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Dry Fruit Horticulture and Production Patterns in Highland Ecosystems: A Case of Almond and Walnut Cultivation in Jammu and Kashmir, India

Feroz A. Wani, Atiqullah Malik, Imtiyaz A. Malik
Ph.D. Research Scholars (Geography)
Centre for Central Asian Studies, University of Kashmir

Abstract
Jammu and Kashmir state is located in north-western part of India. The region shows predominantly mountainous topography with an average elevation of more than 5700 meters above sea level. With fragile climatic regime and interconnected physiographic characteristics, the region forms a typical case of the highland ecosystem. This highland nature of the state forms the suitable characteristics for the cultivation of different agricultural products especially saffron, dry fruits, apple and basmati rice. Over the years, both dry and fresh fruits have emerged as the important contributors to the state economy and the government has come up with various schemes and programmes for the development and growth of the fruit industry. Jammu and Kashmir besides attaining prominence in fresh fruit cultivation have also emerged as a favourite destination for the cultivation of dry fruits especially almonds and walnuts. These crops occupy a significant place and are an important contributor to the state economy as the bulk of their production is exported not only to different parts of India but the world over. The present study is an attempt to study the growth patterns in the dry fruit industry of the state especially almond and walnut.

Keywords: Horticulture, Production, Temperate climate, Dry Fruits, Floods, Precipitation.

Introduction

Located between 32˚17' to 37˚5' North latitudes and 73˚26' to 80˚30' East longitudes, the Himalayan state of Jammu and Kashmir covers a geographical area of 222236 kms^2 and consists of the three distinct regions viz. Jammu, Kashmir and Ladakh (*Hussain, 2000*). The economy of the state is agrarian in nature as about 70 percent of the population is directly or indirectly associated with the agriculture sector (*Economic Survey-2017, J&K Govt.*). Horticulture sector of the state has tremendous potential and the land under this sector has been continuously increasing. The important horticultural crops grown in the state are apple, almond, walnuts, apricots, peach, pear, grapes etc. (*Rather et al, 2013*). Among the three regions of the state, Kashmir valley is most productive in terms of the fruit cultivation both dry and fresh mainly because of its fertile soils as well as the highland ecosystem of the state is ideal for the cultivation of temperate fruits. Due to favourable agro-climatic conditions, fruit culture has emerged as an important sector of the state economy (*Hussain, 1996; Ahmad et al, 2017*). Majority of production of the almonds and walnut comes from Kashmir valley because the Arid Ladakh and Sub-tropical Jammu regions of the state are not suitable for the temperate fruit cultivation. Dry fruits of Kashmir valley especially almond and walnut are world famous

and are exported the world over (*Lone et al, 2014; Rather et al, 2013*). Total production of the dry fruits in Jammu and Kashmir during 2016-17 was 275629 MT and they occupy about 96908 hectares of land area (*Directorate of Horticulture, J&K Govt*.). Almonds and walnuts occupy about 99 percent of the area under dry fruits and provide about 98 percent of the dry fruit and 12.19 percent of the total fruit production in the state. However, Climatic variability and untimely precipitation during the last few years has affected the horticulture sector. Besides this, the lack of capital has hindered the use of modern technology and machinery in horticulture sector, as majority of the cultivators are economically not well off, which has further effected the productivity of the fruit crops.

