

Low Productivity of Fruits, Its Implications and Combating Strategies in Cold Arid Eco-region of Ladakh (J&K)

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Authors' contributions

All the authors of this manuscript were fully involved in conducting as well as framing the study. Authors MUR, BH and TA identified and designed the study, collected the necessary data and wrote the first draft of the manuscript. Authors MMM and EP managed the analyses and edited the study while author MZ performed the statistical analysis. All authors read and approved the final manuscript.

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ABSTRACT

The present study was undertaken with a vision to study the status of commercially important fruit; Apricot and Apple in Ladakh region of J&K state, India. The study is based on the secondary data. The main source of data collection includes; Economic survey, statistical digest, government official records, books, magazines, articles and journals. The data has been analyzed, arranged and interpreted through tabulation and simple percentage method. It was observed that with the increasing demand for these fruits, the area under cultivation in the region has increased, with the Compound Annual Growth Rate (CAGR) of 1.49% and 5.1% for apricot and apple respectively during the decade (2008 – 2017). But the production remained almost static in case of apple, whereas, it decreased with a compounded rate of 2.77% in apricot. The productivity, which determines the economic feasibility of the crop as profitable enterprise, declined in both crops with

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a CAGR of -4.91% in apricot and -2.9% in apple, this may be attributed mostly to insect pest infestations, especially Codling moth in apple, and aphid and Brown tail moth in apricot. Low density planting systems with traditional varieties, and poor management of orchards has added to the woes. Thus from the study, it can be interpreted that the enterprise need to be restored by switching to the new innovative technologies adapted worldwide like High density planting. This in addition to the high yields may also prove beneficial in losses due to pest damage by reducing the overwintering sites (bark crevices).

Keywords: *Apple; apricot; Ladakh; cold arid; desert; J&K; climate change.*

1. INTRODUCTION

Ladakh is a high altitude cold arid region at about 3000 - 7500 masl and spread over a large area of 83,000 km², with a population density of 5 km² [1]. Despite extreme topography, and a highly variable cold desert climate, Ladakh agriculturalists have strategically managed the environment for centuries, but the risks are changing as a result of recent and rapid climatic and socio-economic shifts. The undulating terrains make it difficult to get the land into agricultural use. The average land holding has been estimated to be 0.68 ha. This smallholder production is critical to poverty alleviation and food security goals of the region.

Moreover, there is a rapid investment in physical infrastructure demands from army bases and opening to tourism; the combination of this growth in urban functions and a consumer cash economy has increased the stress on limited environmental resources and severely disrupted its traditional agricultural system [2]. Population growth is driving increasing demand for food, it is also threatening the farmland that can support increased food production.

Historically, subsistence agriculture has been a major component of both society and the economy in Ladakh. Apricot followed by Apple being the main fruit crops grown, develop a unique taste and colour due to high intensity sunlight the area receives, and the place is well-known for its quality fruits. There are several cultivars of apple like Karkichoo, BongKushu, Mar Kushu, ThaKushu, KharaKushu, MungolKushu, PhamerKushu, Sanker, Kushu, ShingKushu, SquirmoKushu and YangmaKushu cultivated in Ladakh, and are supposed to be indigenous to the region [3]. Few exotic varieties like Red Delicious and Golden Delicious can also be found growing in the region.

Geographically wide spread apricots have not become horticulturally important except in areas

with very special ecological conditions, because the cultivars are highly specific in their ecological requirement and cannot be grown away from their place of origin with the exception of few [4]. Here in Ladakh, apricots are locally known as *Chuli* and classified into two broad categories based on kernel taste [5]. Fruits with bitter kernel are called *Khante* meaning bitter, while those with sweet kernel are called *Ngarmo* meaning sweet [6]. The *Ngarmo* is further divided into two sub-groups based on seed coat colour. Fruit with brown seed coat are called *Nyarmo*, while those with white seed coat are called *Raktsey-karpo*, which is a unique genotype of Ladakh.

