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THE CROP GROWING SEASON CLIMATES OF SOUTH VIET-NAM

by

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I. Introduction

Climate is the primary environmental factor influencing the production of crops. Three crop-climate factors are important: (1) The length of the period during the year when crops can be grown; (2) which crops can be grown; and (3) how favorable a local climate is in relation to other areas where the same crop or crops can be grown. The latter factor is particularly important in countries like South Viet-Nam where agricultural crops are called upon to produce a major share of the foreign exchange.

Because of the great variations in latitude and topography, the Republic of South Viet-Nam has a wide range of climatic conditions. The country occupies a narrow strip facing the South China Sea, extending from north to south, approximately 600 miles between the 8th and 17th parallel.

The Mekong Delta area is a flat flood plain of alluvial soil which occupies the entire southern portion of South Viet-Nam from Saigon north and west to the Cambodia border, flanked on the east by the South China Sea, and on the west by the Gulf of Thailand.

The central and northern part of South Viet-Nam is the seaward edge of the great Asian continental land mass...a narrow strip of coastal plain - backed by the Annamite Mountain ridge. Extensive areas of high

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plateau lie to the west of the mountain ridge, along the Cambodian and Laos borders. This plateau area is referred to as The Central Highlands.

In Viet-Nam, the dominant climatic factor is the monsoon. "Monsoon" is a term used to describe a periodic wind, usually associated with highly seasonal rainfall.

The "winter" monsoon (actually a fall monsoon) is produced by a cool, dry continental high pressure area which moves from north to south. Beginning in August, it causes heavy rainfall in the Hue-DaNang area, less at Quang Ngai and Tuy Hoa, and becomes very unreliable by the time it reaches Nha Trang. It has little influence on rainfall in the Saigon area.

The "summer" monsoon is more consistent. It is a mass migration of cool, moist air drawn inland from the sea by the upward movement of super-heated continental air. Starting in April or May, it brings heavy rains to the Delta, the mountains and the Central Highlands, and decreasing amounts to the coastal area from Saigon to Phan Rang.

Crops grow during the entire year in Viet-Nam, but seasonal crop temperature adaptations become more definite and more critical as we move from south to north. Also, the cooling effect of higher elevations must be considered in the mountain valleys, and on the plateaus of central and northern South Viet-Nam.

The Mekong Delta, close to the Equator, has high temperatures throughout the year; but the DaNang-Quang Tri area, also near sea level, but 400 miles farther north, has hot summers and cool winters. Dalat in the

mountains has average temperatures 10 to 15 degrees Fahrenheit cooler than the nearby coastal area at Nha Trang. These temperature differences have a profound effect upon crop production.

The Mekong Delta enjoys a surprisingly quiet marine climate; in fact, typhoons and severe cyclonic disturbances are rare in this portion of the South China Sea and the Gulf of Thailand.

Typhoons are more frequent in the central and northern coastal areas of South Viet-Nam. Also, continental storms and hot winds sweep out of Laos and Cambodia to damage crops in this area. Average wind velocities are generally low in South Viet-Nam (below 10 knots), but quite consistent with some air movement at least 75% of the time. Damaging winds and periods of windy weather are most likely to occur from June to November, and in the central and northern part of the country.

The difference between the marine climate of the Delta and the more continental climate of the northern portion of South Viet-Nam is reflected in the intensity of rainfall, and the reliability of the rainfall for crop production (see Table I - "The Relative Influence of Rainfall and Irrigation on the Length of the Growing Season for Rice in South Viet-Nam").

Frosts may occur in the highest mountains (over 8,000 feet), but they are not a factor in crop production.

Hail (usually from March to May) may occur at Dalat and other mountain areas, but is unknown at coastal elevations.

Fog is rare in most parts of Viet-Nam. Fog may be expected to occur about 10 per cent of the time during the late winter and early spring in the northern provinces; 10 to 20 per cent year long at Pleiku; for short periods during the summer and fall at Dalat; and during the winter in the lower part of the Mekong Delta.

Humidity is relatively high in South Viet-Nam, usually above 75 per cent, even in the dry months. But extremely low humidity accompanied by very hot, dry winds may occur during the late summer in the northern provinces, causing severe crop damage.

II. The Crop Growing Seasons of South Viet-Nam (Figure I)

The lines on the Crop Growing Season map, Figure I, are isotherms drawn to delineate areas with similar temperature conditions. Each of the areas delineated have agronomic significance; the map describes and explains crop temperature relationships, and crop adaptation. (This classification system permits the comparative study and evaluation of climates in all parts of the world.)