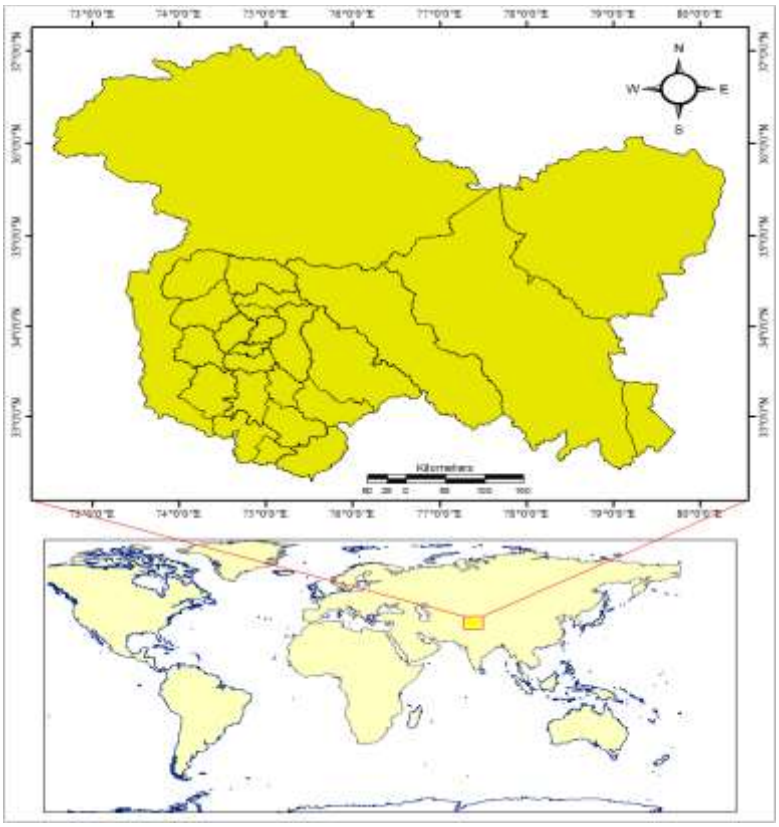

Figure 1: Location map of the Study Area

Database and Methodology

The study has been carried out by using secondary data of both the selected dry fruit crops. Secondary data on area and production of dry fruit for a period of 16 years from 2001-02 to 2016-17 were obtained from the government publications, including Directorate of Horticulture (Govt. of J&K), Digest of Statistics (published by the Directorate of Economics and Statistics, J&K Govt.), Economic Surveys (published by Govt. of J&K), and other relevant official records. The data has been analysed, tabulated and then interpreted, and suitable statistical tools were used. The results were drawn through cartographic tools and highlighted on maps using remote sensing techniques like Arc GIS 10.2.

Results

The present study analyzes the growth pattern in production and area in almond and walnut cultivation in the state for a period of more than one and a half decade (2001-2016). The almond production of the state during 2001-02 was 7897 MT and the fruit was grown on an area of 17247 hectares of land area. While walnut production during the same period was about 86263 MT and occupying a land area of about 61782 hectares. The production of almond and walnut has shown an opposite trend during 2007-08, 2011-12 and 2015-16. The production of almond has shown a negative growth of -25.83 percent, -70.10 percent, and -29.77 percent during 2007-08, 2011-12 and 2015-16, while the production of walnuts during the same period has shown the highest growth of 27.72 percent, 37.16 percent and 40.19 percent respectively. Almond crop has recorded the highest growth of 119.35 percent in 2012-13 and the lowest growth of -70.10 percent in 2011-12. While the production of walnut recorder highest growth of 40.19 percent in 2015-16 and the lowest growth of about -14.80 percent in 2014-15. The variations in production of both fruits have been attributed to the differential variations in temperature and precipitation.

Table 1: Almond: Production and Area under cultivation in Jammu and Kashmir

Year	Area (Ha.)	Yearly Growth Rate (%)	Production (MT)	Yearly Growth Rate (%)
2001-02	17247	---	9879	---
2002-03	16526	-4.18	10621	7.51
2003-04	15379	-6.94	13263	24.88
2004-05	15433	0.35	13473	1.58
2005-06	15549	0.75	14331	6.37
2006-07	16374	5.31	15183	5.95
2007-08	16405	0.19	11261	-25.83
2008-09	17161	4.61	12043	6.94
2009-10	17581	2.45	12515	3.92
2010-11	17587	0.03	12511	-0.03
2011-12	18404	4.65	3741	-70.10
2012-13	15931	-13.44	8206	119.35
2013-14	15982	0.32	11815	43.98
2014-15	15350	-3.95	10052	-14.92
2015-16	7132	-53.54	7060	-29.77
2016-17	7107	-0.35	6360	-9.92