Apricot and apple cultivation is of particular relevance to the horticultural/agricultural economy in Ladakh, as it gives income opportunities in hilly and mountainous areas in which other agricultural activities are difficult due to the adverse environmental and topographical conditions. The region is confronted today with the task of finding strategies to elevate the fruit production and techniques to enhance the produce quality, so as not to be swept up in the changing market. So it becomes imperative to think of, and introduce new sustainable and rewarding technologies for the area, which can ensure enhanced productivity and diversity within crops for export and domestic purpose.

The present study was conducted to find out the reasons behind the dismaying scenario of apricot and apple production in the region, with the objectives: 1) To study the trends in area, production and productivity of apple in Ladakh. 2) To analyze the compound annual growth rate (CAGR) of area, production and productivity of Ladakh.

1.1 Study Area: Ladakh (J&K)

The state of Jammu and Kashmir is situated in the north of the India. Geographically, the state is divided into three regions, viz. Jammu, Kashmir and Ladakh and the administrative capital of the

state is Srinagar (Kashmir) in summer and Jammu (Jammu) in winter. Ladakh constitutes India's highest plateau at over 3,000 m. It spans the Himalayan and Karakoram mountain ranges and the upper Indus river valley. Ladakh, a high altitude desert as the Himalayas create a rain shadow, denies entry to monsoon clouds. The winter snowfall on the mountains constitutes the main source of water. Ladakh region consists of two districts; Leh and Kargil. Ladakh is located between 32°15' to 36°N latitude and 75°15' to 80°15' E longitude. The region experiences a maximum temperature of upto 38°C in the summers and a minimum of -30°C in the winter.

2. RESEARCH METHODOLOGY

The present study is based on the secondary data. The main source of data collection includes; Economic survey, statistical digest, government official records, books, magazines, articles and journals. The data has been analyzed, arranged and interpreted through tabulation and simple percentage method.

3. RESULTS

The present study has worked within the setup of its prime objectives, and has found that:

The area distribution under fruit crops for the year 2016-17 (Fig. 1) clearly shows that Apricot and Apple are the major crops of commercial importance in Ladakh region, with a negligible share for other fruit crops.

Sixty three percent of the fruit grown area is under apricot, while as 36% is under apple.

The area under apple in Ladakh region during the period, 2007-08 to 2016-17, has extended steadily from 805 ha. to 1324 ha., with a compound annual growth rate (CAGR) of 5.1% (Fig. 2). The growth rate is much higher when compared to the national rate, which was calculated to be 0.48% during the same period from the initial values of 264000 ha. to 277000 ha. (Data not shown). While as, the area under apricot has increased from 1989 ha. in 2007-08 to 2306 ha., with a compound annual growth rate of 1.49% (Fig. 3).

Apple production increased from 4607MT in the year 2007-08 to 5644MT in 2016-17. However, a dip in production from 6738MT in the year 2012-13 to 4543 MT in 2014-15 can be found, which later recovered a bit and stabilized (Fig. 4). Moreover, the compound annual growth rate of apple production during the decade was calculated to be as 2.05%. In case of apricot, the production decreased from 7547 MT in year 2007-08 to 5698 MT during 2016-17, with the CAGR of -2.77% (Fig. 5).

Though world over apple productivity has increased from 14.78MT/ha in 2007-08 up to 16.88MT/ha in 2015-16, with a compound annual growth rate of 1.49% during the period, it has not shown any remarkable increase in India. Most importantly the CAGR for apple productivity in Ladakh has decreased by 2.9% from the initial of

