

PROSPECTS OF WHEAT PRODUCTION

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Profound changes in agricultural development have taken place in Sri Lanka during the past few decades. Yet, food production has not kept pace with population growth. This is a phenomenon that is akin to many of the developing countries. Studies carried out by the FAO and other international agencies forecast that by the year 2000 most developing countries will necessarily have to increase their food imports.

Rice has been the staple food of Sri Lankans from time immemorial. Nevertheless, with the advent of the second World War and the stoppage of rice imports, wheat flour became an increasingly acceptable source of food. Bread is very popular today. Hoppers, stringhoppers, pittu and roti, which were prepared primarily from rice flour before, are now prepared wholly or partly with wheat flour. Wheat flour is also used for the baking of cakes cookies, etc., which store well for reasonably long periods. Thus, wheat flour at present is an important source of food for Sri Lankans.

WHEAT IMPORTS

The nation's requirement of wheat is imported in toto. Rs. 1,825/- million were expended to import wheat flour and Rs. 575/- million for whole wheat grain in 1980. Imports of wheat flour and grain and their cost over the past two decades are given in Table 1.

Table 1 Imports of Wheat Flour and Grain and the Cost (1960-1981)

Year	Wheat Flour		Cost-Rs. million	Whole Wheat Grain		Cost-Rs. million
	Rate Rs/ton	Total Imports '000 tons		Rate/ Rs/ton	Total Imports '000 tons	
1960	...	449/	144.4	64.9	—	—
1965	...	436	311.9	136.0	—	0.14
1970	...	611	368.6	225.3	—	29.27
1975	...	2297	455.2	1045.6	—	87.57
1980	...	5055	361.0	1825.0	—	163.97
1981	...	No imports of wheat flour		—	463.36	na

Source: Customs Department.

These statistics clearly show that the imports of wheat flour and grain have increased almost four times from 144,000 tons in 1960 to 540,000 tons in 1980. Similarly, the price of wheat flour which was Rs. 449/- per ton in 1960 has rocketed to Rs. 5055/- per ton in 1980. Obviously, this steep rise in the price of flour had not acted as a deterrent to the consumer. Based on these statistics the probabilities are that wheat will continue to play a paramount role as a supplementary source of food despite further price increases which may occur in the future.

TYPES OF WHEAT

Bread wheats (*Triticum aestivum*, sub-species *vulgare*) comprise two distinct types: spring wheats and winter wheats which differ physiologically and have different growth habits. Spring wheats are sown at the commencement of a growing season and continue to grow until harvest, the life cycle being completed in 3-5 months. Winter wheats, on the contrary, necessitate an interruption in growth after sowing by a continuous period of low temperature, thus requiring 10-11, months to complete the growth cycle. Bread wheats provide the bread for over one third of the world population.

Durum wheats (*Triticum turgidum*, sub-species *durum*) provide the world's macaroni, spaghetti, semolina and other special preparations. They are generally grown under a diversity of ecological conditions. Several promising lines which can be grown successfully under tropical conditions have been released by CIMMYT.

CLIMATIC REQUIREMENTS

Growth and development of the wheat plant is highly influenced by the climate. Cool moist weather during the vegetative phase and dry weather during the reproductive phase are considered ideal for wheat production. Optimal temperature for growth and development also varies considerably; for germination it ranges between 20-22°C, for tillering it is between 16-20°C, and during the reproductive phase it is between 20-23°C.

In the early tillering phase when the daily mean temperature exceeds 20°C, tillering is poor and heading is accelerated. When the mean temperatures exceed 25°C during grain filling the plants dry up prematurely, especially when there is water stress.

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VARIETAL TESTING

In 1969 an attempt was made to test the performance of four introductions from India: Sonalika, Sharbati Sonora, Kalyansona and Safed Lerma, at the Agricultural Research Station, Rahangala. Due to the high incidence of smut the performance of these cultivars was poor, with yields ranging between 96–205 kg/ha.

However, with the establishment of the Regional Research Centre at Bandarawela in 1973 several introductions primarily from CIMMYT (Mexico) were tested. Initial tests carried out in 1974 revealed that certain short aged cultivars of bread wheat and durum wheat could be successfully cultivated under rainfed conditions during the Maha season. Subsequent studies have established the feasibility of cultivating wheat during both the Maha and Yala seasons under rainfed conditions.

