

# Crops in Kashmir and Ladakh, India

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## Summary

Crop distribution was investigated in the Kashmir and Ladakh regions of the State of Jammu and Kashmir, India.

Fruit and vegetable production was highly developed in Srinagar (capital of Kashmir) within a climate of relatively cool summers and moderate precipitation year-round. There were many kinds of vegetables, including predominantly *Cucurbitaceae* and *Leguminosae* and secondarily *Cruciferae*, *Solanaceae*, *Umbelliferae* and *Liliaceae*. The main staple food crops in Kashmir were paddy (*Oryza sativa*) and maize (*Zea mays*).

Ladakh is situated on the Tibetan plateau within a dry and cold climate. These severe climatic conditions restrict the available crop species and cultivation period. Therefore, crops and cropping systems in Ladakh were simpler than those in Kashmir. The main staple food crops in Ladakh were barley (*Hordeum vulgare*) and potato (*Solanum tuberosum*).

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## Introduction

Crops are one of the most fundamental factors supporting people's lives. Because the kinds of crops and their methods of cultivation are closely related to the geographic and climatic conditions of each area, the kind of cultivated plants and their cropping systems are useful indices of the environment, agriculture and culture of people living there.

From October 1-7, 1987, the authors had an occasion to observe the cultivated crops and agriculture in Kashmir and Ladakh, India. Because each day entailed long-distance, round-trip travel by car, most of the observations were made from within the car itself with only a few observations being made in the fields.

In this paper, we will describe the vegetable cultivation in Srinagar (capital of Kashmir) and the crops which were found in the fields along the road from Srinagar to

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Leh (capital of Ladakh).

## Geography and climate

Kashmir and Ladakh are regions within the State of Jammu and Kashmir. Jammu and Kashmir is the northernmost state of India, bordered to the north and east by China, to the west by Pakistan and to the south by Indian states of Punjab and Himachal Pradesh (Fig.1).

Jammu is the southern part of the state and is the transitional zone from the Indian plains to the mountainous range of Himalayas. Kashmir is the northern part of the state, but usually Kashmir refers to the Vale of Kashmir, a large valley in the north-west bounded by Pir Panjal Range and Himalaya Range, wherein Srinagar lies.

The eastern part of the state is Ladakh and Zaskar. The Himalayas separate the Vale of Kashmir from Zaskar Valley and Zaskar is separated from Ladakh by Zaskar Range.

Ladakh is situated on the Tibetan plateau about 3000 to 4000m above sea level. Leh and most of the villages in Ladakh stand along Indus River Valley, which runs from north-west to south-east between Zaskar Range and Ladakh Range.

The Himalayas contain great variations in geography and climate as well as inhabiting a multiplicity of races, cultures and religions (Table 1).

The high mountains of the Himalayas act as a barrier to clouds carrying the rain from the south. Consequently, there is less than 100mm of precipitation per year in Ladakh with most areas exhibiting arid, barren landscape excepting the sites near the

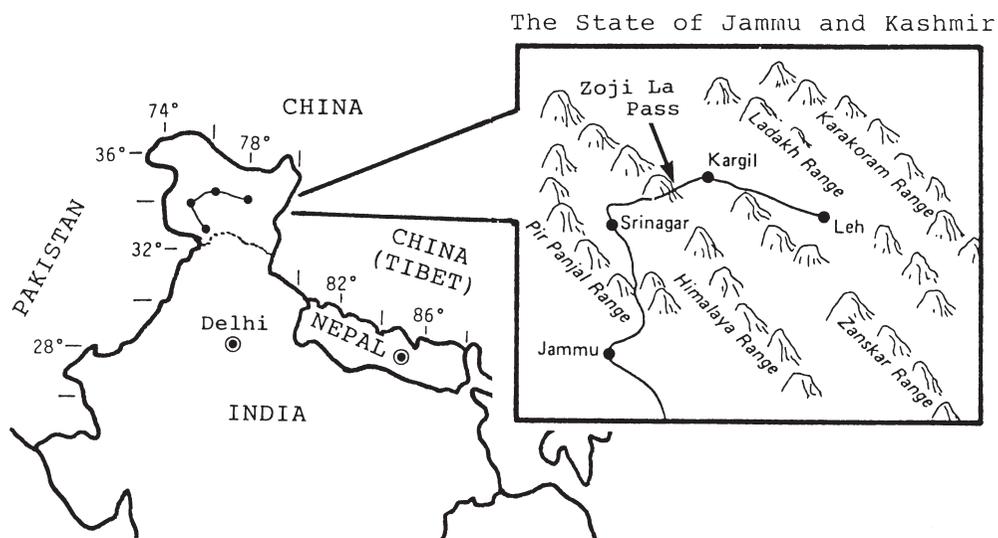


Fig.1 Geographical map of the State of Jammu and Kashmir.

