

Full Length Research Paper

Changing Cropping Pattern around the Urban Centre: Analyzing the Role of Consumption Pattern of the People

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Cropping pattern in developing countries has been undergoing a major transformation from cereals to non-cereals cash crops, but, there is dearth of study evaluating cause and effect relationship of this phenomena. The objectives of the present study were to analyze the consumption pattern of major food items and its impact on cropping patterns in India as a whole and in the National Capital Territory (NCT) of Delhi particularly. The analysis depicts that cereal consumption/person/day in the country were declined by 11.6%, whereas the consumption of eggs, vegetables and fruits were increased by 80.41%, 41.58%, and 39.13% respectively during 1993–2013. The impact of changing consumption behaviour on cropping pattern was depicted by increasing areas under fruits (14.4%), vegetables (15.37%), spices (16.9%) and plantation crops (13.16%). A similar trend was observed in the case of NCT of Delhi. Information collected from 896 farming households revealed that vegetables (28.38%), potatoes (25.32%) and cereals (23.9%) were the prime crops in the study area. Increasing demand of non-cereal crops in the city markets, ($p < 0.000$), in the local market, and in commercial establishments ($p < 0.05$) were determined the cropping pattern. With changing consumption pattern, more and more agricultural land may be devoted to non-grain crops. Integrated planning for land allocation between grain and non-grain crops is needed for sustainable agriculture development.

Key words: Delhi, consumption pattern, cropping pattern, food grain, non-cereals

INTRODUCTION

Cropping pattern refers to the proportion of area under different crops at a point of time. A change in cropping pattern thus implies a change in the proportion of area under different crops during two or more points of time. It is, however, dynamic as no cropping pattern can be good for all times to come, and differs from macro to micro regions, both in space and time. Cropping patterns of a region are mainly controlled by agro-ecological setting for the nourishment and appropriateness of a crop or a combination of crops.

The decisions with respect to choice of crops and cropping pattern are further narrowed down under the influence of several other factors related to infrastructural facilities (irrigation, transportation, storage, trade and marketing, post-harvest handling and processing),

technological factors (improved varieties, cultural requirements, mechanization, plant protection measures, access to information), socio-economic factors (financial resource base, land ownership, size and type of land holding, household needs of food, fodder, fuel, fibre and finance, and labour availability), and political factors (government plans and policies) (Ratheesh, 2014; Mohammed, 2007; Matsuda, 1994; Vaidyanathan, 1987). Nevertheless, at farmers' level, monetary benefits mainly act as guiding principles while opting for a particular crop or a cropping pattern.

Net return per acre of crops influences the acreage under crops, mainly in two ways. Firstly, the variations in intercrop price disparities lead to shifts in acreage allocation between the high and low remunerative crops.

Secondly, to maintain a stable level of prices for a considerable period of time from a crop or a combination of crops leads to shifts in acreage allocation in favour of crops less susceptible to price fluctuation despite of being less remunerative. To be more specific, the cropping pattern is governed by law of comparative advantage in relation to agro-climatic conditions (Bowman and Zilberman, 2013; Vyas, 1996).

Agriculture in India has a predominant position, provides a livelihood for two-thirds of the population, gives employment to around 52% of the workforce, and accounted for 13.7% of the gross domestic product in 2013-14 (Agricultural statistics, 2015). But, from the last few decades, agriculture in the country has been undergoing a major transformation, driven by the same factors shaping the nation's current demographic scenario i.e. *Urbanization*. By and large, India is still a rural country; however, a process of rapid urbanization is already making strides in the form of growth of big cities and urban agglomerations. Like the other countries around the world, increasing urbanization in the country is inducing major changes in demand for agricultural products, both from increases in urban populations and, from changes in their food preference, which in turn tend to increase demand for high quality, more diverse and year round non-grain crops and animal products (Zhai et al., 2009; Chatterjee et al., 2006; Huang and David, 2003; Rao, 2000; Popkin, 1999).

