

Availability and accessibility of agricultural markets and their relation with commercialization of agriculture in Haryana, India

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Abstract

The present study evaluates the availability and physical accessibility of agricultural markets in Haryana and their relationship with crop arrival in markets, an indicator of development of tradable agriculture. Based on secondary data the availability and accessibility parameters have been examined at the level of district as well as across three agro-ecological regions, namely wheat-rice region, wheat-rice-cotton region and mixed-crop region. The study brings out that the state has well developed agricultural infrastructure. Overall, north Haryana is far ahead of south Haryana in terms of availability of agricultural markets. Wheat-rice-cotton region in north-western Haryana has the best availability followed by wheat-rice region in north-eastern and eastern Haryana. The market access to the farmers is the highest in wheat-rice region and lowest in mixed-crop region. There is a huge north-south, inter-region and inter-district difference in average arrival of agricultural produce in the state. Correlation analysis reveals that there is a good correspondence between the quantity of agricultural produce arriving in the market and parameters of availability and physical accessibility of markets. The study brings out that bridging the inter-regional and intra-regional gaps in availability and accessibility of agricultural markets boosts the regionally balanced agricultural development.

Keywords: *Agricultural marketing, market availability and accessibility, mandi, tradable agriculture*

Introduction

Regulated and efficient marketing of agricultural produce plays a significant role in agricultural development and transformation of rural economy. The role of an efficient agricultural marketing system in accelerating agricultural production and thereby promoting economic growth in developing countries has been accepted by various scholars (Jain, 2001). The presence of sufficient marketing infrastructure is crucial for the execution of diverse marketing functions, the enlargement of market size, and the transmission of suitable

price signals, which enhances marketing efficiency (Dilipkumar, 2020). The regulated agricultural marketplaces in India, often known as *mandis*, are the principal locations for purchasing and selling various goods. “A regulated market is a market in which market functionaries are controlled by legislative measures designed to regulate the marketing of agricultural produce” (Saxena, 1992: p.21). These marketplaces are critical for assuring fair prices for farmers, facilitating efficient distribution of agricultural produce,

and sustaining overall agricultural economic stability. The Agricultural Produce Market Committee (APMC) Act controls the operation of these marketplaces in several states across India. Under this legislation, each state is divided into different market zones, each with its own set of *mandis*. Farmers bring their produce to these marketplaces, where dealers, wholesalers, and retailers conduct deals via an auction system or direct discussions. Additionally, even though India's agricultural policies have been dynamic to boost crop and livestock production, there is still a big disconnect between policy objectives and their actual application. The grassroots level frequently misses out on policies intended to increase market access, offer financial assistance, and guarantee fair pricing. Haryana and Punjab have a sophisticated *mandi* network, but the marketing infrastructure in other states is less advanced (Patel, 2023).

The main objective of establishing a physical market network is to guarantee transparency and create an environment where the forces of supply and demand operate fairly to ensure that farmers receive adequate returns. The availability of adequate marketing infrastructure is a key prerequisite not only for the well-functioning of agricultural markets, but also for providing farmers with fair prices for their produce (Kumar and Jaglan 2022). Availability of agricultural market ensures the price of agricultural products. There are two important dimensions of market infrastructure, one is availability of agricultural market and another is access to market. The diffusion of new agricultural technology and farm management systems do not ensure agricultural development in a region unless supported by adequate availability of agricultural market infrastructure. The

history of economic development reveals that the areas that lacked investment in market structure lagged behind in production despite the development of production technology (Fagerberg, 2000). Strengthening of the agricultural marketing system through regulation and network connectivity is a must for agricultural development (Rehman and Selvaraj, 2012). The physical access to the market i.e. distance of farm from the market, the road network and means of transportation facilities, ensures easy and efficient transportation of crop produce to agricultural markets. Ease of access to market is key to development of tradable and commercial agriculture which continues to be a neglected area of research.

The present study therefore examines the availability and accessibility of agricultural markets and their relationship with arrival of crop produce in the agricultural markets in Haryana. Exploring the links and relationship of availability and accessibility of agricultural markets with degree of tradable agriculture and its analysis in the framework of three agro-ecological regions is a nuanced approach for studying agricultural marketing from spatio-ecological perspective.