Source: Directorate of Horticulture Kashmir/Jammu

Table 2: Walnut: Production and Area under cultivation in Jammu and Kashmir

Year	Area (Ha.)	Yearly Growth Rate (%)	Production (MT)	Yearly Growth Rate (%)
2001-02	61782	---	86263	---
2002-03	66340	7.38	90032	4.37
2003-04	69182	4.28	94579	5.05
2004-05	74894	8.26	100596	6.36
2005-06	77217	3.10	108274	7.63
2006-07	81393	5.41	114926	6.14
2007-08	82045	0.80	146781	27.72
2008-09	85148	3.78	149135	1.60
2009-10	88593	4.05	154276	3.45
2010-11	89789	1.35	163744	6.14
2011-12	91992	2.45	224596	37.16
2012-13	93641	1.79	209051	-6.92
2013-14	95601	2.09	220589	5.52
2014-15	57048	-40.33	187934	-14.80
2015-16	88960	55.94	263466	40.19
2016-17	89339	0.43	266280	1.07

Source: Directorate of Horticulture Kashmir/Jammu

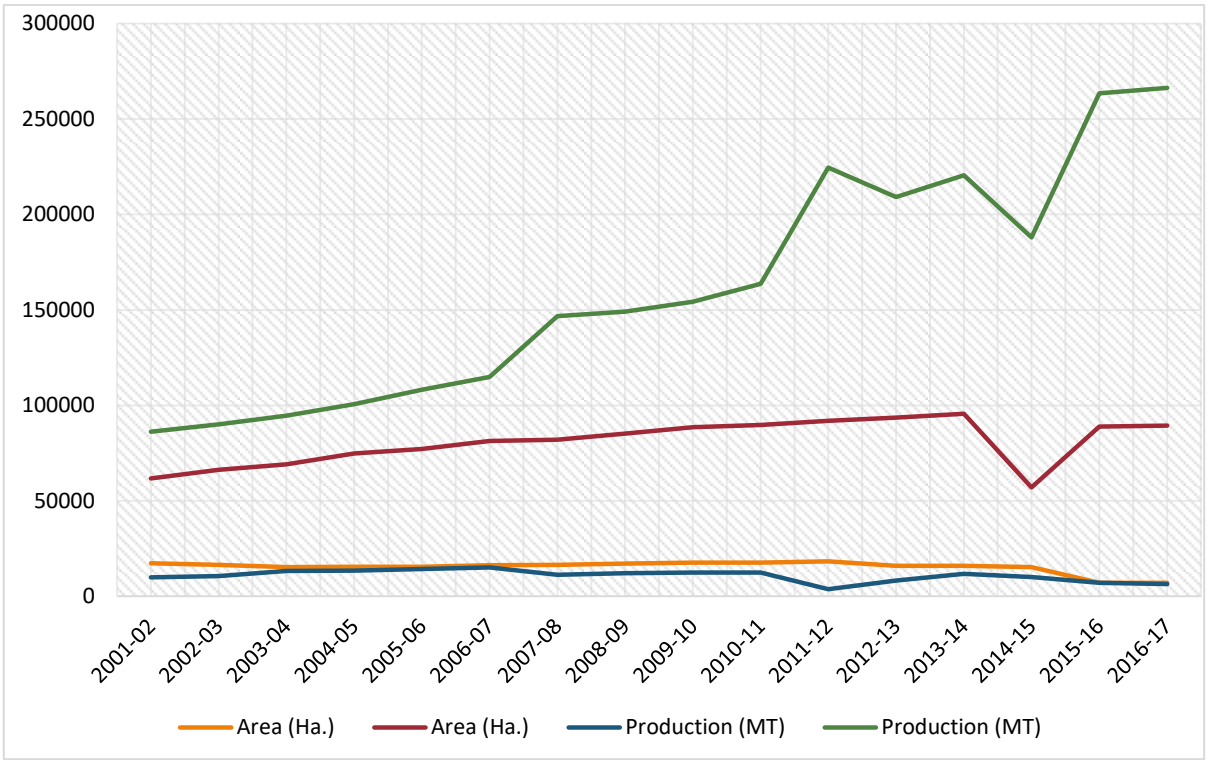

Fig.2: Production and Area under Almond and Walnut cultivation

As clearly depicted from the Figure 2, the area under almond and walnut cultivation has not shown much variation during the study period except in 2014-15 when the area under walnut cultivation registered a negative growth of 40.19 percent and in 2015-16 when the area under almond cultivation reduced significantly with a negative growth of 53.54 percent. The decline

in area under the dry fruit cultivation in the state during 2014 and 2015 was mainly because of September 2014 floods that created havoc in the valley of Kashmir which is the main producer of dry fruits.