Numerous studies demonstrate an emerging shift in food consumption pattern from food grain to non grain crops and animal products in the country (Gupta & Mishra 2014; Ramesh & Pradhan 2006; Kumar, 1998; Kumar and Mathur, 1997; Huang and David, 1993; Radhakrishna and Ravi, 1992). Therefore, it is expected that with increasing urbanization, cereal consumption in the country will tend to decrease and non-cereal and animal products will likely to increase. According to a research report the composition of calorie supply from grain, non-grain and animal products is expected to increase from 63%, 29% and 8% in 2000, to 55%, 33% and 12% by 2025, and 48%, 36% and 16% by 2050, respectively (Amarasinghe et.al., 2007). The changing consumption patterns have had, and will continue to bring major changes in how agricultural demands are met, and what is produced where and how, that will adversely affect global food supply, balance in eco- system, bio-diversity and quality of land and water resources. Therefore, it is very imperative to analyse the changing cropping pattern in the country with particular reference to food preference of the people. It was hypothesized that urbanization leads to change in the consumption behaviour of the people, which in turn determines the cropping pattern at the macro as well as micro levels..

Considering this point, the National Capital Territory (NCT) of Delhi was selected for micro level study (Figure 1). The NCT of Delhi was considered the ideal subject for the present study because the ever increasing

urbanisation has been immensely transformed the agricultural activities in the region (Ghuncha and Ahmad, 2011). Further, the traditional agricultural practice has also been replaced by high value commercial horticulture and other high value added agricultural activities (Economic Survey of Delhi, 2014-15). Apart from it, having the highest percentage of urban population (i.e., 97.5 %) in India, it represents both modern and traditional features of the Indian urban system in particular and of developing world in general.

The present study was designed to examine the impact of consumption pattern on cropping pattern while identifying the factors contributing most to this association. The study discussed the issues as follows: firstly, it discusses the consumption pattern of the people, both in rural and urban population at the national level. Secondly, it analyses the trend of consumption of major food items in both urban and rural areas of the NCT of Delhi. Thirdly, the implication of changing consumption pattern of the people on the cropping pattern was evaluated. Finally, it was tried to assess the extent to which this association is determined by the specific determinants of the social environment with particular reference to the NCT of Delhi.

Data sources

The study is based on both primary and secondary sources of data, and has an exploratory design. The primary data were collected through field surveys, whereas the secondary data were obtained from government and quasi-government agencies and institutions through published and unpublished reports, records and literature. Accounts of the secondary sources of data include: National Sample Survey's published reports (50, 55, 61, 66th round's reports), the Municipal Corporation of Delhi (MCD), and Department of Economics and Statistics of Government of NCT of Delhi.

Primary data were obtained from field survey conducted during March–April 2014 with the help of a structured questionnaire. After reviewing secondary data, a list of villages located in seven districts of NCT of Delhi was prepared, and from each district 5% of the total villages were selected for intensive study. For the selection of villages a purposive random sampling method was applied. In total, 11 villages were selected on the basis of their agricultural characteristics, including the type of agricultural activities, infrastructural facilities and farming characteristics. From these selected villages, each fifth farming household was chosen for an interview. The study was limited to the head of the household because they have a primary role in the decision-making process of agricultural activities. In all, 849 head of household were interviewed.

The questionnaire covered the following aspects: farmers' socio-economic characteristics, area under