However, it was observed that the yields obtained during the Yala season were lower than in the Maha season, especially when the sowing was delayed. Yields ranging from 2000–3000 kg/ha have been obtained with select cultivars such as Trigo-1 and Zambesi. On-going research includes testing of varieties and selections from F-2 bulk populations that have been introduced from CIMMYT.

Although the climatic conditions at Bandarawela and its environs provide the most suitable conditions for the production of wheat, the availability of land for this purpose is a serious constraint. Thus, in Maha 1979/80, on the basis of the experience gained in wheat production in the highlands, several lines and cultivars were tested at lower elevations at the Moneragala Research Station (100 m above mean sea level) and at Kegalle (270 m above mean sea level). These investigations revealed that wheat can be cultivated successfully even at lower elevations provided the crop is sown at the right time i.e. during late Maha (December to February) when cool night temperatures prevail).

OBSERVATIONAL TRIALS

Island-wide observational trials were consequently initiated during Maha 1981/82 to investigate the feasibility of extending this new cereal crop over a wider range of agro-ecological regions. For this purpose 15 tons of seed of the variety 'Sonalika' were obtained by courtesy of the FAO for cultivation in about 250 ha of farmers' fields in observational plots of 0.4 ha each.

Unfortunately, late planting and the unusual drought experienced during this particular season were detrimental to crop growth in several locations. The weather data from September 1981 to February 1982 are given in tables 2—4. Despite this setback satisfactory results were obtained in nine Districts, particularly in Jaffna, Vavuniya, Mannar and Mullaitivu in the northern dry zone. Individual plot yields ranged from 845 kg to 3750 kg per hectare. The average yields districtwise are given in Table 5.

Table 2 Maximum—Minimum Temperature in °C (Sept. 1981 to Feb. 1982)

Station	District		1981				1982	
			Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
Thirunelvely	Jaffna	Max.					26.7	24.1
		Min.					24.5	25.2
Vanathavillu	Puttalam	Max.	29.7	29.4	29.1	28.6	29.5	30.7
		Min.	25.5	24.7	23.3	21.4	20.3	20.4
Kantalai	Trincomalee	Max.	34.6	34.5	31.8	—	30.5	32.6
		Min.	23.5	22.9	22.2	—	19.7	22.2
Karadian Aru	Batticaloa	Max.	33.6	32.8	31.1	29.2	29.5	31.5
		Min.	22.9	23.1	22.9	21.5	18.0	17.2
Angunakola-pelessa	Hambantota	Max.	31.9	32.9	30.9	30.3	31.9	33.0
		Min.	22.8	22.6	22.5	20.8	19.8	20.2
Bombuwela	Kalutara	Max.	29.7	30.5	30.9	30.6	30.5	31.0
		Min.	24.5	23.5	23.4	22.3	22.1	22.0
Ratnapura TRI	Ratnapura	Max.	30.6	30.1	23.5	27.5	33.5	35.2
		Min.	23.9	24.2	18.4	26.7	21.9	22.9
Matale	Matale	Max.	25.7	26.9	26.3	28.4	28.3	27.7
		Min.	22.4	21.5	20.7	21.8	20.8	22.1
Batalagoda	Kurunegala	Max.	30.1	30.9	30.6	30.1	30.4	32.8
		Min.	23.9	23.2	23.1	21.6	21.6	19.7
Maha-Illuppallama	Anuradhapura	Max.	31.5	32.0	30.6	30.1	30.4	33.20
		Min.	23.7	23.2	23.1	19.6	19.7	19.20
Sita Eliya	N'Eliya	Max.	17.8	18.8	18.9	18.9	18.9	20.2
		Min.	12.3	12.4	12.1	10.6	9.1	9.9
Bandarawela	Badulla	Max.	25.7	25.4	24.8	23.0	23.4	26.4
		Min.	16.4	15.6	15.3	14.7	13.7	12.1
Alutharama	Badulla	Max.	32.5	31.9	30.3	30.0	30.2	33.3
		Min.	22.9	22.3	22.1	21.6	20.4	19.5
Labuduwa	Galle	Max.	29.9	29.8	26.5	30.0	30.0	31.1
		Min.	23.7	22.9	22.7	21.6	21.0	21.5
Peradeniya	Kandy	Max.	26.4	27.1	27.0	26.9	28.7	31.6
		Min.	20.7	20.9	19.8	18.0	18.8	16.7
Kundasale	Kandy	Max.	28.6	30.9	30.7	29.6	30.3	32.3
		Min.	22.9	20.6	20.2	18.5	16.8	16.0

