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An Over View of Tea Plantation in Pakistan

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Abstract: Study on the economic feasibility of tea in Pakistan was illustrated from the start till to date. The flourishing of the tea industry in Pakistan in its present form, many attempts have been made so far on Governmental level and in private sector as well from the last 50 years. The serious efforts began in the late 80's. With the Governmental encouragement tea was started to its blooming and the replacement of other crops in the area were made accordingly. Recently new and more extensive plantations are being built-up, under the auspices of PARC/NTRI in the Northern part of Pakistan. In the study an over view of all efforts are being shown for its development along with its stages being faced. The successful growth of tea plants in the area have been ascertained, the yield potential and quality of made-tea have been assessed to be economically viable, the extent of suitable area has been identified and finally, the production package for growers has been evolved.

Key words: Tea (*Camellia sinensis*), plantation, history, growth, economics, Pakistan

Introduction

Tea is one of the three major non-alcoholic beverages used in the world, which was originally discovered in China. Currently tea industry has spread from China to the far corners of the world encompassing countries ranging from 30° latitude in the Southern Hemisphere (Kenya) to 45° latitude in the Northern Hemisphere (Georgia). According to recent statistics, the total amount of world tea production reaches 2.8 million tons annually, 70% as black and 30% as green tea. On the average 3 billion cups of tea are drunk every day, the main black tea producing countries are India, Sri Lanka and Indonesia, while the main green tea producing countries are China, USSR and Japan. Global demand for tea exceeds supply and this gap will continue to increase over time due to population growth resulting in considerable rise in prices (Anonymous, 1991d).

Materials and Methods

In this review, data were used on the basis of research has been actually carried out at National Tea Research Institute (NTRI) from 1982- 2002.

Results

Tea in Pakistan

Roll of tea in our economy: The per capita consumption is more than 1.0 kg. Unfortunately, all tea consumed in Pakistan is imported from abroad. Tea is the third commodity after petroleum and edible oil on which our billion of expenditure has been spent annually. More over, Pakistan is the second largest importer of tea in world next to United Kingdom with current rate of population growth (3.1% annually), the country is likely to be the largest importer of tea in the world during next few year. (Nathaniel, 1992). As reported by Jamali and Jamali (2001) that Pakistan consumes a substantial quantity of tea and country enjoys the distribution of being the world 2nd largest non-producing tea importer.

Tea cultivation history: Tea cultivation was started for the first time in 1958 at village Baffa, district Mansehra and subsequently, in 1964 at Misriot Dam, Rawalpindi under the auspices of Pakistan Tea Board. The efforts could not become fruitful for want of proper governmental attention. This was most probably due to self-sufficiency in domestic tea production in the than East Pakistan (Now Bangladesh). Soon after the separation of East Pakistan in 1971, a special crops cell was created in the Ministry of Food and Agriculture, Govt. of Pakistan and a project entitled "Research and Introduction of Tea in Pakistan" was initiated in 1973-74. In order to carry out systematic research studies on the performance of crop, the project/task was handed over to Pakistan Agricultural Research Council (PARC) in 1976-77, which

initiated solid steps and planted tea seed on 1.5 acres at village Baffa, district Mansehra. Subsequently, in 1982, a four member team of Chinese tea experts visited the area, who after surveying the prospective tea growing area of Northern hilly tract of Pakistan, developed a collaborative Tea Research Programme and planted Tea (*Camellia sinensis* L.) on 2 acres (0.8 ha) land at Daively, district Mansehra. The team again visited Pakistan and suggested for the establishment of National Tea Research Station in 1986 at Shinkiari, Mansehra. As reported by Seurei (1997) that tea *Camellia sinensis* improvement in Kenya has in three phases. Initial pioneer introduction, secondly subsequent mass clone selection and breeding between superior clones.