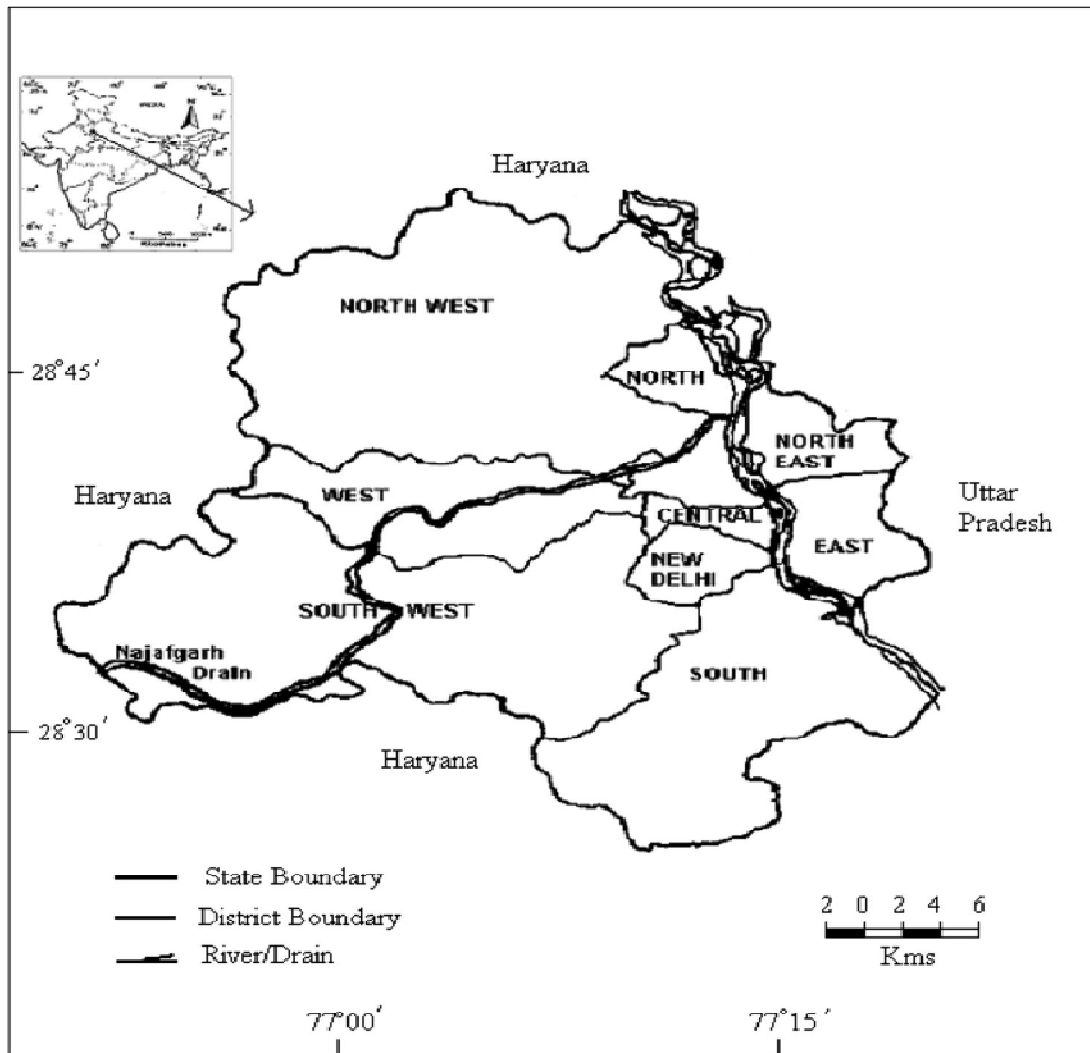


Figure 1: Location Map of NCT of Delhi

different crops, and changes in the cropping patterns during the last ten years. Apart from household surveys, key informants such as farmers' groups were consulted with the aim of obtaining information about the changing nature of agricultural activities in the study area. A field survey included transects across the farmland to observe cropping patterns, and also to verify the information collected through group discussions and household surveys.

METHODOLOGY

The collected data were organized, classified and analyzed with suitable statistical techniques. Secondary data regarding consumption of major food items in India, and in the NCT of Delhi, were presented through simple cartographic techniques, i.e. diagrammatic method, to

develop a more detailed understanding of temporal variation in the consumption pattern. Cropping pattern data for different years were arranged through simple tabulation method to get detailed information about area allocation to different crops. Primary information farmers were categorized into four categories on the basis of their size of landholding i.e. marginal (< 1 hectare.), small (1-2 hect.), medium (2.1-3 hect.) and large (3.1-4 hect.), and then, the percentage of area under different crops (i.e. cereals, pulses, potatoes, vegetables, flowers, fruits) were calculated for each category of farmers. To identify the factors controlling farmers' decision making process about cropping pattern, various determinants were identified and analysed through a multiple regression method.