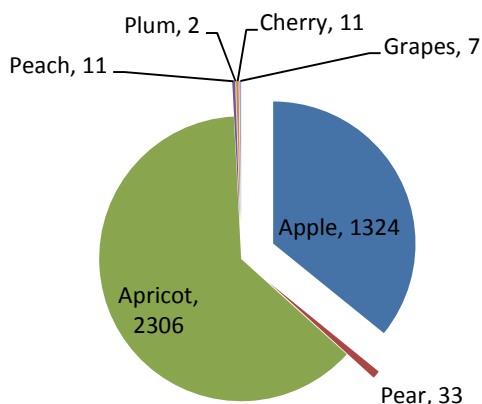


Fig. 1. Area (ha.) under various fruit crops in Ladakh region

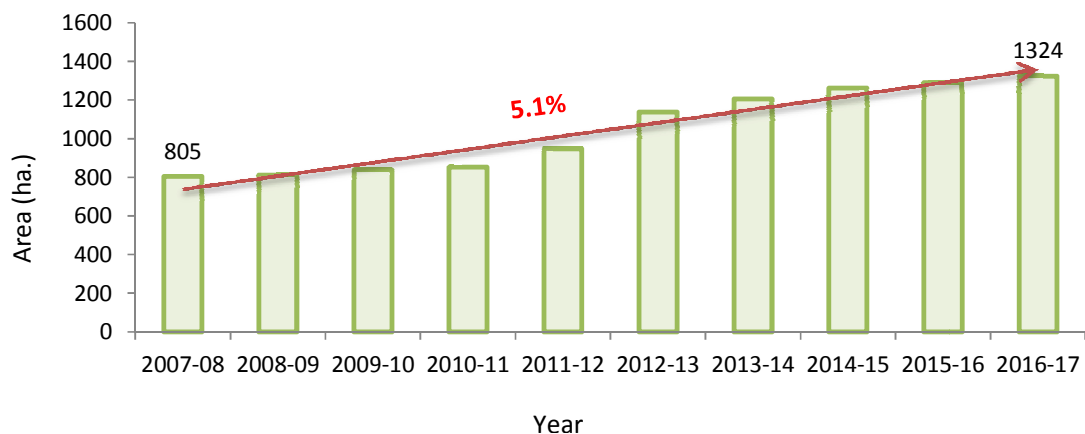


Fig. 2. Land area (ha.) under apple cultivation in Ladakh region

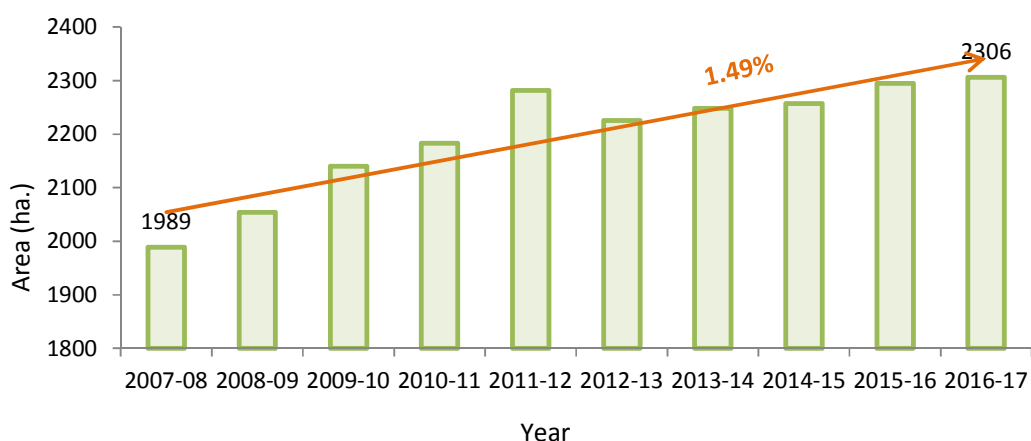


Fig. 3. Land area (ha.) under apricot cultivation in Ladakh region

5.72MT/ha to 4.26MT/ha during the decade (Fig. 6). In addition to this, for apricot, although worldwide the productivity has remained static with CAGR of 0.53%, but in India and Ladakh region particularly the productivity has dipped to -0.04% and -4.91% respectively (Fig. 7).