Growing condition: The area is located at Hazara and Swat in NWFP lying around 34 - 35 °N latitude and between 72 - 75 °E longitude in a fairly contiguous belt in the foothills of Himalayas and Hindukush. The special features of the area are the mountain ranges with a series of level tracts of different sizes and ecological characters. The climate of the area is in a zone of major changes due to largely mountains, which produce their own frost pockets and mountain microclimates. The statistic of Shinkiari Metrology shown (Table 1) of the last 5 years generally the climate is too cold in winter for vegetative growth in Shinkiari. The period from December to March is the coldest with air temperature ranging from 0 to 12°C causing the arrest of vegetative growth of the plants. With the on-set of spring when the temperature risen to 13°C, the growth starts in April and continues through summer till October in autumn except June when the temperature risen to 35°C (Anonymous, 1983). The length of growing period ranges from 180 days in the north to 200 days across central Mansehra. The mean annual rainfall ranges from 1000 mm at 1000 m altitude to 1400 mm at higher altitude in the north. The land in the project area is either gently sloping in the bottom of valleys with adequate soil depth or is very steep causing soils to be shallow. The soil pH is specific to different pockets ranging from 5.0 to 6.8 (Table 2). The physicochemical properties of soil of Shinkiari at NTRI is given in Table 3.

Types of processed tea: Tea essentially signifies two or three leaves and the terminal apical bud of the shrub mainly *Camellia sinensis* small and *Camellia assamica* broad leaf. There are many different types of processed tea, each with its own individual characteristic flavor, produced in the world. The differences in flavor are caused by the differences in chemical composition of fresh tea leaves, which are determined by genetic constitution of tea clones, climate and soil horticultural practices and the process of manufacturing (Table 4).

Tea as a health beverage: As reported by Oguni and Hara (1990) that the tea is a miraculous medicine for the maintenance of health

Table 1: Statistics of Metrology at Shinkiyari (Mansehra)

Parameters	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Avg.
Calendar year 1995													
Temp °C max.	13.5t	15.8t	19.5t	22.2X	31.4X	36.5XX	31.4X	31.5X	31.1X	29.5X	27.7t	15.4t	25.5
Min	1.1	3.5	6.3	10.3	16.2	17.8	21.4	21.1	15.9	10.7	4.1	2.6	10.9
Rain fall (mm)	7.0	59	116	117	28	48	426	239	36	13	34	26	114.9
R. humidity(%)	65	69	67	71	59	56	87	87	72	63	57	69	68
Calendar year 1996													
Temp °C max.	14.4t	17.0t	18.9t	27.1X	29.2X	33.4X	33.6X	31.7X	32.7X	37.5t	32.9t	18.1t	27.2
Min	1.9	4.1	8.6	11.2	14.1	20.1	21.2	23.1	18.4	11.3	6.7	1.3	11.8
Rain fall (mm)	50	103	183	93	43	118	62	233	95	15	2	14	101.1
R. humidity(%)	73	70	74	60	52	69	72	80	74	68	65	71	69
Calendar year 1997													
Temp °C max.	16.5t	19.9t	19.8t	23.1X	29.3X	33.1X	32.8X	33.0X	31.8X	25.8X	22.1t	15.0t	25.2
Min	0.1	0.8	6.0	12.9	12.9	17.5	20.3	23.2	22.1	10.2	6.2	6.1	11.5
Rain fall (mm)	29	22	119	112	90	166	225	275	144	38	26	5	125.1
R. humidity(%)	72	57	63	78	63	72	81	82	88	85	67	65	73
Calendar year 1998													
Temp °C max.	14.5t	16.0t	18.9t	27.6X	31.0X	34.8X	32.8X	31.0X	31.3X	29.3X	26.0X	19.3t	26.04
Min	1.5	4.0	4.9	10.5	15.2	17.8	21.7	21.2	18.3	11.9	5.6	2.6	11.26
Rain fall (mm)	55.2	198.6	130.5	139.2	36	54.5	243.1	127.8	97.0	19.3	5.5	0.0	110.7
Pan Evap (mm)	0.159	0.136	0.211	0.207	0.419	0.526	0.225	0.431	0.439	0.276	0.180	0.144	0.279
R. humidity(%)	70	69	64	59	49	46	72.5	76	67	48	63	78	64.45
Calendar year 1999													
Temp °C max.	14.6t	16.7t	20.0t	29.9X	34.2X	37.2XX	34.3X	30.3X	32.0X	29.3X	21.8t	22.8t	26.92
Min	4.3	6.1	7.3	12.0	15.1	18.6	22.0	20.8	20.0	9.83	7.1	2.5	12.13
Rain fall (mm)	105.3	56.5	131.2	16.8	11.5	11.8	253.1	152.5	83.9	2.4	85.6	-	910.6
Pan. Evop (mm)	0.119	0.215	0.116	0.498	0.636	0.542	0.357	0.413	0.403	0.310	0.182	0.174	0.330
R. humidity(%)	68.8	64	56	45	36	43	65	77	84	61	76	89	63.73
Calendar year 2000													
Temp °C max.	15.5t	15.7t	22.3t	31.0X	35.7X	36.0XX	31.8X	31.3X	31.5X	30.7X	24.4X	20.3t	27.18
Min	1.8	2.1	5.3	12.0	17.3	18.6	20.3	20.0	16.2	11.0	7.0	3.6	11.26
Pan. Evop (mm)	0.138	0.172	0.323	0.472	0.592	0.535	0.670	0.403	0.346	0.297	0.162	0.164	0.356
Rain fall (mm)	74.7	34.7	39.7	6.9	57.2	137.2	298.2	118.5	151.6	30.0	0.00	40.3	98.9
R. humidity(%)	15.5	15.7	22.3	31.0	35.7	36.0	31.8	31.3	31.5	30.7	24.4	20.3	27.18
Calendar year 2001													
Temp °C max.	19.5t	20.2t	24.3t	27.2X	35.7X	33.3X	32.0X	32.4X	32.4X	31.3X	25.1t	19.7t	27.75
Min	1.7	4.0	6.3	11.6	16.3	20.3	22.4	21.4	15.2	10.5	6.2	4.7	11.71
Pan. Evop (mm)	0.194	0.365	0.331	0.410	0.395	0.475	0.459	0.468	0.407	0.300	0.229	0.123	0.346
Rain fall (mm)	15.0	69.5	87.5	64.5	149.6	229.4	101.1	132.1	3.8	43.6	3.5	899.6	149.93
R. humidity(%)	51	54	48	61	45	67	78	74	63	79	80	58	63.16