The Growing Season Climates of South Viet-Nam are all Class I climates (i.e. temperatures are satisfactory for commercial crop production during the entire year). The second symbol indicates the prevailing heat conditions. South Viet-Nam has B, C, and small c climates, indicating warm, moderate, and cool crop growing seasons. Where more than one symbol is used, the climate has a seasonal difference which should be observed in planting or selecting crops.

The actual crop growing seasons in Viet-Nam are determined by the rainfall pattern. The average effective growing season based on adequate rainfall is six months, but crops can be grown over the full twelve-month period, if irrigation water is available. (See Table 1)

III. Description of Crop Growing Season Climates of South Viet-Nam

Class IB_T - Mekong Delta

This is a tropical ("T") marine climate with consistently high temperatures (over 78° F.) and a narrow range between day and night temperatures.

Temperatures are above the optimum for nearly all commercial crops, so the slightly higher maximum temperatures that occur during the dry season, February to May, not only increases crop-water requirement, but the excessive heat limits crop adaptation to the most heat tolerant species. (Heat tolerant crops: sugar cane, watermelons, sweet potatoes, okra, eggplant, peppers, and tropical trees and bushes.)

Rice can be grown during the entire year, but the climate is not conducive to maximum yields. Sunlight is restricted during the monsoon period, the humidity is high, and the excessive rainfall limits the effectiveness of fertilizers. Pests and plant diseases are difficult to control, and pollination may be effected.

The dry season is generally more favorable for rice production, but the excessive heat makes almost every task in rice growing a more technical proposition. Sprays must be used carefully to avoid spray burn,

nitrogen application rates are more critical, and excessive field drying of grain at harvest time may lower the quality of the crop.

Drainage, land leveling, and irrigation are required to grow a second crop of rice in the Delta. Drainage is required to get the fields dry in time to grow a second crop, and land leveling is necessary to facilitate drainage and make efficient use of the irrigation water. Irrigation farming is high-cost farming in the Delta. When water is available, crops other than rice may be better adapted and more profitable.

Hardy crops, such as Irish Potatoes, small grains, and salad crops are not well adapted to Class B_T climates. But, a strong local market demand makes practical a considerable acreage of cabbage, Chinese cabbage, cauliflower, green onions, lettuce, white radishes, and escarole grown to mature in mid-winter as the monsoon rains taper off. Cucumbers, watermelons, peppers, eggplant, long beans, squash, gourd, okra, and sweet potatoes are well adapted to the winter and early spring season in the Delta.

Sorghum and sugar cane can be grown where the soil and drainage conditions are satisfactory, but corn, soybeans, ~~mung~~ mung beans, green beans, summer squash, cantaloupe, celery, and dry onions are subject to serious heat stress, plant disease, and day length technicalities which make them problem crops in the Delta.

Increased interest in tropical fruits and nuts adapted to the Delta can be expected when security is improved and world markets become more interested in products from South Viet-Nam (bananas, papaya, mangoes, etc.).

Class I $\bar{B}B_T$ - An Loc to Phan Thiet, Coastal Plains to Qui Nhon

The growing season temperature climate is very similar to $\bar{I}B_T$ (average temperature over 78°F) described above. The major difference occurs during the winter season, November through February, when average temperatures drop to 73°F to 78°F range. This winter temperature climate is more favorable for nearly all crops, particularly rice, corn, soybeans, tomatoes, squash, and green beans, and also the heat tolerant hardy crops - onions, cabbage, cauliflower and leaf lettuce grown for local market. Within this class, the season and climate for the above mentioned crops is somewhat longer and more favorable at Qui Nhon than it is at Phan Thiet.

This climatic zone includes the driest and most unreliable rainfall environment in South Viet-Nam (see Table 1). Irrigation is required to make effective use of the relatively more favorable winter season. When irrigation projects can be fully developed, it is likely that suitable sites can be found for the production of many high income crops like grapes, cotton, and other vegetable-fibre crops which are damaged by high rainfall and humid conditions in other parts of South Viet-Nam. Sheep and goats are well adapted to this dry climate.

Class $\bar{I}B_C_T$ - Foothills of Central South Viet-Nam (1000 to 2000 elevation) and Coastal Plains from Bong Son to DaNang.

This growing season climate is tropical, but there is a very definite variation in temperature between the summer and winter seasons. The summer

season is best adapted to heat tolerant crops (Examples: sugar cane, watermelons, sweet potatoes, okra, eggplant, peppers, and tropical trees and bushes).