Study area

Haryana is one of the agriculturally developed states of India. Its share in the central pool was about 9 percent in rice and 27 percent in the case of wheat in 2020-21 (CACP, 2021). Though small in size the state displays considerable diversity in agro-ecological conditions and crop production systems. The state is divided into three agro-ecological regions namely, wheat-rice region (eastern and northeastern parts), wheat-rice-cotton region (northwestern part), and mixed-crop region (south and southwestern parts) on the basis

of uniform production and environmental restrictions criteria adopted by Indian Council of Agricultural Research Project (Saxena *et al.*, 2001). It must be noted that these agro-ecological regions are dominantly carved out by level of irrigation development. Wheat-rice region has very well-developed tube well irrigation, whereas wheat-rice-cotton region has very good canal and tube well irrigation. The mixed-crop region lacks development of both canal and tube well. Among these regions wheat-rice region is the largest and covers about 45 percent of total geographical area of state, followed by mixed-crop region (about 30%) and wheat-rice-cotton region (about 25%). The state has a good network of agricultural *mandis* where marketing of agricultural produce is regulated by the Agricultural Produce Marketing Act 1961 enacted by erstwhile Government of Punjab, even before Haryana was carved out as a separate state in 1966. Haryana Marketing Board was set up on 1st August 1969. At the time of creation of the Board, there were only 58 principal markets, 60 sub-yards. Presently there are 114 principal regulated markets, 93 sub-yard and 195 purchase centres (Statistical Abstract of Haryana, 2020-21).

Objectives

The study places the following specific objectives:

1. To examine the availability and physical accessibility of regulated agricultural markets in Haryana, and
2. to find out the relationship of parameters of availability and physical asseccibility with arrivals of agricultural produce in agricultural markets.

Data base and methodology

This study entirely depends on secondary data. Data on area of agricultural land and

number of farmers was collected from Agricultural Census 2015-16. Information pertaining to number of markets, number of villages, served area, distance from markets and arrival of agricultural produces were obtained from Statistical Abstract of Haryana, 2020-21. There are three indicators of market availability computed at the district level namely, market-village ratio denoted as X_a , market-farmer ratio denoted by X_b and market-agricultural land ratio denoted by X_c . The normalized values of these indicators have been computed by dividing the district value by the state value (Kundu, 1992, p.173; calls it ideal value) of the concerned indicator. Based on thus normalized values of three indicators we computed the composite index of availability of agricultural markets using following formula:

$$\text{Composite index} = \frac{\sum X_n}{n}$$

Where n is number of indicators and X is normalized value of indicators.

The physical accessibility to agricultural market has been measured in terms of two parameters, i.e. average distance of farm from agricultural market and percent agricultural area of district/region within 10 km distance from the market (based on Swaminathan, 2005 guideline that agricultural market must be within 10 km radius from the farm). The following formula is used to calculate the average area served by regulated market.

$$B = \frac{A}{n}$$

Where B is average area served per market, A is total area of the district in km^2 and n is number of regulated markets in the district. Average distance from the markets is then calculated from this with the following formula by dividing B by pie constant value (Sahoo, 2015):

$$\text{Average Distance of Farm from Market} = \sqrt{\frac{B}{\pi}}$$

Arc GIS is used for computation of another indicator of market access, i.e. percent area of a district within 10 km distance from the market. Buffers of 5, 10, and 15 km radius

have been drawn around the locations of all markets in the district and the overlapped area has been excluded from the buffers. The areas of three buffers have been calculated using Arc GIS. The percentage of area under 5, 10, and 15 km buffers has been computed.

Table 1: Haryana - Parameters of Availability of Agricultural Markets (2020-21)

Districts	Principal market	Sub yards	Total	Markets per 100 villages	Markets per lakh farmers	Markets per lakh ha agriculture land	Composite index
Wheat-Rice Region	69	43	112	3	14	7	1.12
Ambala	7	2	9	2	17	9	1.19
Karnal	10	3	13	3	17	7	1.16
Kurukshetra	7	4	11	3	15	7	1.13
Jind	7	6	13	4	14	6	1.19
Rohtak	3	1	4	3	6	3	0.66
Sonipat	4	8	12	4	13	6	1.10
Faridabad	4	1	5	4	18	12	1.53
Panipat	5	2	7	4	11	7	1.10
Yamunanagar	7	5	12	2	18	9	1.24
Panchkula	3	1	4	2	24	15	1.73
Kaithal	8	10	18	7	25	10	1.96
Palwal	4	0	4	1	5	4	0.50
Wheat-Rice-Cotton Region	20	29	49	6	13	5	1.27
Hisar	7	9	16	6	15	6	1.37
Sirsa	6	13	19	6	11	4	1.13
Fatehabad	7	7	14	6	16	7	1.48
Mixed-Crops Region	25	18	43	2	9	4	0.72
Bhiwani	7	7	14	3	10	4	0.83
Gurugram	4	3	7	3	14	10	1.26
Mahendergarh	5	1	6	2	8	4	0.62
Jhajjar	3	1	4	2	5	3	0.49
Rewari	2	5	7	2	11	6	0.82
Nuh	4	1	5	1	7	5	0.58
Haryana	114	90	204	3	13	6	