Table 1. Monthly mean temperature and precipitation in Srinagar, Leh and New Delhi, India.

Month	Srinagar*			Leh**			New Delhi***		
	Temp. (°C)		Precip. (mm)	Temp. (°C)		Precip. (mm)	Temp. (°C)		Precip. (mm)
	Max.	Min.		Max.	Min.		Max.	Min.	
Jan.	5.0	-2.2	73.3	-1.1	-13.3	10.2	21.1	6.7	22.9
Feb.	7.2	-1.1	71.1	0.6	-12.2	7.6	23.9	9.4	17.7
Mar.	13.9	3.3	91.4	7.2	-6.1	7.6	30.6	14.4	12.7
Apr.	18.9	7.2	93.9	13.3	-1.1	5.0	36.1	20.0	7.7
May	24.4	11.1	60.9	16.1	0.6	5.0	40.6	26.1	12.7
June	29.4	14.4	35.6	20.0	6.7	5.0	38.9	28.3	73.7
July	31.1	18.3	58.4	25.0	10.0	12.9	35.6	27.2	180.3
Aug.	30.6	17.8	60.9	23.9	10.0	15.2	33.9	26.1	172.7
Sept.	27.8	12.2	38.1	21.1	5.6	7.6	33.9	23.9	116.8
Oct.	22.2	5.0	30.5	15.0	-0.6	2.5	33.9	18.3	10.2
Nov.	15.6	-0.6	10.2	8.3	-6.7	2.5	28.9	11.1	2.5
Dec.	10.7	-2.2	33.0	2.2	-10.6	5.0	22.8	7.8	10.2
Annual			657.7			83.8			640.2

\*1866-1943 \*\*1899-1942 \*\*\*1881-1942

(SCHETTLER and SCHETTLER 1985)

riverside. Furthermore, the high altitude of the Tibetan plateau contributes to making Ladakh cool in summer and severely cold in winter. The minimum temperatures reach below freezing for six months, including temperatures of less than  $-10^{\circ}\text{C}$  from December to February. In summer, the daytime temperatures reach around 20 to  $25^{\circ}\text{C}$  in Leh.

On the other hand, the Kashmir Valley is warmer than Ladakh and there is constant precipitation year-round, about 700mm per year. In Srinagar, temperatures during the day are above  $30^{\circ}\text{C}$  in summer and the minimum temperatures are just below freezing from November to February. In striking contrast to the barren landscape in Ladakh, these climatic conditions create an abundance of green vegetation in Kashmir.

### Vegetable cultivation in Srinagar

Within a climate of relatively cool summers and moderate precipitation year-round (Table 1), Kashmir is famous for the production of such fruits as apples (*Malus pumila*), walnuts (*Jugrans regia*) and apricots (*Prunus armeniaca*). These natural conditions also prove advantageous for vegetable production. Because Srinagar is the largest city in Kashmir and is a famous resort-city attracting many visitors, there is a large consumption of vegetables. Therefore, vegetable production for market is highly developed in and around Srinagar.

Vegetables and cultivation practices in Srinagar are shown in Table 2. Many kinds

Table 2. Vegetable cultivation in Kashmir.