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Table 3 Mean Maximum & Minimum Temperature in °C (1976-1981)

Station	District		Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
Thirunelvely (1976-1980)	Jaffna	Max.	31.5	31.0	29.5	29.2	29.0	30.3
		Min.	25.9	24.8	22.5	21.0	20.8	20.5
Vanathavillu (1976-1981)	Puttalam	Max.	31.2	30.7	30.4	29.8	30.7	32.1
		Min.	25.4	23.7	23.2	21.9	20.8	20.9
Kantalai (1976-1981)	Trincomalee	Max.	35.1	34.0	31.4	30.0	29.9	21.4
		Min.	24.6	23.3	22.5	22.0	20.6	20.6
Karadian Aru (1980-1981)	Batticaloa	Max.	35.1	33.2	31.0	29.5	29.6	31.1
		Min.	21.2	23.2	23.1	21.8	21.1	20.0
Angunakolapelessa (1976-1981)	Hambantota	Max.	32.5	31.5	30.3	30.4	30.9	31.5
		Min.	23.8	23.1	22.9	22.2	20.9	21.6
Bombuwala (1977-1981)	Kalutara	Max.	29.9	30.3	30.6	30.9	30.9	31.0
		Min.	24.5	23.8	23.5	24.5	21.9	22.5
Ratnapura TRI (1971-1981)	Ratnapura	Max.	30.2	30.4	30.1	31.2	32.5	33.3
		Min.	23.4	23.6	22.7	23.8	22.1	22.3
Matale (1977-1981)	Matale	Max.	28.5	28.9	28.5	28.1	29.1	31.6
		Min.	22.3	21.5	20.6	20.4	17.6	18.6
Batalagoda (1976-1981)	Kurunegala	Max.	31.2	31.1	30.5	29.9	29.7	31.8
		Min.	24.3	23.3	22.9	22.1	20.9	20.9
Maha-Illuppallama (1977-1981)	Anuradhapura	Max.	32.4	31.9	30.3	29.7	29.8	31.8
		Min.	24.1	23.3	22.3	22.1	20.1	20.7
Sita Eliya (1975-1981)	Nuwara Eliya	Max.	18.5	18.5	18.6	18.4	18.7	20.4
		Min.	11.9	12.3	12.3	11.6	10.9	11.2
Bandarawela (1975-1981)	Badulla	Max.	26.4	25.4	24.6	23.1	23.2	24.9
		Min.	15.4	15.9	15.9	15.4	14.2	13.9
Alutharama (1976-1981)	Badulla	Max.	35.2	33.0	31.4	29.5	30.4	31.5
		Min.	22.5	21.8	21.9	20.9	21.1	20.2
Labuduwa (1976-1981)	Galle	Max.	29.5	29.8	29.5	29.5	28.7	30.1
		Min.	25.2	25.4	24.4	23.8	24.1	23.9
Peradeniya (1967-1981)	Kandy	Max.	28.1	28.2	28.4	28.1	28.1	29.9
		Min.	20.5	20.8	20.7	20.2	18.5	18.9
Kundasale (1975-1981)	Kandy	Max.	29.6	29.4	29.4	28.2	28.7	30.5
		Min.	20.6	20.4	19.9	18.8	17.6	17.8

Table 4 Rainfall Data in mm (Sept. 1981-Feb. 1982)