4. DISCUSSION

Apple and apricot production has been a very successful enterprise in Ladakh. The demand for these fresh Ladakhi fruits has increased tremendously with the inflow of tourists in the region [7]. Most of the produce is marketed locally and fetches a good price. With this increased demand and surge in economy, people are driven to get more and more land under its cultivation. Fruits grown here are

produced organically, with no fertilizers and no fungicide applications. Due to the elevation and dry environment, incidence of fungal infestation is almost nil and the fruits develop good colour, firmness and taste under high intensity daylight [8]. The area expansion under these fruit crops also reflects the increase in irrigated area of the region. The changing climate has come out to be the blessing in disguise for Ladakh, as with the melting of glaciers on the mountain tops, water availability has improved in-between the mountain passes, thus an increase in cultivable area, though can be for a limited period [9].

Although apple production has remained almost static during the decade, but it has decreased in case of apricot, and both are not paralleling with the area expansion (Figs. 3 & 4). This may be

because of low maintenance of the orchards and mismanagement of other cultural practices, as most of the farm work is performed by the female folk, with little technical knowhow [10]. Most importantly, tree canopies are poorly maintained, giving a bushy appearance with no proper training and pruning, providing a safe nesting place for some economically significant insect pests like, Codling moth, Brown Tail moth and Aphids. With the infestation of pests, about 60 – 80% fruit is rendered inedible and drops prematurely to the ground [11]. The pest (Codling moth) is supposed to be the main factor for low apple productivity in the region. The sharp decline in apple productivity during the year

2013-15, may be attributed to this notorious pest, as per the local sources. Also because of these pests, some quarantine regulations have been enforced for fresh fruit export outside the region. This perhaps has perplexed the orchardists of the region as the populace is reluctant in using pesticides to control the pests due to some religious ethics, though some new pest control measures like use of Matting disrupting pheromone dispensers have been tried successfully keeping the religious sentiments into consideration [12]. With this, traditional low yielding cultivars on seedling root stock, augment the concern and thus reduce the sustainability and profitability of its cultivation in the region.