X Harvesting period of tea in Pakistan.

XX Depends upon the temp if the temp goes up 35 °C then the growth is stopped.

t Dormant seasons.

R. humidity = Relative humidity. Source: (Anonymous, 2001a)

and has an extra-ordinary power to prolong working life. Tea has been found to provide psychological solace and satisfaction, enhances memory and perception, relieves fatigue and induces tranquility and mental equilibrium (Table 5).

Discussion

As a result of 20 years long research and efforts by the Scientists of Pakistan Agricultural Research Council (PARC), Islamabad, the healthy/ satisfactory growth of tea plants has been ascertained with existing tea plantation growing vigorously at Battal and Shinkiyari since 1982 and 1986, respectively. The maximum yield of 5000 kg harvest (top tender leaves) as fine plucking (2 leaves + bud) and 3 times as much i.e., 15000 kg harvest as coarse plucking (4 leaves + bud) per acre per year has been obtained from selected tea bushes in the existing seedling gardens at Shinkiyari. Where as fine plucking is used for making green tea and superior quality black tea while, coarse plucking is used for making black tea with a quality comparable to the one in the market. The internationally accepted ratios for making green and black tea from fresh harvest is 4:1 and 4.5:1, respectively (Waheed, 2000) However, a yield of 4,200 kg harvest (930 kg black tea) under good management (adequate nutrients supply) and 2500 kg harvest (550 kg black tea) under farmer level management (low nutrient supply) have been obtained per acre per year tea garden at NTRI Shinkiyari. The plucking season starts in mid April and continues till late September or early October. Jehangiri (2000)

reported that the quality of black tea harvested and made at NTRI was evaluated by Tea Craft at United Kingdom 1991 and was found to be excellent scoring above 90% grades. Finally, the production package for tea growers has been evolved. Black tea processing plant starts working from the last year i.e., 2001 with the capacity of 1000 kg made tea /day with the assistance of P.R.China. The quality of Black tea as good as we have drunk every day. The Net Income per acre from traditional crops grown in the area in comparison with tea have been given in Table 6.