$$D(\text{index}) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n$$

Where,

D (index) = Determinants of cropping pattern

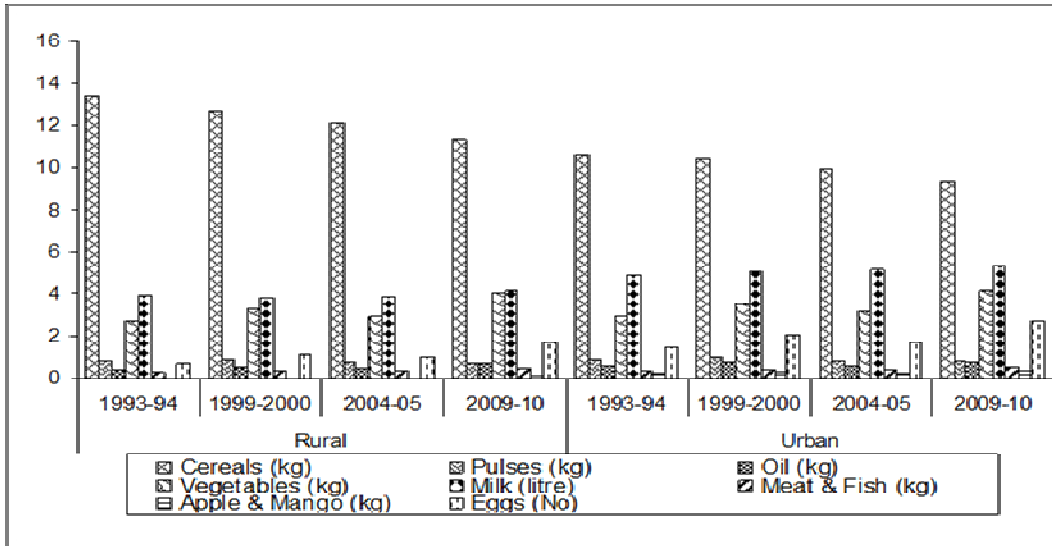


Figure 2: Per capita per month consumption of major food items in India during 1993-2010

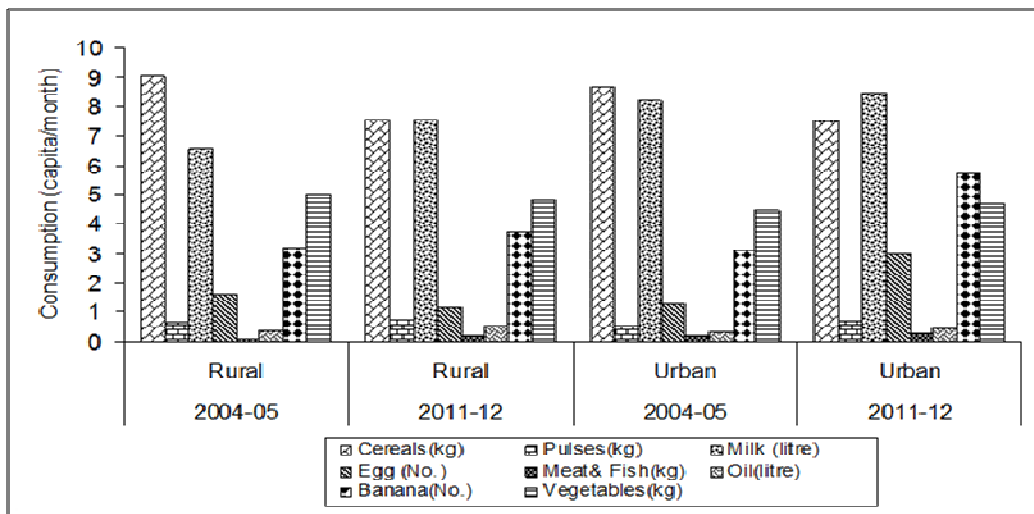


Figure 3: Per capita per month consumption of major food items in Delhi

β_0 = Intercept

$\beta_1-\beta_6$ = Coefficients of the explanatory variables

The dependent variable, i.e., cropping pattern, hypothesized to be influenced by six independent factors, i.e. increasing demand of a particular crop from local market (X_1), from city market (X_2), from commercial establishments (X_3), from surrounding states (X_4), for export to other states (X_5), and increasing demand from the social institution like orphanages, ashrams, hostels (X_6). These independent factors were identified on the basis of the percentage of farmers who considered these factors as significant reasons of changing cropping pattern in the study area.

RESULTS AND DISCUSSION

Consumption Pattern of Major Food Items in India

Figure 2 shows percentage break-up of monthly per capita consumption of major food items including 'all cereals', 'pulses', 'edible oil', 'vegetables', 'milk', 'meat & fish', 'eggs', and 'fruits' in urban and rural India spanning over the period of twenty years (1993-94 -2013-14). In general, the consumption of cereals shows a declining trend both in rural and urban areas. The per capita consumption of cereals in urban areas was declined from 10.6 kg to 9.94 kg per month, whereas in rural areas, it

was declined from 13.4 kg to 11.35 kg per month during the observational period. Like cereals, a declining trend in the consumption of pulses was also observed. It declined from 0.86 kg to 0.79 kg/capita/month in urban areas, and from 0.76 kg to 0.65 kg/capita/month in rural areas over the period of twenty years.