Station	District	1981				1982	
		Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
Thirunelvely	Jaffna	72.2	275.1	524.1	163.3	0.0	0.0
Vanathavillu	Puttalam	114.8	122.0	271.7	138.0	0.0	0.0
Kantalai	Trincomalee	279.5	346.8	167.6	167.6	0.0	0.0
Karadian Aru	Batticaloa	110.5	367.0	202.3	626.2	17.2	0.0
Angunakolapelessa	Hambantota	73.9	116.5	219.9	62.0	28.5	0.0
Bombuwala	Kalutara	206.2	310.4	399.3	166.6	28.1	0.0
Ratnapura TRI	Ratnapura	500.9	246.2	502.7	120.9	75.8	11.0
Matale	Matale	131.0	54.0	99.8	84.0	0.4	0.0
Batalagoda	Kurunegala	208.3	233.5	335.1	40.2	0.6	0.0
Maha-Illuppallama	Anuradhapura	117.7	184.7	142.5	129.0	0.0	0.0
Sita Eliya	N'Eliya	229.9	158.4	216.5	231.7	9.1	0.0
Bandarawela	Badulla	149.7	183.5	188.8	118.1	5.4	0.0
Alutharama	Badulla	103.7	82.9	150.3	337.1	7.3	0.0
Labuduwa	Galle	0.0	425.0	357.2	365.6	20.3	2.5
Peradeniya	Kandy	376.0	112.9	287.1	49.7	0.0	0.0
Kundasale	Kandy	216.7	68.3	212.7	64.8	0.0	0.0

Table 5 Average Yields of Wheat in Nine Districts (Maha 1981,82)

<i>District</i>	<i>Agro-ecological Region</i>	<i>Average Yield (kg/ha)</i>
Jaffna ...	Low Country Dry Zone	2595
Vavuniya ...	do	2150
Mannar ...	do	2010
Mullaitivu ...	do	1965
Trincomalee ...	do	1385
N'Eliya ...	Up Country Wet Zone	1945
Ratnapura ...	Low Country Wet Zone	1535
Badulla ...	Up Country Intermediate Zone	1975
Moneragala ...	Low Country Intermediate Zone	1705
Average		1917

The average yield for the nine Districts recorded above was 1917 kg/ha or 28 bushels per acre. The highest yield of 2595 kg/ha or 38 bu/ac was obtained in the Jaffna District.

FUTURE TRIALS

The promising varieties identified so far: Zambesi, Trigo and Sonalika are short-aged (2 1/2-3 1/2 months). They have a low water requirement. They are also less demanding in management techniques than rice. As such, farmers can be persuaded to introduce them into the existing cropping patterns as a subsidiary cereal.

Processing is also easy. Sonalika, which is not a bread wheat, can be simply processed into atta flour at the domestic level and used for the preparation of several wheat foods popular in local cuisine. State-operated mills also exist for the processing of bread wheats such as Trigo.

The per capita consumption of rice annually is about 100 kg. Wheat is the next most important cereal food with a per capita consumption of about 40 kg.

Table 6 Apparent per Capita Consumption of Rice and Wheat Flour (1960-1979)

	<i>Rice (kg)</i>	<i>Wheat flour (kg)</i>
1960 ...	114	20
1961 ...	108	20
1962 ...	114	20
1963 ...	116	19
1964 ...	115	20
1965 ...	103	22
1966 ...	98	24
1967 ...	98	33
1968 ...	103	35
1969 ...	196	32
1970 ...	128	33
1971 ...	100	28
1972 ...	88	33
1973 ...	92	34
1974 ...	102	31
1975 ...	93	34
1976 ...	91	36
1977 ...	118	41
1978 ...	100	41
1979 ...	103	40

Source: Economics Division, Department of Agriculture.

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Even though rice production may be expected to increase in the years ahead, it is unlikely that the per capita consumption of wheat will fall below 23 kg the calculated output for 1990 from the Prima Flour Milling Complex and the State Flour Milling Corporation. Every effort should therefore be made to supply at least a part of this requirement from locally produced wheat and provide welcome savings in foreign exchange.

With this objective in view the Department of Agriculture envisages:

1. intensifying wheat research to determine new adaptable varieties other than Trigo and Sonalika, appropriate planting times, spacings, fertilizer practices, pest and disease control measures, and
2. promoting production in areas where preliminary observational trials have indicated that the environmental conditions are suitable.

Special attention will be given to promoting wheat production in the hill country, because it can be fitted into the rotation with vegetables and rice in the highlands and lowlands respectively. This should disrupt the cumulation of pests and diseases which has resulted from the intensive cropping of the highlands, particularly with solanaceous vegetables. Furthermore, in the well-drained and moderately drained paddy fields which lie fallow during the early part of the Maha season due to the high sterility caused by low temperatures, a crop like wheat which is adapted to low temperatures can be an ideal substitute. Researches carried out in the Badulla district have amply demonstrated this.

Also, on the basis of the satisfactory results obtained in the dry zone, wheat will be introduced as a Maha crop on the highlands and in the paddy fields where water is a constraint.

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