Economics of production

Tea plantation: Tea plants raised whether from seed or cuttings (clones) has to remain in nursery for one year. The cuttings/seeds are planted in September to December and become ready for transplantation after one year. Keeping the recommended plant to plant (2 feet) and row to row (4 feet) distances, 5000 plants are required for one-acre plantation. After transplantation it takes 4 years in the field to gain sufficient height 2.5 -3 ft (plucking standard), develops bush canopy and starts production on 5th year, which reaches its peak or full capacity on 7th year age. Thus, the cost of garden establishment on one acre for 4 years is Rs.1,01500/- which looks very nominal as compared to the other crops (Table 7). Inter-cropping of traditional crops between the rows can be practiced during the 4 years of gestation period, which not only reduces the cost of weeding but also ensures additional income to compensate the growers. After the expiry of

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Table 2: Areas suitable for tea plantation in Hazara and Malakand division

Place Name	Altitude (m)	pH value					
		Depth (cm)					
		0-10	10-20	20-30	30-40	40-50	50-60
Mundhar	1080	5.5	6.0	6.5	7.0	7.0	7.0
Rive	900	6.5	7.0	7.0	7.5	NA	NA
Guldehri	800	5.5	6.0	6.5	7.0	7.0	7.0
Jagir	820	5.0	6.0	6.0	6.0	6.0	6.0
Besian	870	5.5	6.0	6.0	6.0	6.0	6.0
Shawal	900	5.0	5.5	6.5	6.5	6.5	6.5
Bedadi	1000	5.5	5.5	6.0	6.5	6.5	-
Khanpur	1000	6.5	6.5	6.5	6.5	6.5	6.5
Bugar Mung	1185	5.5	6.0	6.0	6.5	6.5	6.5
Dadar	1200	5.0	5.5	6.0	6.5	6.5	6.5
Jabori	1320	5.0	5.5	6.0	6.5	6.5	6.5
Sachan	1360	5.0	6.0	6.5	6.0	6.5	6.5
Nawaz Abad	1580	4.0	4.5	5.5	5.5	5.5	5.5
Daively	1500	5.5	5.5	6.0	6.5	6.5	6.5
Avloke	1520	4.5	5.5	6.5	6.5	6.5	6.5
Chattar Plain	1525	5.5	6.0	6.0	6.5	6.5	6.5
Chinnar	1100	5.5	6.0	6.5	6.5	6.5	6.5
Madan	980	5.0	5.5	5.5	5.5	6.0	6.5
Bazargay	1096	5.0	5.5	5.5	5.5	6.0	6.5
BazarKot	1630	6.5	6.0	6.0	6.0	6.5	6.5
Linwani	1420	5.5	5.5	5.5	6.0	6.5	-
Shangla	2000	6.5	6.0	7.0	7.0	7.0	-
Topsin	1775	6.0	6.0	6.5	6.0	6.5	6.5
Bedara	1080	5.5	6.5	6.5	6.5	6.5	6.5
Druksh Khalla	1100	5.5	6.5	6.6	6.5	6.5	6.5
Kulagram	1270	6.5	6.5	6.5	7.0	7.0	7.0
Madyan	130	5.5	6.0	6.0	6.0	6.5	6.5
Punjigram	1375	5.5	6.5	6.0	6.0	6.5	6.0
Peshmasl	2150	5.5	5.5	6.0	6.0	6.0	6.0
Malam jaba	2450	5.5	6.0	6.5	6.0	6.0	6.5

Source: (Anonymous, 2001c)