Table 3: District wise Area and Production of Dry Fruits in Jammu and Kashmir (2016-17)

District	Walnut		Almond		Total (Walnut + Almond)	
	Area (Ha.)	Production (MT)	Area (Ha.)	Production (MT)	Area (Ha.)	Production (MT)
Srinagar	222	606	469	58	691	664
Ganderbal	5320	11155	43	19	5363	11174
Budgam	3991	14198	1467	1486	5458	15684
Anantnag	14393	45695	30	12	14423	45707
Kulgam	5781	25259	2	1	5783	25260
Pulwama	4849	18184	4668	4180	9517	22364
Shopian	3280	12924	15	36	3295	12960
Baramulla	3114	9956	258	553	3372	10509
Bandipora	1238	2463	8	8	1246	2471
Kupwara	8787	37423	13	0	8800	37423
Leh	49	109	2	1	51	110
Kargil	15	12	2	1	17	13
Jammu	0	0	0	0	0	0
Samba	0	0	0	0	0	0
Udhampur	4640	9910	19	1	4659	9911
Reasi	2706	6965	20	1	2726	6966
Kathua	3271	11404	12	3	3283	11407
Doda	6480	22548	67	0	6547	22548
Kishtwar	4650	12000	0	0	4650	12000
Ramban	5210	7000	1	0	5211	7000
Rajouri	4370	7900	11	0	4381	7900
Poonch	6991	14500	0	0	6991	14500
J&K	**89339**	**266280**	**7107**	**6360**	**96446**	**272640**