Common name	Planting time	Days to harvesting	Distance between		
			Plants	Rows (inch)	
Asparagus(root)	1st Oct.-mid Dec. & Mar.-mid Apr.	1-2 years	12-15	26-30	
(seed)	do.	3-4 years	do.	do.	
Dwarf bean	Apr.-last June	50-55	6-9	8-24	*
Broad bean	mid Oct.-mid Nov.	90-100	12-	24-	*
Soy bean	mid Apr.-last May	96-	9-12	30-36	
Climbing bean	1st Apr.-mid May	60-70	24-30	48-60	
Asparagus bean	do.	do.	do.	do.	
Garden beet	last Mar.-July & Sept.	53-65	6-9	15-18	
Brinjal(Eggplant)	do.	50-60	12-	do.	
Bitter gourd	1st Mar.-mid May	70-80	18-	24-	
Bottle gourd	last Mar.-1st May	75-90	48-60	60-72	
Brussels sprout	mid Mar.-last June	110-120	18-24	24-30	
Cabbage(early)	mid Mar.-June & Aug.	55	15-18	18-	
(late)	March-last June	90-120	24-30	30-36	
Chinese cabbage	Mar.-June & Aug.	70-75	15-	21-	
Chili	mid Mar.-mid May	65-80	15-18	24-	
Carrot	Mar.-mid Apr.	60-75	3-4	12-	*
	& last July-last Aug.				
Celery	mid Sept.-1st Nov. & last Feb.-last Mar.	115-125	9-12	30-36	
Coriander	April-Sept.	40-	8-10	12-15	*
Sweet corn	mid Apr.-last May	85-90	20-	36-48	*
Cucumber	mid Apr.-mid June	70-	12-15	60-72	*
Khol rabi	mid Mar.-1st Aug.	60-65	9-	15-18	
Leek	mid Mar.-last Apr.	120-	8-12	18-	
Lettuce	last Feb.-last Apr. & Aug.-mid Sept.	80-85	12	12-15	
Mask melon	1st Apr.-1st May	80-90	48-	60-	*
Mustard	March-Sept.	40	9-	12	*
Methi	mid Mar.-mid Apr.	60-	6-	12	*
Okra	last Apr.-last June	60-65	18	30-36	*
Water melon	mid Apr.-1st May	85-90	48-	72-84	*
Onion	September	100-115	6-9	12-15	
Parsley	Oct.-Nov. & Mar.-mid May	75	9-12	do.	
Parsnip	March-April & 1st July-mid Aug.	105-110	12-	15-18	*
Pea	mid Feb.-mid Apr. & Oct.-Nov.	65-80	4-	24-36	*
Pumpkin(small)	last Mar.-last Apr.	65-80	60-	65-108	*
(big)	do.			108-144	*
Radish(table use)	mid Feb.-mid Oct.	20-30	3-4	12-	*
(winter use)	mid Feb.-March & Sept.-Oct.	65-	6-8	12-15	*
Spinach	mid Aug.-mid Oct. & last Feb.-mid Apr.	60	9-	10-12	*
Round gourd	March-June	55	48-	50-60	*
Tomato	do.	70-90	15-18	24-36	
Sponge gourd	May-June	60-	9-	50-60	*
Turnip	Mar.-Apr. & Sept.-Oct.	45-60	6-	12-15	*

\*Direct sowing

of vegetables, including root, leaf and fruit vegetables, as well as spice and herbs, are cultivated utilizing developed horticultural techniques. Most of these are native to India but some were introduced from Europe by English colonizers.

Improved seeds were partly used for their better tolerance of heat and cold and for their ability to mature quickly, making it possible to expand the cropping season.

From the taxonomical point of view, *Cucurbitaceae* and *Leguminosae* were predominant, and *Cruciferae*, *Solanaceae* and *Umbelliferae* were secondary, followed by *Liliaceae*.

Generally speaking, vegetables such as *Cucurbitaceae* which are weak against the cold and require warm temperatures for growth, are seeded after April or May, while the vegetables of *Cruciferae* and *Liliaceae* which are strong against the frost and thrive in cool temperatures are seeded in early March and in September. For early March transplanting, a portion of cabbage (*Brassica oleracea*) is either seeded in mid-October or mid-November and stored in well protected frames during the winter, or is seeded on warm beds in early February.

### Crop distribution from Srinagar to Leh

Here we will describe the crops found in the fields along the route from Srinagar to Leh. A vertical section of the route and the crop distribution are presented in Fig.2.

Zoji La, a pass in Himalayas, forms the boundary between Kashmir and Ladakh. The altitude ascends from Srinagar (altitude of 1700m) to Zoji La (altitude of 3500m).

Paddy (*Oryza sativa*) was predominant in Srinagar and had just been harvested or was at the ripening stage. Paddy decreased however as the altitude became higher and was observed up to 2000m in Gund.

On the other hand, maize (*Zea mays*) increased as the altitude became higher. Consequently maize predominated over paddy in Gund. Maize was found up to 2600m in Sonamarg.

Barley (*Hordeum vulgare*), common bean (*Phaseolus vulgaris*) and potato (*Solanum tuberosum*) were observed between Sonamarg and Zoji La.