Table 3: The physicochemical properties of soil of Shinkiyari at NTRI

Location	Physical properties (cm)					Chemical properties (ppm)				
	Layers (cm)	Specific gravity	Unit wt. (1cm ⁻¹)	porosity (%)	pH	N	P ₂ O ₅	K ₂ O	MnO	Fe ₂ O ₃
Shinkiyari	5-10	2.44	1.16	52.47	6.41	0.12	6.73	60.51	11.19	36.63
	20-25	2.63	1.47	44.15	6.64	0.09	7.92	57.50	15.67	42.88
	50-55	2.69	1.49	44.53	6.77	0.06	7.64	60.94	12.80	44.00

Source: (Anonymous, 2001c)

Table 4: Approximate chemical composition of fresh tea leaf and shoot

Constitution	Percent of total dry weight	
	<i>C. sinensis</i>	<i>C. assamica</i>
Polyphenol (mostly catechins)	13-17	25-30
Fiber	26	26
Protein (including enzymes)	15	15
Carbohydrate	07	04
Lipids	07	03
Free Amino acid	1.6-5.6	1.6-5.6
Caffeine	3-5	3-4
Pigments	02	9-13
Minerals	05	05

Source: (Mulky and Sharma, 1993), (Robertson, 1992), (Oguni 1993)

gestation period, tea plants develop sufficient canopy, which completely covers the ground suppressing all kinds of weeds for the next 60-90 years. The productive capacity of the tea plants ranges from 800 to 2000 kg harvest (4 leaves + bud) during the next 5th, 6th and 7th year when the plants reach their full productive capacities on 8th year.

Cost of tea production: The management of traditional annual crops (Cereals and vegetables) covers a whole range of agronomic

Table 5: The components and healthy effect of green tea

Components of green tea	Healthy effects
Polyphenol(catechins)	Reduces incidence of cancer
The main component	Reduces tumors
	Reduces mutations
	Lowers blood cholesterol
	Inhibits Increase of blood sugar
Caffeine	Kills influenza virus
	Fights cryogenic bacteria
	Prevents halitosis
	Stimulates wakefulness (removes fatigue and sleepiness)
Vitamin C	Acts as diuretic
	Reduces stress
Vitamin B complex	Prevents flu
	Aids carbohydrate metabolism
	Lowers blood pressure
	Strengthens blood vessel walls
r-Amino Butyric Acid (GABA)	Prevents halitosis
	Lowers blood sugar
	Prevents dental cavities
Flavonoids	Acts as antioxidant and regulates aging
	Gives green tea its delicious taste
Polysaccharides	
Fluoride	
Vitamin E	
Thionine (a kind of amino acid)	

Source: (Oguni and Hara, 1990)

practices of land preparation, seed (variety/quality), irrigation (adequate and timely), weeding, plant protection measures and

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Table 6: Comparison of tea with other crops (approximate values *)

Crops	Net income(Rs.)	Grading by price
Tea	35,725/-	I
Wheat	8,350/-	IV
Maize	4,190/-	V
Rice	13,025/-	II
Tobacco	11,650/-	III
Vegetables	Highly variable(Economically risky)	VI

Source: (Anonymous, 2001b); *, Variation in the prices due to market fluctuation

Table 7: Cost of establishing tea garden on one acre for 3 years

Item	Ratio	Rupees
Cost of plants	5000 (No.of plants) x 3 (Cost/saplings)	15,000.00
Land preparation by tractor etc.	5 hrs @ Rs. 200/hrs.	1,000.00
Cost of transplantation	@Rs:1.50/ sapling	7,500.00
Cost of fertilizers for 3 years	Rs. 6000/-per year	18,000.00
Cost of labour on Weeding/ irrigation etc.	3 lab. @Rs:100.00 x 200 days	60,000.00
Grand total		1,01,500.00

Source: (Anonymous, 2001a)

adequate nutrient supply (Table 5). But, unlike nitrogenous other crops, management of tea refers only to adequate nutrient supply (balanced in type and in quantity of nutrients) especially the fertilizers (Ammonium sulfate or urea) as the top tender leaves comprises of commercial portion of the crop. The net income from tea excels all other income obtained from traditional crops on per acre per year basis. It is established fact that nothing is attractive unless it is economically attractive. Now the priority is to demonstrate the economic profitability/attraction of tea practically to the growers. To do this the acreage under tea is needed to increase as soon as possible.

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