhai, Mardan District.
4. Mohammad Ali, Banda Piran, Mansehra District.
5. Ghani Khan, Khaki Doraha, Manshera.
6. Haji Sultan, Khaki Doraha, Manshera.

APPENDIX IV

Specimen of the questionnaire used for investigating marketing of firewood consumed in FCV tobacco curing

WOOD USING INDUSTRY OF PAKISTAN
WOOD DISTRIBUTION QUESTIONNAIRE
TOBACCO INDUSTRY

1. Name and address
2. Number of years in business
3. Type of business
 - a) Year long or seasonal
 - b) Firewood only
 - c) Firewood + timber
 - d) Others, specify
4. Source of firewood
 - a) Direct from the grower
 - b) Through a middleman
 - c) Govt. auctions
5. How firewood is purchased, converted & transported.
6. When the firewood is purchased?
7. If the wood is purchased through a middleman, what are his sources of its purchase?
8. Expenses involved on wood procurement.
9. Expenses involved on wood sale
10. How firewood is sold to the growers? At what price?
11. How long firewood is to be stored in the sale depot?
12. Is there any species preference?
13. Any other relevant information?