Source: Agricultural census and statistical abstract of Haryana (Computed by authors)

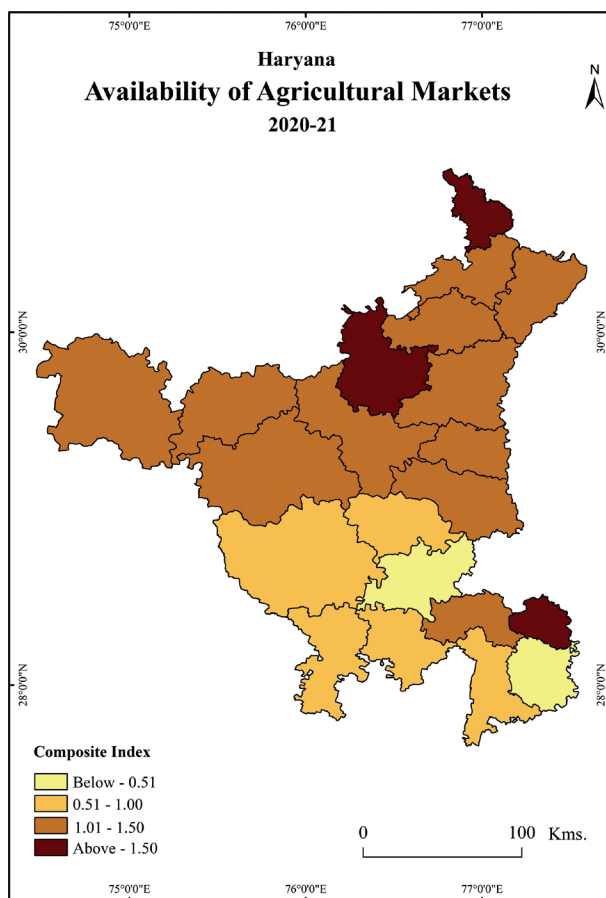


Fig. 1

Fig. 1: Haryana: availability of agricultural markets, 2020-21

The proportion of area within 10 km distance from the market was taken as the indicator of easy access to the markets.

Arrival of crop produce in agricultural markets indicates the level of commercialization of agriculture in an area. This may also be taken as an efficiency indicator of marketing infrastructure and its ability to induce agricultural development. This indicator has been calculated using formula as following:

$$\text{Crop Arrival (tonnes per ha)} = \frac{\text{Total crop arrival of the district in tonnes}}{\text{Total agricultural land of the district in ha}}$$

The Pearson's correlation coefficient has been used to examine the relationship between arrival of agricultural produce and parameters of market availability and accessibility. The analysis of the parameters of market availability, accessibility and crop produce arrival in the market has been done with respect to the three agro-ecological regions of the state. The spatial variation in these parameters has been assessed in terms of their intra-regional and inter-district differences.

Result and discussion

Availability of agricultural markets

This section examines the physical availability of markets at district level in terms of three indicators namely, number of markets per hundred villages (market-village ratio), number of markets per lakh farmers (market-farmer ratio) and number of markets per lakh ha agricultural land (market-agricultural land ratio) for the year 2020-21. There were 114 principal agricultural markets and 90 sub-yards in Haryana in 2020-21; 69 of the principal agricultural markets are located in wheat-rice region, 25 in mixed-crop region and 19 in wheat-rice-cotton region. Overall, Haryana ranks second in terms of availability of agricultural markets.