The consumption of edible oil shows an increasing trend in both urban and rural areas, but its consumption was found to be 12.5% higher in urban areas than the rural areas. The consumption of vegetables shows an increasing trend with less pronounced rural-urban intake gap. A prominent spatial and temporal disparity were observed in milk consumption. Despite showing an increasing trend in rural areas, the consumption of milk in urban areas was found to be higher by 30% than the rural areas. The consumption was increased from 4.89 to 5.36 liter/capita/month in urban areas and from 3.94 to 4.12 liter /capita /month in rural areas (1993-2013). Following this trend, the consumption of meat and fish also appears to be higher in urban areas i.e. 0.34-0.51 kg/capita/month than the rural areas (0.26-0.44 kg capita/month). The consumption of egg shows wide rural-urban intake gap (54.33%). In urban areas the consumption rate was 2.67/capita/month while in rural areas, it was 1.73/capita/month. Highest rural-urban intake gap was observed in the consumption of fruits, i.e. 540%, and its consumption has been consistently increasing over time, especially in urban India.

The present study found a wide rural-urban disparity in the consumption pattern of major food items in the country. Traditionally, cereals have been dominating the vegetables centered diet of the Indian people, where rice is the main food grain in the south and the east, followed by wheat in the east and coarse cereals in the south. Wheat is the principal food grain in the north and the west, followed by rice and other coarse cereals in the west, and by rice in the north. However, the present data of national consumption pattern indicate different trends, i.e. a considerable shift from cereal consumption to non-cereals food items mainly vegetables, milk, eggs, meat, fish and fruits. The present finding is in conformity with earlier studies conducted elsewhere (Delgado et al., 2005; Rosegrant et al., 2001; Bansil, 1999; Bhalla et al., 1999; Rao, 2000; Kumar, 1998; Kumar and Mathur, 1997; Radhakrishna and Ravi, 1992).

These emerging shifts in the consumption pattern in the country from grain to non-grain products may be attributed to urbanization, increasing income and changing standard of living. It is because of the fact that low income people increase their nutritional intake through easily accessible crops, such as cereals and pulses, but, as income and access to other food increase, people diversify food habits and consume more non-grain crops and animal products (Radhakrishna and Ravi, 1992). A substantial changes in the consumption pattern especially a trend of declining cereal intake and increase of consumption of other food items which has often been

explained as an outcome of economic growth is found in numerous recent studies (Ali 2007; Atibudhi 2006; Giri 2006; Golait and Pradhan 2006; Nasurudeen et al. 2006; Radhakrishna 2006; Singh et al. 2006; Viswanathan 2001; Shariff and Mallick 1999; Radhakrishna and Reddy 2004).

Consumption Pattern of Major Food Items in the NCT of Delhi

Concerning to the consumption pattern of major food items in the rural and urban areas of NCT of Delhi, a shift in the patterns of nutritional intake from food grains to non-grain crops and animal products and a declining magnitude and share of calorie from cereals was observed. The consumption of cereals was found to be comparatively lower in urban areas accounting for 7.51 kg/capita/month, whereas in rural areas, it was around 7.55 kg/capita/month during 2011-12 as compared to 8.64 kg/capita/month and 9.02 kg/capita/month respectively during 2004-05.

A fall of 15% in cereal consumption was observed in urban areas during the period of study. Pulses were showing an increasing consumption in both rural and urban areas. But, it had less consumption in urban areas than the rural areas (11.14%). Following this increasing trend, the per capita consumption of oil also rose from 0.33 gm/capita/ month to 0.48 gm/capita/ month in urban areas, and from 0.36 gm to 0.53 gm/capita/ month in rural areas. Monthly per capita consumption of vegetables was observed to be increased by nearly 5% in urban areas; while it decreased by 3.8% in rural areas. The consumption of milk shows an increasing trend in both urban and rural areas, but in urban areas the per capita consumption was higher (10.6%) than the rural areas.

The disparity between urban and rural areas in consumption of meat and fish was more pronounced with 34.35% rural-urban intake gap. In urban areas the consumption rose from 0.17kg to 0.29 kg per capita/month, recoded 40% increase over the period of seven years, whereas in rural areas it increased by 13.68%. A prominent urban-rural disparity was observed in egg consumption. Among the urban residents the consumption of eggs shown a 56.38% increase as it rose from 1.3 to 3/capita/month, but, it declined from 1.6-1.1/capita/month in rural areas. The consumption of fruits shows an increasing trend both in urban and rural areas, but it was found to be higher in urban areas i.e. 5.7/capita/month than the rural areas (3.7/capita/month), recorded 34.33% rural-urban intake gap.