The winter season, November 15 to March 15, has temperatures (average 68°F to 73°F) which are very favorable for nearly all tender crops, rice, corn, tomatoes, squash, etc.; and also hardy crops such as Irish potatoes, cabbage, cauliflower, onions, beets, carrots and lettuce. The coastal areas of northern South Viet-Nam are subjected to periods of extremely hot weather during the late summer, often accompanied by high winds and rapid drops in the relative humidity. This is very damaging to crops, particularly those in the blooming or fruiting stage of their development. This is an area of torrential rainfall, with high intensity storms and flash floods effecting crop production. Rainfall in excess of 19 inches in 24 hours has been recorded at Quang Ngai. Severe storms most frequently occur during the monsoon period from September through November, but may come as early as June.

The most favorable season for commercial farming in this area is from January to May, a period during which irrigation is required (see Table 1).

Class IBC̄ - The coastal area of northern South Viet-Nam (Hue-Quang Tri area); coastal foothills South to Qui Nhon; and western portion of the Central Highlands west and southwest of Pleiku.

The climate of this area is very similar to Class IBC̄_T - because of a more northern latitude, or higher elevations, night temperatures are

lower. This climate is slightly more favorable for hardy crops, also the growth of tropical plants may be retarded for short periods during the winter months. In general, the description given previously for Class $\bar{I}\bar{B}\bar{C}_1$ applies to this area. Detailed climatic data for the western Highlands is not available.

Class $\bar{B}\bar{C}$ - The foothills, lower mountains, and interior valleys of northern South Viet-Nam, northwest, west, and southwest of DaNang, average elevation 1500 feet.

Servicemen who have served in this area can testify in regard to the great variations in climate they experienced. Periods of extreme heat may occur during the summer months. (average temperatures over 78°F , with maximum temperatures in the 100°F range). This has an adverse effect upon nearly all crops, especially when accompanied by high winds and low humidity.

The mid-winter season is cool, average temperatures from 60° - 65°F , a very favorable climate for hardy crops such as Irish potatoes, onions, cabbage, cauliflower, celery, beets, carrots, and lettuce, even head lettuce. The long spring and fall seasons are well suited to most tender crops, such as rice, corn, beans, soybeans, squash, cucumbers, and many other vegetables and field crops.

Class IBC - The Central Highlands of South Viet-Nam, an extensive plateau between the Annamite Mountains and the Laos-Cambodian border - Also mountain valleys (average elevation slightly over 2000 feet).

It would be difficult to find a more satisfactory temperature climate for a wide variety of crops anywhere in the world. Winter average temperatures are between 65° and 73°F, the upper range of optimum temperatures for hardy crops like Irish potatoes, onions, celery, peas, cabbage, and beets; and the lower range of optimum temperatures for rice, corn, beans, squash, cucumbers, and peppers. Temperatures are ideal for most canning crops and seed crops; somewhat like summer in Michigan and Minnesota in the United States.

The summer season, from March through September, has average temperatures between 73° and 78°F, suitable for all the tender crops listed above, and also melons, sweet potatoes, sorghum, and okra which prefer warm weather. Heat tolerant hardy crops also can be produced during the summer, particularly those like onions, cabbage, chinese cabbage, and beets.

Temperatures are near ideal for livestock production, specifically for dairy and beef cattle, poultry, hogs, and rabbits. Rainfall is the most critical climatic factor in the Central Highlands (see Table 1). The excellent winter season, October to February, has bright sunshine, moderate temperatures, generally storm-free weather, and very little rainfall. Lack of rainfall during this season limits both crop and livestock production in the area -- irrigation is a prerequisite.

Excessive rainfall, damaging to crops, can be expected during the summer season, but the monsoon rainfall pattern is not consistent, and severe droughts occur at some time, or some place, during the summer season almost every year. Thus, irrigation developed for the dry season will also ensure the success of commercial agriculture during the unreliable rainy season.

Class I \bar{C} - The mountain valleys of Central South Viet-Nam (Dalat area - elevation 3000 to 5000 feet).

Monthly average temperatures are between 65° and 73°F year long. This is the upper range of favorable temperatures for hardy crops, and the lower range of temperatures favorable for most tender crops. Hardy crops, like Irish potatoes, cabbage, cauliflower, chinese cabbage, carrots, onions, beets, small grains, and lettuce grow very rapidly in this temperature climate. The tender crops like sweet corn, beans, cucumbers, peppers, okra, summer squash, eggplant, and sweet potatoes grow more rapidly at higher temperatures, but \bar{C} is the temperature range producing the highest commercial market quality -- hence, the Dalat area is particularly suited to the production of vegetables for the commercial market, and for drying, canning, and freezing. The only serious hazard to crop production is excessive rainfall and long periods of cloudy weather during the summer and early fall. The monsoon rainfall is relatively consistent, moist winds, supplemented by the condensation effected by cool high mountain air. But irrigation is required to ensure

against periods of drought, and to take advantage of the bright, sunny, more storm-free weather that occurs during the winter months.