In terms of the availability, market-village ratio in Haryana is 3 principal agricultural markets per hundred villages (Table 1). This ratio in wheat-rice region is identical to the state average of 3, but much higher (6) in wheat-rice-cotton region where it is double that of the state average. Mixed crops region on the other hand, has only 2 markets per hundred villages. Intra-regional variations in the market-village ratio is equally glaring. In 5 districts of the wheat-rice region the ratio is more than the state average, whereas 6 districts have less than the state average. In terms of availability of markets, Kaithal district has the highest (7) market village ratio in the region as well as in the state. On the other hand, Palwal district has the lowest ratio within this region. All the three districts in wheat-rice-cotton region have double the market-village ratio than the state average. In the mixed-crops region, only Bhiwani and Gurugram have the market-village ratio equal to the state average. All the other districts of the region have lower market-village ratio than the state average, lowest being in the

Nuh district. Overall, wheat-rice-cotton region in north-western part of the state has the best availability followed by wheat-rice region. The districts of Mixed-Crop Region in the southern part of the state have very low market village ratio.

In terms of market-farmer ratio, there are 13 markets per lakh farmers on an average in Haryana (Table 1). The ratio is the highest in wheat-rice region (14) closely followed by wheat-rice-cotton region (13). The mixed-crop region (9) has the lowest market-farmer ratio in the state. Like other indicators of availability, there are significant intra-regional and inter-district difference in market-farmer ratio in the state. Kaithal (25) and Panchkula (24) districts in the wheat-rice region for example have high market-farmer ratio, in contrast to Palwal (5) and Rohtak (6) districts characterised by much lower ratio. In mixed-crop region, Jhajjar, Nuh and Mahendergarh districts lag behind the regional average of 9 markets per lakh farmers.

With respect to market-agricultural land ratio, the wheat-rice region has the highest market-agricultural land ratio (7) in the state followed by wheat-rice-cotton region (5) and mixed crops region (4) (Table 1). There is a big north-south, intra-regional and inter-district difference in this regard. The Panchkula district in wheat-rice region has recorded the highest market-agricultural land ratio (15) followed by Faridabad (12). But in the same region the ratio is merely 3 in Rohtak district. In wheat-rice-cotton region Fatehabad and Hisar have higher market-agricultural land ratio than Sirsa district. Mixed-crop region lags in terms of market-agricultural land ratio as well. Eight out of 21 districts of the state have recorded ratio below the state average and four of them are located in the mixed-crops region.

Table 2: Haryana - Average distance of farm from agricultural market (2020-21)

Regions/Districts	Distance (Km)	Regions/Districts	Distance (Km)
Wheat-Rice Region	9.7	Wheat-Rice-Cotton Region	14.6
Ambala	8.5	Hisar	13.5
Kaithal	9.6	Fatehabad	10.7
Karnal	9.0	Sirsa	15.1
Kurukshetra	8.4	Mixed-Crop Region	12.8
Faridabad	7.7	Bhiwani	14.7
Panipat	9.0	Rewari	15.9
Jind	11.1	Jhajjar	14.0
Sonipat	13.0	Mahendergarh	12.3
Yamunanagar	9.0	Gurugram	10.0
Panchkula	9.8	Nuh	11.0
Rohtak	13.6	Haryana	11.2
Palwal	10.4		

Source: Agricultural census of Haryana (computed by authors)

For the state as a whole, there is one agricultural market per 33 villages, 7700 farmers and 17000 ha agricultural area. The composite index based on three parameters shows the overall picture of availability of agricultural markets in Haryana (Table 1 and Fig. 1). The index value above 1 and its deviation from 1 indicates the better availability of markets, whereas, the index value below 1 and its deviation from 1 indicates that the region/district is lagging in marketing infrastructure. The composite index value comes out to be the highest in the wheat-rice-cotton region (1.27) followed by the wheat-rice region (1.12). With a composite index value 0.72, the mixed crops region lags far behind the two other regions in the northern part of the state.

It must be noted that the mixed crop region lacks irrigation facilities relative to other two regions and it is the level of irrigation development that determines the regional differentiation in cropping pattern in the state. Overall, the state is characterised

by a north south divide in availability of agricultural markets and the inter-regional and intra-regional variation too is striking. Districts like Kaithal and Panchkula in wheat-rice region, Sirsa in wheat-rice-cotton region and Gurugram under mixed-crop region have better availability of market. Palwal and Rohtak, Jhajjar, Nuh and Mahendergarh districts are however less served.