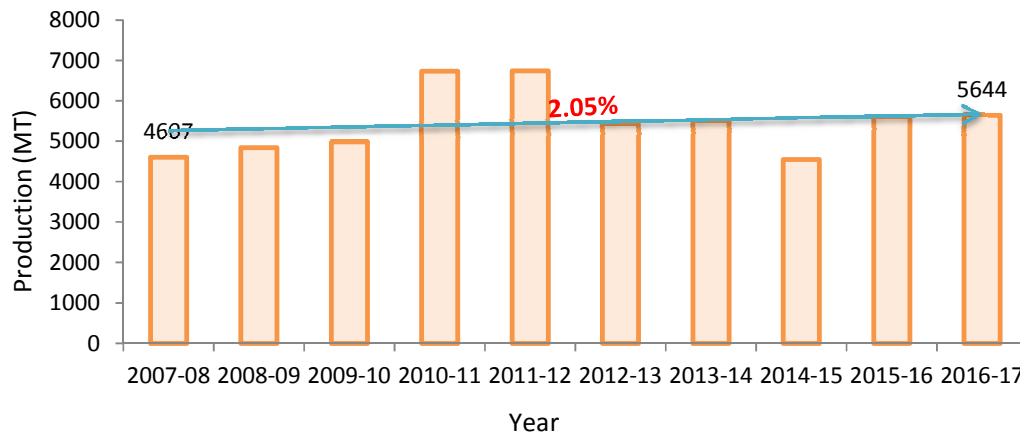


Fig. 4. Apple production (MT) scenario in Ladakh region during the last decade

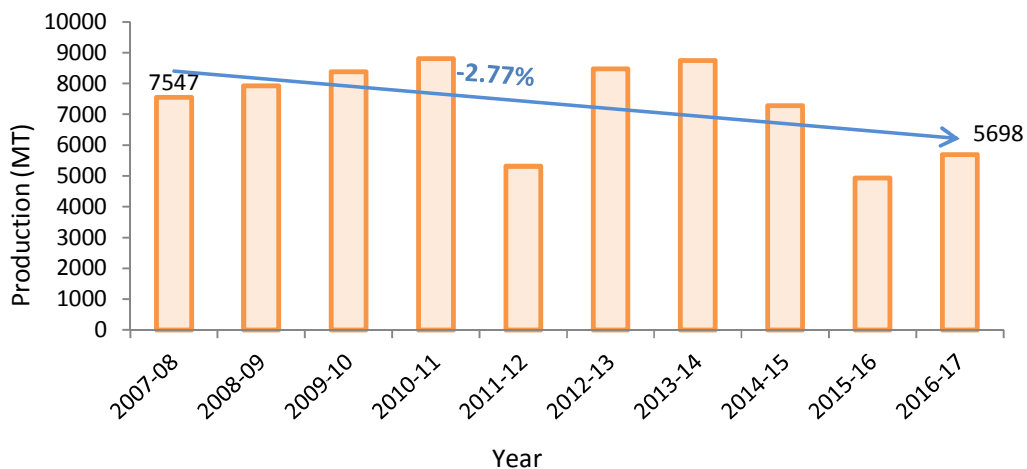


Fig. 5. Apricot production (MT) scenario in Ladakh region during the last decade

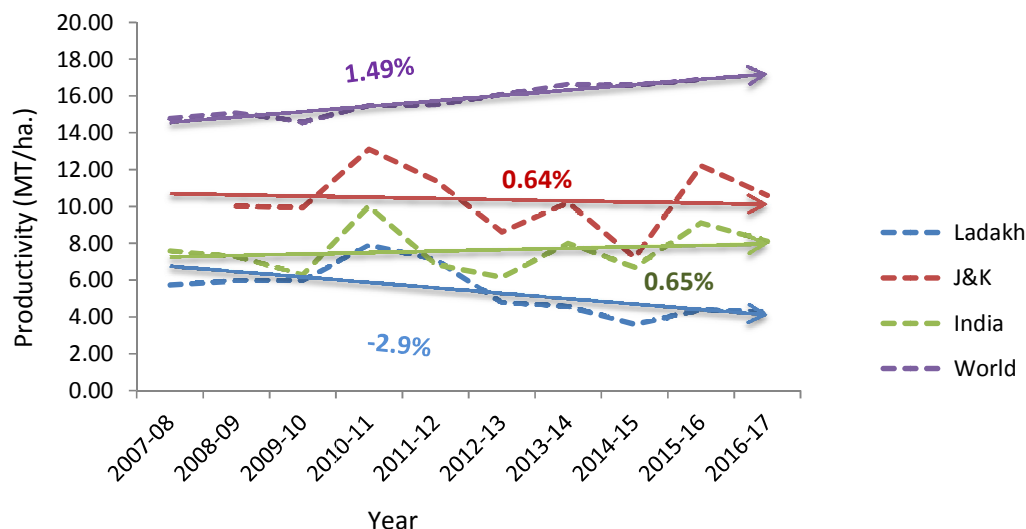


Fig. 6. Comparison of apple productivity (MT/ha)

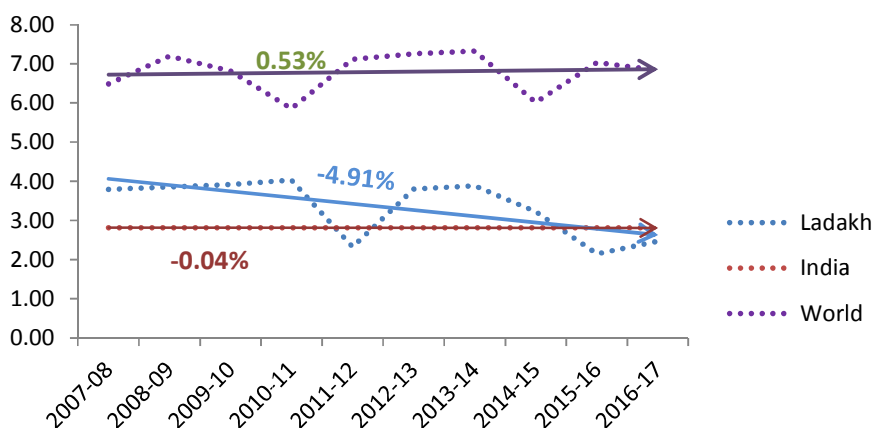


Fig. 7. Comparison of apricot productivity (MT/ha.)