The consumption pattern shows a similar trend at the micro-level, i.e., the NCT of Delhi. The data indicate that Delhi has been experiencing a shift in the patterns of nutritional intake from food grains to non-grain crops and animal products. The collective effect of urbanization, increase in per capita income and high standard of living

Table 1: Total Area under Different Crops in India

Crops Category	2008-09	2009-10	2010-11	2011-12	2012-13
Food Grains (million hect.)	122.83	121.33	126.67	123.93	120.16
Pulses (million hect.)	22.09	23.28	26.4	23.97	23.47
Oilseeds (million hect.)	27.56	25.96	27.22	26.31	26.53
Nuts (000 hect.)	N.A.	N.A.	138.4	173.9	144
Fruits (000 hect.)	6102.3	6323	6382.6	6705	6982
Vegetables (000 hect.)	7979	8011	8494.5	8989	9206
Spices (000 hect.)	2629.4	2463.7	2940.4	3212	3074
Plantation (000 hect.)	3217.3	3264.6	3305.7	3577	3641

Source: Department of Agriculture and Cooperation

Table 2: Cropping pattern based on size of landholding in the NCT of Delhi

Categories	% of area under different crops					
	Cereals	Pulses	Potatoes	Vegetables	Flowers	Fruits
Marginal < 1 hact	3.25	Nil	19.23	41.12	23.07	13.6
Small 1-2 hact	24.08	6.02	19.39	34.11	8.69	7.69
Medium 2.1-3 hact	54.43	Nil	45.56	Nil	Nil	Nil
Large 3.1-4 hact	62.69	Nil	37.03	Nil	Nil	Nil
Total	23.9	2.12	25.32	28.38	12.24	8.0

Source: Based on Field Survey 2014; Note: Figure in parenthesis is %

may be the reason behind the higher the consumption of all animal protein-supplying foods, fruits and vegetables in the NCT of Delhi. The present finding is in conformity with the study of Dyson and Hanchate (2000), based on consumption trend data between 1987-1988 and 1993-1994. He found a declining trend in per capita cereal consumption in all states except in Kerala and West Bengal. Another study based on 1960-1988 consumption data conducted by Huang & David (1993) found a reducing demand for cereals in higher income Asian countries due to urbanization. Gupta and Mishra (2014) in their study of food consumption pattern in rural India also found a decline in cereal especially coarse cereal intake and an increasing trend in the consumption of other food items (fruits, vegetables, meat products) which vary across different socio-economic groups.

Changing Cropping Pattern in India

Changing consumption patterns are worth considering changes at household level which is determining the agricultural system of the country, mainly in the form of relative area allocation under the major crop groups. Table 1 shows areas under different crops during 2008-2013. The area under food grains was declined by -2.17% from 122.83 to 120.6 million hectares during the period of observation.

Area under pulses depicts fluctuating trend, i.e. sometimes upward and sometimes downward. A downward trend was observed in the area of oilseed, it declined from 27.56 to 26.53 million hectares over the period of six years. The area under fruit cultivation was increased by 14.4% during 2008-13. Similarly, the area under vegetable was also increased by 15.3%, from 7979 to 9206 thousand hectares. The area under spices was recorded the highest growth rate, it increased by almost 17% during the observational period. Plantation crop acreage also appeared to increase by 13% over the same period of study. In the wake of this trend, two types of significant changes has been observed in the cropping pattern of the country; firstly, the relative area allocation of cereal crops have been decreasing continuously, and secondly, fruits, vegetables and spices have been gaining considerable importance in area allocation. The finding of the present study is in conformity with earlier studies which observed a shift in the Indian agricultural system from food grain crops to commercial crops (Ghosh, 2011).

Changing Cropping Pattern in the NCT of Delhi

The changing consumption pattern has also been influencing the cropping pattern in the NCT of Delhi (Table 2).