Physical accessibility

The ease with which farmers can carry their produce to the market depends on the accessibility factors such as distance from the agricultural market, transportation facilities, availability and network of roads, railways, etc. The distance between the market and the farm is an important factor in accessing agricultural market. Shorter distances often lowers transportation cost and reduces travel time which is crucial for perishable agricultural products. Greater farm-to-market distance reduces access to the market. So, the one parameter chosen for the agricultural market

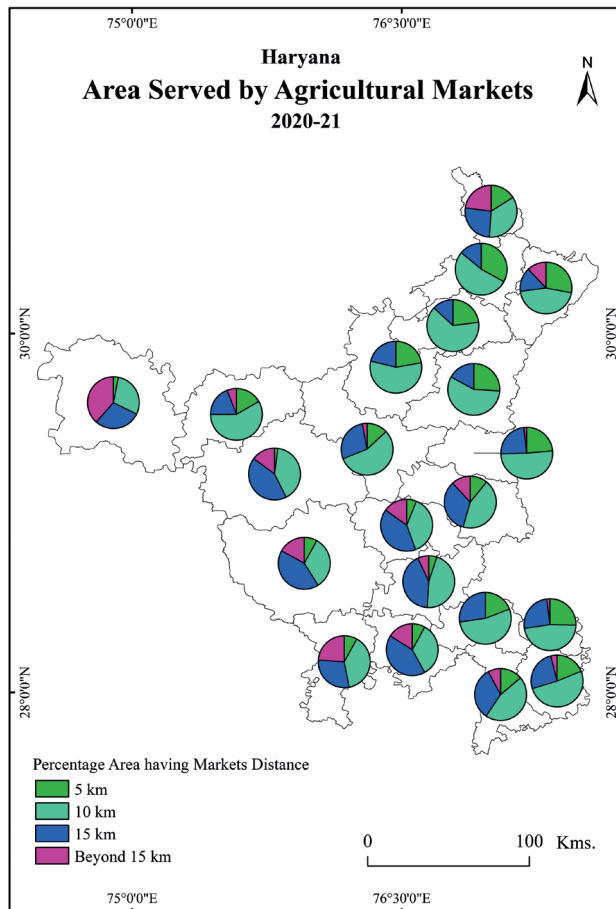


Fig. 2

Fig. 2: Haryana: area served by agricultural markets, 2020-21

accessibility at district level is the ‘average distance of farm from agricultural market’. The National Commission on farmers, 2005, also known as MS Swaminathan Commission, recommended one agricultural market within 5 km radius and can be 10kms if the road connectivity is good. Since the villages in Haryana are well connected with the road networks, the ‘percent agricultural area within 10 KM distance from the market’ is the second accessibility parameter chosen for the study.

Average distance of farm from agricultural market

It is evident from table 2 that a farmer on average travels 11.2 km to reach a regulated market in Haryana. This figure comes to very close to that recommended by Swaminathan Commission but there are perceptible interregional and inter-district variations in this regard.