These observations are summarized as follows. This relationship between the altitude and the predominant crops is thought to generally persist within the Vale of Kashmir.

Altitude	Predominance of crops
1700-1800m	Paddy > Maize
1800-2000m	Maize > Paddy
2000-2600m	Maize > Barley = Potato
2600 <	Barley = Potato

As mentioned above, most parts of the Ladakh region are higher than 3000m in

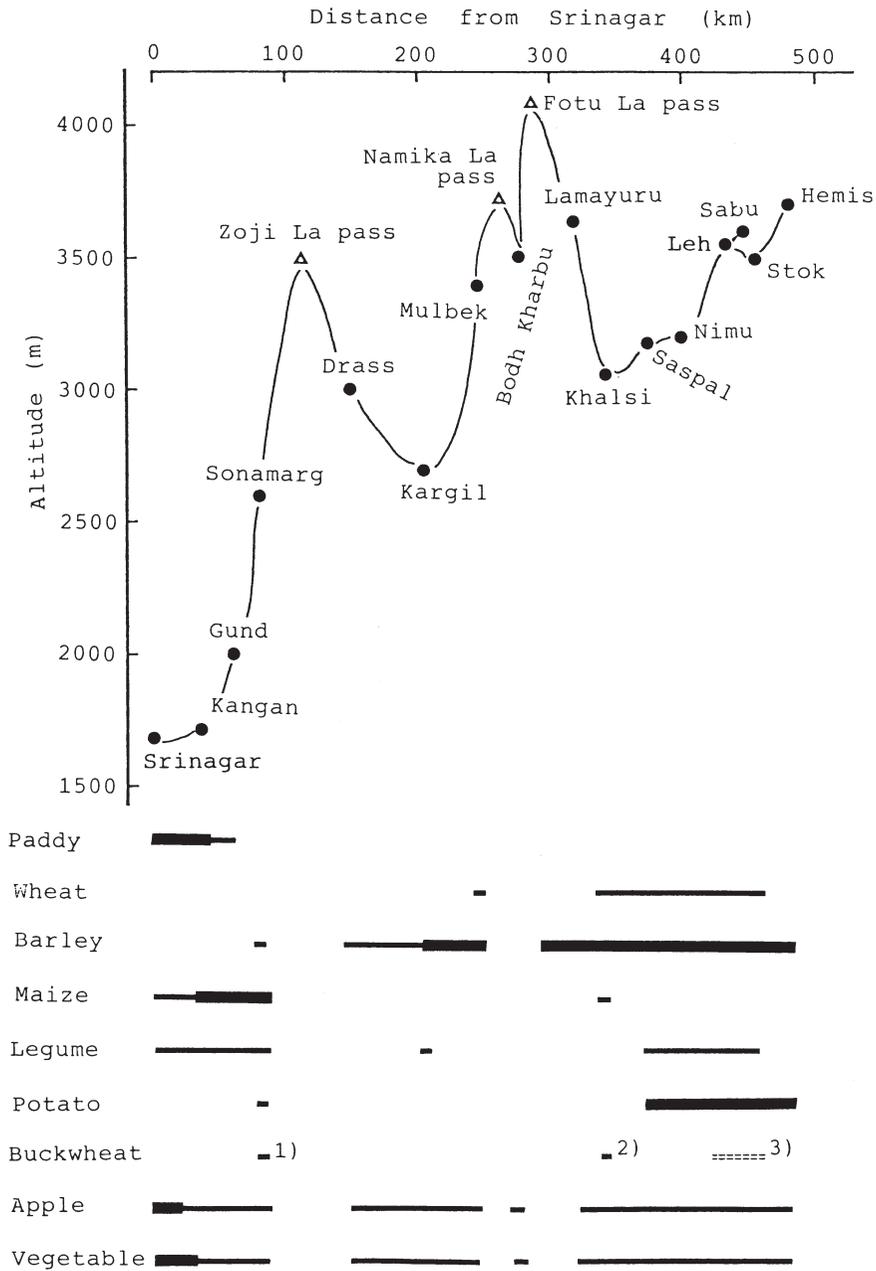


Fig.2 Sketch map of vertical section of the route from Srinagar to Leh and the crop distribution.

Thickness of bars represent the degree of predominance of each crop.

- 1) Tartary buckwheat cultivated.
- 2) Common buckwheat cultivated.
- 3) Tartary buckwheat as weed in potato fields.