Table 3: Factors affecting cropping pattern in the National Capital Territory of Delhi

Variables	Co-efficient	t-state	Sig.
Intercept	6.647	16.75	0.001
Demand in local market	0.046	6.33	0.028
Demand in city market	1.074	40.57	0.000
Demand from Commercial establishment	0.399	13.84	0.022
Demand from surrounding states	0.576	13.71	0.036
Demand for exports	0.399	13.84	0.047
Demand from social institution	0.124	2.80	0.082

the cropping pattern practiced by the different size of farmers in the NCT of Delhi. In general, area under vegetation shows largest share i.e. 28.38% among all crops followed by potatoes (25.32%), cereals (23.9%) flowers (12.24%) and fruits (8%). Vegetables were mainly cultivated by very small and small farmers, devoted 41.12% and 34.11% of the total area under this crop respectively. Next in importance were potatoes, cultivated by all categories of farmers. Nearly 46% and 37% of the total area were devoted to the potato cultivation by medium and large farmers respectively. Cereals were found to be third significant crop mainly cultivated by large farmers.

Fruits and flower cultivation was gaining momentum, and were mainly cultivated by very small and small farmers. In general, the cropping pattern in the study area shows more inclination towards horticulture crops, especially vegetables, seasonal fruits and flowers rather than food grain crops as observed in other states of the country (Mahesh, 1999).

Determinants of Changing Cropping Pattern in the NCT of Delhi

Table 3 shows the determinants of changing cropping patterns in NCT of Delhi. Increasing demand in city market appeared to be the most significant factor ($p=0.000$) influencing the cropping pattern. The coefficients of increasing demand from a commercial establishment and local market positively influenced the cropping pattern, and were significant at 95% confidence level. Demand for exports to other states and from social institutions was appeared to be insignificant determinants ($p>0.05$) of the changing cropping pattern in the study area.

The NCT of Delhi, being overwhelming urban, where 97.50 per cent of the total population lives in urban areas and remaining 2.5 percent in rural areas (2011 Census) provides a large market for horticulture crops. There is a great demand for vegetables, fruits, flowers throughout the year. Consequently, the returns from commercial horticulture and other high value added agricultural activities are higher compared to the traditional crops. Therefore, farmers are taking-up vegetables, floriculture

production, mushroom cultivation and seasonal fruit cultivation (Firdaus & Ahmad, 2011) instead of traditional crops.

Apart from the increasing domestic consumption, there is an increasing demand for horticulture crops from commercial sectors including hotels, restaurant and other food outlets. As the city of Delhi is the hub of social, political and economic opportunities, there is large concentration of hotels and restaurants to meet the increasing demand of food. Further, the increasing income levels of the residents accompanied by exposure to the global 'urban' eating pattern have also resulted in increasing consumption of many Western-style food items. The decreasing demand of traditional food items is inducing major changes in cropping pattern on surrounding agricultural land to meet the requirement of urban society. Our finding is in agreement with earlier studies conducted elsewhere (Satterthwaite, 2010; de Haen et al., 2003; Popkin, 2001).

CONCLUSION

The present study confirms a close association between urbanization and consumption behavior of the people and its impact on cropping pattern at the macro as well as micro levels. Presently, the impact of changing consumption patterns on agricultural activities is mainly taking place in and around the urban areas, and expected to continue with increasing urbanization in the near future. As per census 2011, there are thirty five million plus cities in India, accommodating 108.29 million people. If the present trends of consumption pattern will continue, a major portion of agricultural land will be required for non-grain, and fodder crops, that will lead to food insecurity, and degradation of land and water resources, ending into social, economic, environmental and political imbalances around the world. Therefore, the effects of urbanization may need to be taken into consideration in forecasting future food demand by taking into consideration the underlying structural shifts in consumption pattern that may help in developing proper agricultural land use policies.

Contribution of the Study

This is the first study which highlighted the changing cropping pattern around the urban center in response of the changing consumption behavior of the people in India. Our study adds to the growing body of literature examining impact of social factors on agriculture, and does generate some provocative insights about the associations between the factor operating at household level, i.e. the consumption pattern of the people, and its impact on cropping pattern at the macro as well as micro levels. Therefore, the present study can be utilized to formulate comprehensive planning and policies, especially on agriculture, rural and urban sectors within the framework of economic viability, social desirability and environmental sustainability that will be applied at local, regional and national levels.

Limitation: Like the other studies our study is not free from limitations. In measuring the changing cropping pattern, our focus of analysis was only one attribute i.e. consumption pattern. The association between these two attributes might also be mediated by socio-economic condition, political factors, culture and tradition, modern infrastructural facilities, and institutional factors which were not included in this analysis. The result could be more comprehensible if these factors were included in the analysis. Accordingly, future studies should not rely on any single indicator, but rather, the complex pathways between socio-economic indicators and their implication on the whole agricultural system of the country.

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