Average distance between farm and agricultural markets is 10 km or less in

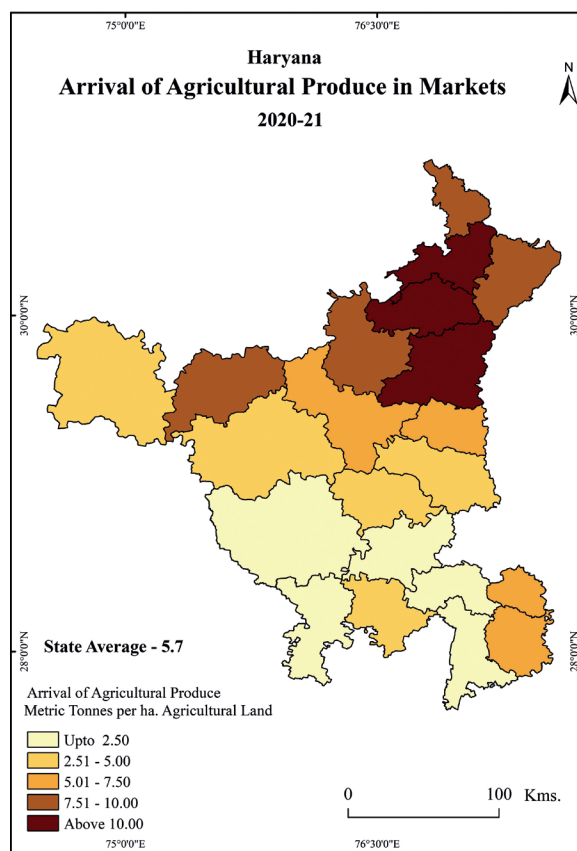


Fig. 3

Fig. 3: Haryana: arrival of agricultural produce in markets, 2020-21

nine of the 21 districts of the state. Most of these districts are in wheat-rice region. The average distance from market is lowest (9.7 km) in the wheat-rice region and the highest in wheat-rice-cotton region (14.6 km). The average distance in mixed-crop region is 12.8 km. Within the wheat-rice region, the districts of Faridabad, Kurukshetra and Ambala have much less average distance to the agricultural market unlike Rohtak and Sonapat districts. In wheat-rice-cotton region Fatehabad district has comparatively better accessibility to markets, while, Sirsa lags in this regard. In mixed-crop region, Rewari and

Bhiwani districts have comparatively less access to agricultural markets compelling the farmers to travel longer distance to reach the agricultural markets.

Areas within 10 Km Distance from Market

Table 3 and Fig. 2 show the percentage area served by agricultural market within 5 km, 5 to 10 km, 10 to 15 km and beyond 15 km in different regions and districts. It is evident that only about 13 percent of the state has very good accessibility to agricultural market as they are located within 5 km distance. In 44

Table 3: Haryana- % agricultural area within distance zones around agricultural markets (2020-21)

District/Region	10 km	Beyond 10 km
Wheat-Rice Region	71	29
Panchkula	51	49
Yamunanagar	73	27
Kurukshetra	87	13
Ambala	86	14
Kaithal	78	22
Jind	69	31
Karnal	83	17
Faridabad	72	28
Palwal	70	30
Rohtak	45	55
Panipat	74	26
Sonepat	54	46
Wheat-Rice-Cotton Region	45	55
Fatehabad	71	29
Sirsa	31	69
Hisar	43	57
Mixed-Crop Region	49	51
Bhiwani	40	60
Jhajjar	51	49
Mahendergarh	47	53
Rewari	42	58
Gurugram	73	27
Nuh	60	40
Haryana	58	42

Source: Agricultural census of Haryana (computed by authors)

percent area the markets are accessible within a distance of 5 to 10 km. Thus, approximately three-fifth area of Haryana has agricultural markets located within the ideal distance of 10 kms. In contrast farmers have to travel more than 15 km to access the market in 12 percent area. In this regard the wheat-rice region is better placed compared to the two other regions. Around 70 percent area in this region has market within 10 km distance and

only about 6 percent has market beyond 15 km. In this region, Kurukshetra and Ambala have most easy physical access to markets while Rohtak, Panchkula and Sonipat had large area having market located beyond 10 km. In the wheat-rice-cotton region, only 45 percent area have markets within 10 km distance. Fatehabad district in this region has highest access and Sirsa has the lowest in this region. In fact, Sirsa district has the

Table 4: Haryana - arrival of agricultural produces in markets (tonnes per ha) in 2020-21

District/Region	Arrival (Tonne)	District/Region	Arrival (Tonne)
Wheat-Rice Region	9.6	Wheat-Rice-Cotton Region	6.5
Faridabad	5.6	Fatehabad	8.7
Ambala	12.2	Hisar	3.8
Jind	7.2	Sirsa	4.0
Kaithal	9.5	Mixed-Crop Region	2.4
Karnal	13.6	Bhiwani	2.0
Kurukshetra	12.3	Gurugram	1.9
Palwal	6.8	Jhajjar	2.1
Panchkula	8.0	Mahendergarh	2.0
Panipat	6.4	Nuh	1.4
Rohtak	4.6	Rewari	3.1
Sonipat	4.7	Haryana	5.7
Yamunanagar	8.9		

Source: Agricultural census of Haryana (computed by authors)

Table 5: Haryana - Relationship of crops arrival with availability indicators in 2020-21

	Crops arrival	Xa	Xb	Xc
Crops arrival	1			
Xa	0.129	1		
Xb	0.600**	0.392	1	
Xc	0.433*	0.043	0.862**	1

** Correlation is significant at the 0.01 level; *Correlation is significant at the 0.05 level

Xa: market-village ratio; Xb: market-farmer ratio; Xc: market-agricultural land ratio

Table 6: Haryana - Relationship of crops arrival with accessibility indicators in 2020-21

Variables	Crops arrival	Distance from markets	Served Area by markets
Crops arrival	1		
Distance from markets	-0.654**	1	
Served Area by markets	0.733**	-0.901**	1

** Correlation is significant at the 0.01 level

lowest physical access to agricultural market in whole of Haryana. In mixed-crop region about half of the area has market within 10 Km distance. Gurugram district in this region has the best access and Bhiwani and Rewari districts have poor access to market.