Hail storms may occur during the spring months. Growers of tomatoes and other crops highly susceptible to hail damage plant to avoid fruiting during this period.

Class IĊc - The high mountain areas of South Viet-Nam - elevation over 5000 feet.

The summer season is similar to the Dalat area, described above, but the mountain winters are very cool with average temperatures between 50° and 60°F, these low temperatures limiting crop production to the more cold tolerant hardy crops, such as Irish potatoes, small grains, onions, spinach, radishes, lettuce and cabbage. However, the mountain valleys are very narrow, and there is little opportunity for the development of commercial agriculture on the steep mountainsides, certainly not at this time. When the war is over, it may be profitable to use this area for the production of specialty crops, strawberries, and rhubarb, for example.

III - The Climate of South Viet-Nam in Relation to Other Factors Influencing Crop Production

Commercial agriculture is becoming the primary source of the World's food supplies. This means that greater attention must be given to the key environmental factors influencing crop production. The growing population of this World can be fed, and fed properly, if farmers grow the

right crops, in the right places, and then provide all the inputs, protection, and management required to stabilize both the yields and the quality at a high level.

Viet-Nam with its growing urban population is a prime example of the need for thoughtful development of commercial agriculture.

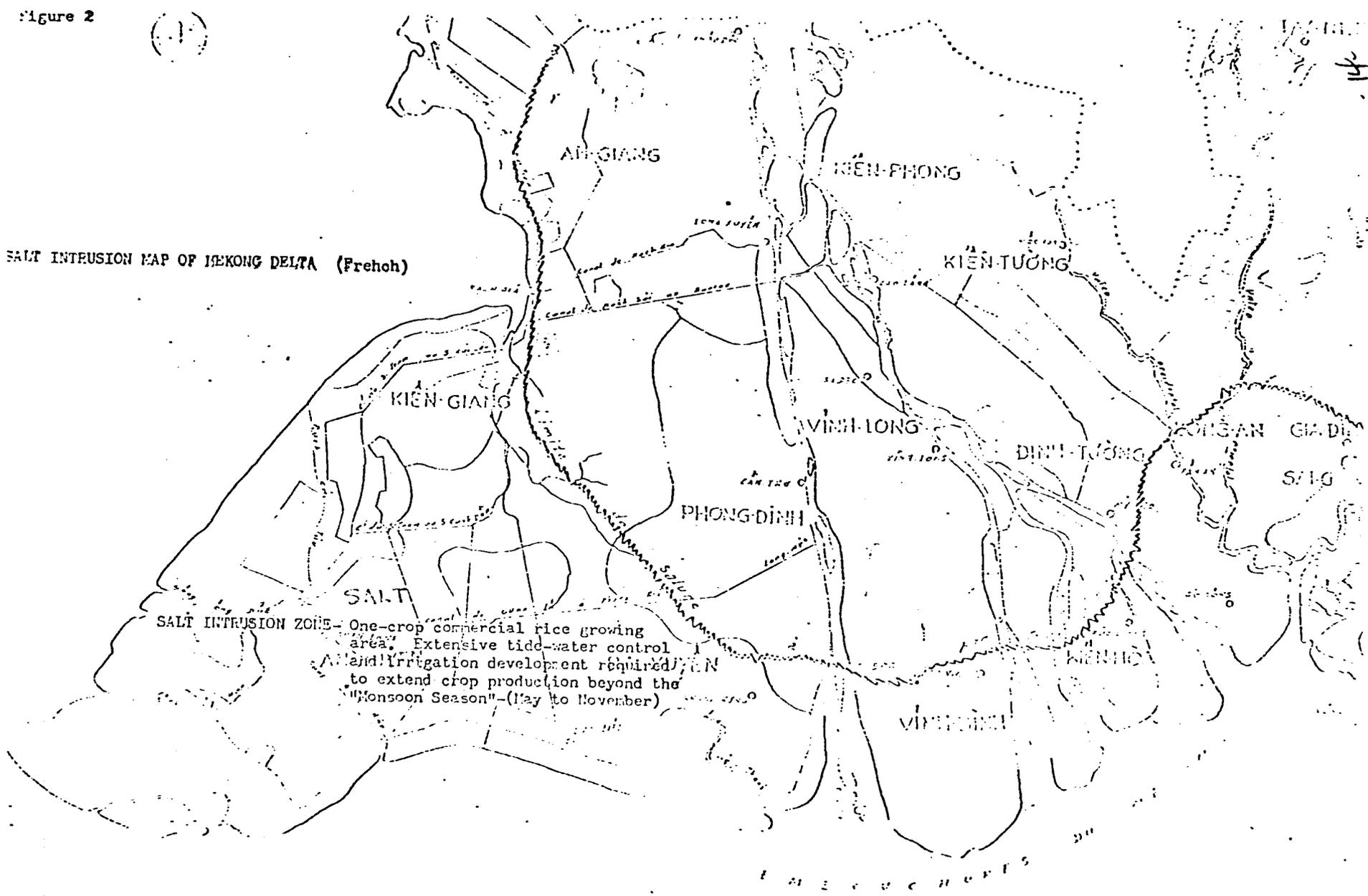
Note: Over $2\frac{1}{2}$ million South Vietnamese people have left subsistence farms since 1963. This creates a market demand for 1000 tons of rice per day, plus the fish, pork, fruit, and other food supplies they formerly gathered on or near their farms.