Source: Directorate of Horticulture Kashmir/Jammu

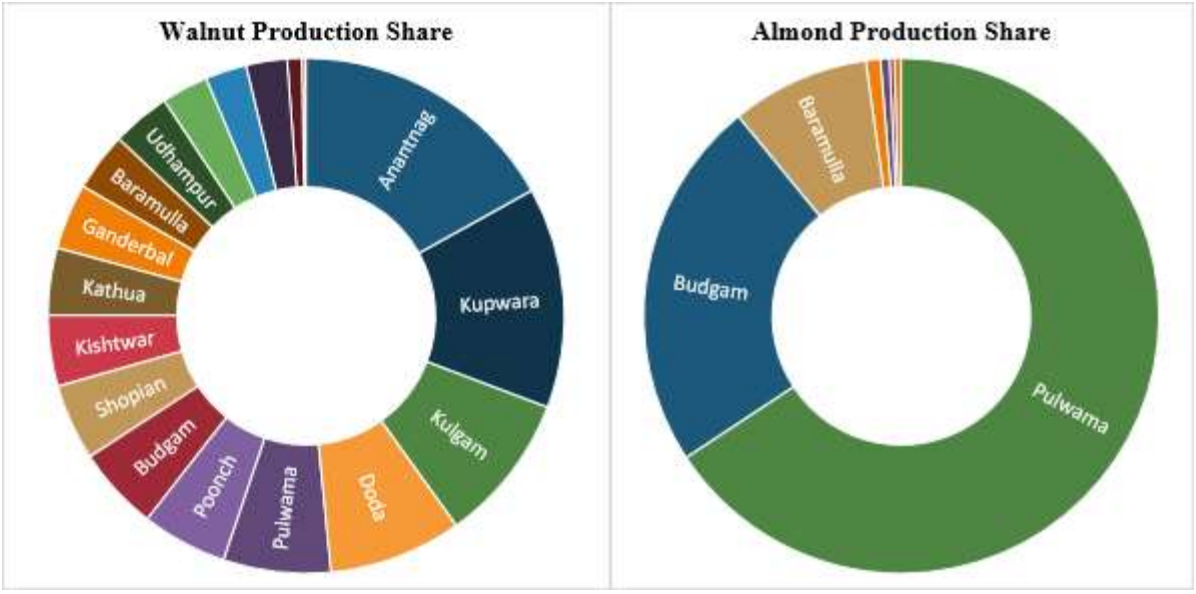

Fig. 3: District-wise share of Walnut and Almond Production in J&K

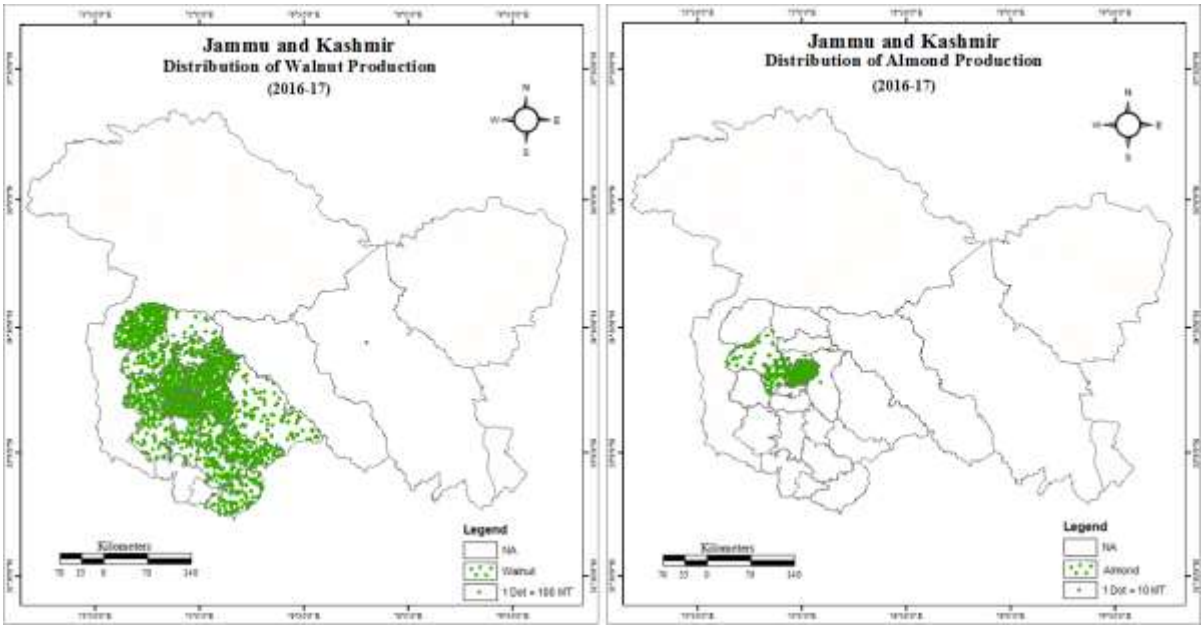

Fig. 4: Spatial Distribution of Walnut and Almond Production in J&K

Pulwama is the leading producer of almonds in the state with a production of 4180 MT in 2016-17 followed by Budgam 1486 MT, Baramulla 553 MT and Srinagar 58MT. While in walnut production district Anantnag and Kupwara lead in both area and production. Almost all of the production of almonds comes from Kashmir valley while in case of walnut production, Udhampur, Reasi, Kuthua, Doda and Kishtwar districts of the Jammu division also contributes to some level. Division wise Kashmir division leads in area and production in both the dry fruits. Kashmir valley provides about 66.16 of the total production and out of total land under walnuts and almonds, its share is around 60.13 percent. An important feature of the almond and walnut cultivation in Jammu and Kashmir is that these dry fruits are grown

mostly in Kashmir valley and the state has failed to expand their cultivation to other parts of the state mainly owing to geographic conditions. Due to agro-climatic condition, the Jammu and Samba districts of the state are not favourable for walnut and almond crops, it is because of this that these districts have no area under these crops.

Conclusion

Fruits and vegetables have multiple health benefits and above all, they can be an important source of income for the farming families. Given the highland topography and agrarian nature of the state's economy, the cultivation of fruits can be an important alternative for the economic and social development. Jammu and Kashmir especially the valley of Kashmir is known from the very early times for its fruit culture and the majority of fruits produced in the state are exported not only to different parts within the country but also to the outside world. Though walnut is grown in Kashmir valley and also in parts of Jammu Division while Almond crop is entirely concentrated in Kashmir due to temperate climate and high elevation but there is every possibility that the cultivation of these crops can be extended to other parts of the state especially the sub-tropical Jammu region. This sector of the economy has a great potential for the employment generation and can become a full-fledged industry if the government of the state encourage the fruit cultivation and provide the related infrastructural facilities for the growth and development of this industry.

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