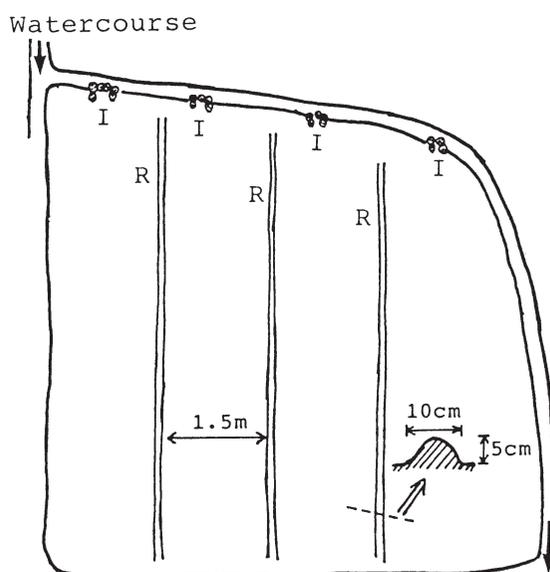


Fig. 3 An example of irrigation in barley field at Chanspa, Leh (3630m).

I; Inlet of water R; Ridge ; Stone

altitude and contain arid land. Clear-cut changes in geoclimatic conditions caused differences not only in the natural vegetation but also in agriculture.

From Zoji La to Fotu La (4000m), only barley, wheat (*Triticum aestivum*) and common bean were observed as staple food crops. Barley, wheat and potato were also found from Fotu La to Leh. Barley was cultivated at an altitude of 3880m between Fotu La and Lamayuru.

Common buckwheat (*Fagopyrum esculentum*; Bulo or Do in Ladakhi name) was collected from a farmer in Khalsi (3000m). This seed collection was contaminated with tartary buckwheat (*Fagopyrum tataricum*). In Khalsi, barley or wheat was seeded in January or February and harvested in late July. After that, common buckwheat was seeded in early August and harvested in early October.

In Leh and neighboring villages (3500–3700m), barley and potato were the predominant crops, followed by wheat. There were two kinds of wheat i.e. Tou (black grain) and Toukalmo (white grain). Farmers distinguished between them but didn't separate strictly at harvest. Threshing of a mixed planting of lentils (*Lens culinaris*), broad beans (*Vicia faba*) and field peas (*Pisum arvense*) was observed.

One of the most interesting observations in Leh was that tartary buckwheat (Tyat) was found as weed in potato fields and farmers didn't partake of it as food. Tartary buckwheat is a staple crop as important as barley and potato in Muktinath, central Nepal (3700m), where race, culture and nature are similar to those in Ladakh.

As for cultivation practices, ridging for the efficient use of water was noticed in every field in Ladakh, but not in fields in Kashmir (Fig.3).

Because severe climatic conditions restrict the available crop species and cultivation period, crops and cropping systems in Ladakh were simpler than those in Kashmir.

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## Kashmir と Ladakh における作物の栽培と分布

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インド共和国最北部の Kashmir と Ladakh 地域における作物の栽培と分布を調査した。

Kashmir の首都 Srinagar とその周辺地域は夏季の比較的冷涼な気候と年間を通して適当な降水量に恵まれることから、リンゴ、クルミ、アンズなどの果樹栽培と蔬菜栽培が盛んであった。穀類では水稲とトウモロコシがほとんどであった。

蔬菜の種類は多様で、その大部分はインドに在来のものであるが、一部は植民地時代にイギリス人によりヨーロッパから導入されたものが含まれていた。分類学的にはウリ科、マメ科が最も多く、次いでアブラナ科、ナス科、セリ科、そしてユリ科蔬菜の順であった。

Ladakh 地域は Kashmir 地域とヒマラヤ山脈で分けられたチベット高原に位置し、乾燥のために農業は川沿いの一部に限られ、また寒冷気候のために栽培可能な期間と作物種が限定され、Kashmir のような多様な農業は見られなかった。主要作物はバレイショとオオムギであった。

Srinagar から Ladakh の首都 Leh までの街道沿いの主要作物の分布と優占度は標高1800 m以下では水稲>トウモロコシ、2000mまではトウモロコシ>水稲であり、2000m以上では水稲がみられず、トウモロコシ>オオムギ=バレイショ、2600m以上ではオオムギ=バレイショであった。

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