This paper has presented a brief introduction to the climatic factors that should be considered in the development of commercial agriculture in South Viet-Nam. In selecting suitable crops or livestock for a given area, a number of other factors must be considered, including soils, availability and cost of developing irrigation water, drainage, pests, diseases, market demand, price, storage, drying facilities, transportation, credit, community organization, and many human factors relating to farm people, their abilities and their aspirations.

Land-use planning will involve all of these factors. A generally favorable climate for crops, with a year-round growing season, makes the whole effort to establish commercial agriculture in South Viet-Nam a very worthwhile project.

(1)

SALT INTRUSION MAP OF MEKONG DELTA (Frehoh)



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THE RELATIVE INFLUENCE OF RAINFALL AND IRRIGATION ON THE LENGTH OF THE GROWING SEASON FOR RICE IN SOUTH VIETNAM *

STATION	LOCATION	ELEVATION (feet)	ANNUAL RAINFALL (inches)	MAXIMUM RAINFALL (24 hours)	NORMAL MONSOON RAINFALL PERIOD	(Months)	MOISTURE REQUIREMENT FOR COMMERCIAL RICE PRODUCTION		
							Rainfall adequate (Reliability 80% +) (Months)	Supplemental irrigation needed (Months)	Irrigation Required (Months)
Quang Tri	16.44N 107.11E	19.7	99.4	13.9	August 15 to Jan 15	5	2	3	7
Hue	16.24N 107.41E	49.2	118.8	16.8	August 15 to Jan 15	5	3	2	7
Da Nang	16.02N 108.11E	19.00	81.6	13.1	August 20 to Jan 15	5	3	2	7
Quang Ngai	15.18N 108.17E	26.0	86.5	19.3	August 20 to Jan 15	5	2	2	8
Qui Nhon	13.46N 109.13E	16.4	67.1	15.1	Sept. 1 to Dec 20	4	2	2	8
Tuy Hoa	13.05N 109.17E	52.5	61.6	12.0	Sept. 1 to Dec 15	4	1	2	9
Nha Trang	12.15N 109.12E	16.4	58.3	11.4	Sept. 10 to Dec 15	4	0	4	8
Phan Thiet	10.56N 108.08E	32.5	46.7	7.0	May 15 to Nov 15	6	0	6	6
Saigon	10.49N 106.40E	29.0	76.2	7.1	May 10 to Nov 10	6	5	2	5
Rach Gia	10.00N 105.05E	5.0	79.7	5.7	May 10 to Nov 15	6	5	2	5
An Xuyen	9.10N 105.10E	6.6	91.9	6.3	Apr 20 to Nov 20	7	5	2	5
Phu Quoc	10.13N 103.58E	6.6	123.3	7.4	Apr 10 to Nov 20	7	6	2	4
Pha My	13.59N 108.00E	2624.0	99.0	6.3	Apr 20 to Oct 20	6	4	2	6
Phu Thout	12.41N 108.05E	1758.0	71.5	7.0	Apr 20 to Oct 20	6	5	2	5
Dalat (Airport-Lien Khong)	11.45N 108.23E	3152.0	62.4	7.3	Apr 15 to Nov 1	6.5	6	1	5

* From the actual list of temperature, all S. Vietnamese stations listed have a year-long growing season for rice. The actual growing season is determined by the periodic occurrence of adequate rainfall, or by the availability of sufficient water for irrigation. In the Mekong delta and on the coastal plains, rainfall is frequently supplemented by flood waters.

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