5. RECOMMENDATIONS

As the ratio of land to population decreases, farmers are induced to adopt technologies that raise returns to land. Availability of land for agriculture is an important factor in high altitude region like Ladakh. The small holdings, scattered on undulating terrain make agriculture a difficult task. Though horticulture industry has been acting as catalyst by becoming generator of economy under such circumstances; In the present situation, where most of the less remained cultivable land is being consumed in infrastructure development, high density plantation remains the only choice with assured high productivity, precocity and quality fruit.

Further the canopy structure of High density plantations are easily manageable, open and harbor little pests. This may also prove to be a good move to eliminate the pests like Codling moth, which otherwise over winter under the bark of old traditional trees. Economic potential of improved varieties and high density technology has been commercially exploited by several countries in the world. In some countries like Chile and Italy, apple productivity has already reached 47MT/ha. In Ladakh region too, the productivity targets can be reached by adapting the new technologies. Here a newly established high density apple orchard on trial basis during 2018, with Gala Redlum, Fuji and Red velox on M 9 as main varieties, and Golden Delicious

Rendier as pollinizer, has been a success. This clearly lays basis for cultivation of other market oriented varieties requiring less than 160 Growing days.

6. CONCLUSION

Agriculture being the backbone of sustainable economy of any nation/region, shifting away may lead to poverty elevation and risk the food security goals, especially in the cold arid region like Ladakh, with limited land resources and which remains disconnected from rest of the country for most of the year. The study clearly reflects that horizontal expansion of the fruit industry has not worked much to benefit the farmers. The dwindling turnout from the sector may be attributed to the low yields due to age old traditional plants and inconsumable fruits rendered by pest infestation. Thus the strategies like high density plantation, which may secure the yields and indirectly help in reducing the pest infestation by reducing the overwintering sites, need to be implemented earlier.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Anon. Indicators of regional development. Directorate of Economics and Statistics, J&K. Govt. of Jammu and Kashmir. 2012;1:5.
2. Pelliciardi V. Sustainability perspectives of development in Leh district (Ladakh, Indian Trans-Himalaya): An assessment. CIRPS, University of Rome Sapienza: Ph.D Thesis; 2010.
3. Dwivedi SK, Kareem A, Cheema GS. Some fruit characteristics of apple varieties indigenous to Ladakh, India. *Acta Horticulturae*. 2005;696:53-55.
4. Bailey CH, Hough LF. Apricots. [In] Janick, J. and Moore, J.N. (Eds.). *Advances in Fruit Breeding*, Purdue University Press, West Lafayette. 1975;171-187.
5. Dwivedi DH, Ram RB. Chemical composition of bitter apricot kernels from Ladakh, India. *Acta Hortic*. 2008;765:335-338.
6. Targais K, Stobdan T, Yadav A, Singh SB. Extraction of apricot kernel oil in cold desert Ladakh, India. *Indian J. Tradit. Know*. 2011;10:304-306.
7. Gupta RD, Arora S. Ecology, soil and crop management for livelihood in Ladakh region: An overview. *Journal of Soil and Water Conservation*. 2016;15(2):178-185.
8. Sharma JP, Mir AA. *Dynamics of cold arid agriculture*. Kalyani Publishers, Ludhiana; 2000.
9. Mani R. How climate change has affected Ladakh: The region has seen unusual floods in July 2005 and August 2006. *India Water Portal*; 2009.
10. Baba SH, Wani MH, Shaheen FA, Zargar BA, Kubrevi SS. Scarcity of agricultural labour in cold-arid Ladakh: Extent, implications, backward bending and coping mechanism. *Agricultural Economics Research Review*. 2011;24:391-400.
11. Dolkar D. Codling moth of apple in cold arid regions of Ladakh. *Biotech Article Online*; 2017.
12. Hussain B, Ahmad B, Bilal S. Monitoring and mass trapping of the codling moth, *Cydia pomonella*, by the use of pheromone baited traps in Kargil, Ladakh, India. *International Journal of Fruit Science*. 2015;15(1):1-9.

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