Arrival of agricultural produce in markets

Table 4 and Fig. 3 depict the arrival of agricultural produce in agricultural markets in tonne per ha in Haryana in 2020-21. It is an indicator of both agricultural prosperity

and the strength of marketing infrastructure. It is evident that overall Haryana records 5.7 tonne/ha crop produce arrival in agricultural markets. Among three agro-ecological regions wheat-rice region has the highest crop arrival (9.6 tonne/ha), four times higher than the mixed-crops region (2.4 tonne/ha). In wheat-rice-cotton region crop arrival is 6.5 tonne/ha. Fig. 3 depicts that the districts in northeastern region of the state, part of wheat-rice region record the highest crop arrival in the state. Fatehabad district in north-western part of the state also records high crop arrival in agricultural markets. Overall, there is a north-south divide in terms of crop arrival. Southern Haryana having low crop arrival is mostly dominated by mixed cropping pattern and low crop yields.

Availability, accessibility and arrival of produce

The goal of profitable and sustainable agricultural development is likely to be achieved through an efficient market system, well-developed infrastructure, and supportive regulations.

It may be postulated that crop arrival in the agricultural markets (*mandis*) is primarily influenced by availability and accessibility of agricultural markets. In table 5 the correlation matrix depicts the relationship of crops arrival (tonne/ha) with numbers of markets per hundred villages, number of markets per lakh ha agricultural land and number of markets per lakh farmers. It is evident that crop arrival has high positive correlation (r value 0.60) with number of markets per lakh farmers at 0.01 significance level. Number of markets per lakh agricultural land is also positively

associated with crop arrival (r value 0.43) though the coefficient value is moderate. The third parameter of availability (number of markets per hundred villages) does not show any relationship with the crop arrival.

In case of accessibility parameters, average distance of farm from agricultural market has high negative correlation (r value -0.65) with crops arrival at 0.01 significance level (Table 6). Crop arrival decreases as the distance of farm increases from the agricultural markets. In other words, distance is an important factor in crop arrivals in mandis. On the other hand, Proportion of agricultural area within 10 km distance from agricultural market has high positive association (r value 0.73) with crop arrival at 0.01 significance level. It means that the areas where agricultural market is in close proximity the crop arrival remains high. Overall, the correlation analysis suggests that there is a strong association between the parameters of availability and accessibility of agricultural markets and development of agriculture in the state of Haryana. Easy availability and accessibility of agricultural markets promote tradable agriculture.

Conclusion

The study examined the parameters of availability and physical accessibility of agricultural markets and their relationship with crop arrival in Haryana exploring availability and accessibility of agricultural markets with a spatial perspective. It adopted a nuanced approach of linking the degree of tradable agriculture with availability and accessibility of market infrastructure in different agro-ecological regions. Since the

state is characterised by regional differences in the level of agricultural development, cropping pattern and farm production system, the analysis was carried out at the district level and three agro-ecological regions, i.e. wheat rice region, wheat-rice-cotton region and mixed-crop region.

Overall, the wheat-rice-cotton region in the north-western Haryana has best availability of agricultural markets. The wheat-rice region in north-eastern and eastern Haryana ranks second in market availability, though there is a big gap between the northern and southern districts in this regard. The mixed-crop region of south and south-western Haryana lags far behind the two other agro-ecological regions mentioned above. firstly the north Haryana overall is far ahead of south Haryana in availability and accessibility of the agricultural markets. Secondly, the regions with greater availability and accessibility of agricultural markets grow and trade higher quantum of commercial agricultural produce. It calls for bridging the inter-regional and intra-regional gaps in availability and accessibility of agricultural markets to boost the regionally balanced agricultural development.

It is a lesson for the policy makers and the government in Haryana as well as agriculturally backward regions to focus on bridging the inter-regional and intra-regional disparities in availability and accessibility of agricultural markets for boosting the regionally balanced growth of tradable and commercial agriculture. The concept of e-NAM is new to Haryana farmers and it is being practiced through platforms of few established traditional mandis. Furthermore,

the relevant data is not available to analyse the impact of e-NAM on tradable agriculture.

Competing interest

The corresponding author declares that they have no conflict of interest.

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