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## Factors affecting the cropping pattern: A case study of Sonipat district, Haryana

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### Abstract

Present research work studied about the factors which influence the cropping pattern in Sonipat district. A survey with a sample size of 200 participants was carried out in order to investigate the cropping patterns in the Sonipat district and examine the variables affecting them. The respondents were chosen by random selection from the district's Community Development Blocks. Participants were included in the sample by randomly selecting 25 respondents from each of the village that were randomly picked from each C.D. Block. Data were collected using a pre-tested questionnaire, and SPSS was used to analyse the results. The study's conclusions showed that the most important elements influencing changes in the cropping pattern in the Sonipat district are marketing and climatic change. In addition, a significant number (80%) of the respondents said they wouldn't use the same cropping strategy going forward. It is significant to note that the extent of the farmers' land holdings is closely related to the cropping pattern in the Sonipat District. It is possible to have a better knowledge of the cropping patterns in the Sonipat district and the variables influencing them by performing this study and analysing the results. Policymakers, researchers, and farmers may find this information useful in developing sound plans for the improvement of the region's agricultural and means of subsistence.

**Keywords:** Cropping pattern, Sonipat district, factors influencing cropping, livelihoods, marketing and climate change

### Introduction

Cropping patterns are the extent to which the arable land under different crops can be put to use (Singh and Dhillon, 1994) [7]. The percentage of land that is used for different crops in a given area is referred to as the cropping pattern. It displays the temporal and geographical distribution of the various crops grown in a region. A complex interaction of several elements, including historical, socio-economic, climatic, and political issues, affects the cropping pattern. Analysing and researching agricultural practices, maximising land usage, and assuring sustainable food production all depend on an understanding of these aspects.

In the Indian state of Haryana's Sonipat district a unique convergence of regionally unique factors has shaped the cultivation pattern. Since crop cultivation serves as the primary means of revenue for the farmers in Sonipat district, examining and evaluating cropping patterns is of utmost importance. The varieties of crops cultivated in Sonipat district are greatly impacted by traditional agricultural methods, and land-use trends. These traditions possess a great basis in the adjacent villages and are frequently passed on across generations.

In Sonipat, socio-economic factors are highly significant in determining the cultivation pattern. For example, the extent of land ownership influences the decisions of farmers regarding their choice of crops. Farmers with smaller landholdings may opt for crops with higher yields or greater financial returns because of a scarcity of resources. However, farmers with larger landholdings may possess the liberty to explore different crops and diversify their agricultural approaches. Temperature, precipitation, soil composition, and water accessibility are few of the climatic elements that significantly impact the agricultural cycle in Sonipat district. The area has a sub-tropic continental monsoon climate. Where we find great variation in temperature, scanty and unreliable rainfall, poses challenges for farming progress.

Government regulations and grants, along with other political concerns, could potentially impact the cultivation arrangement in Sonipat. Farmers' determinations may be swayed by agricultural regulations and endeavours that endorse a specific harvest, offer encouragements for crop variation, or fulfil market requisites.

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These guidelines frequently aim to enhance food safety, elevate farmer revenues, and endorse ecologically conscious agricultural practices.

Prices and market demand are additional determining factors. Farmers in Sonipat district formulate crop choices based on economic factors, and the demand for specific commodities on local and international markets might exercise an influence. Moreover, the profitability and charm of cultivating specific crops may be affected by price volatility and market fluctuations.

In recent times, cropping arrangements worldwide, especially in the Sonipat district, have been greatly influenced by climate change. Crop aptness and yield may be influenced by altering climate patterns, an increase in the occurrence of extreme weather incidents, and modifications in temperature and rainfall patterns. In order to mitigate the perils presented by climate change and conserve agricultural production, farmers may need to adapt their planting patterns.

In order to foster sustainable agricultural strategies, enhance farm production, and ensure the socioeconomic welfare of the farming community, it is imperative to comprehend the myriad factors impacting the cropping pattern in the Sonipat district. Policymakers, researchers, and farmers may enhance agricultural methodologies and contribute to the region's overall expansion by thoughtfully contemplating these concerns.

### Materials and Methods

The study area is a part of Upper Yamuna Plain which is composed of the deposition of the sediments brought down by Yamuna river. It is one of the 22 districts of Haryana. In the area elevations roughly vary between 213 to 235 meters above the mean sea level. It lies from 28° 47' 48" to 29° 17' 31" North Latitudes and from 76° 28' 36" to 77° 13' 40" East of Longitudes. The perennial Yamuna river marks the eastern boundary of the district & shares a common boundary of same 49 Kilometer between Uttar Pradesh and Sonipat district. National Capital Territory, Delhi and Jhajjar district lies in the south of the study area. It is connected with Panipat district in the north. To its north-west and west is Jind district, and in the south-west Rohtak district is situated. The Sonipat district has a geographical area of 2122 square Kilometers, containing 2039.99 square kilometers of rural area and 82.01 square Kilometers of urban area. As per the 2011 Census data, Sonipat district having a population of 1450001 out of this 31.27 per cent lives in with urban area and 68.73 inhabiting the rural regions. In agricultural activities 41.4 per cent of main worker engaged. The district has a 683 persons per square kilometer population density.

The study area is divided into four sub- divisions & eight community development blocks (C.D. Block) and contain 319 inhabited & 13 uninhabited villages. The research work is based on the primary and secondary data. All eight C.D. Blocks of Sonipat district namely Ganaur, Murthal, Sonipat, Rai, Kharkhoda, Gohana, Mundlana and Kathura, were selected arbitrarily to collect the data. One sample village was arbitrarily chosen from each C.D. Block resulting in a grand total of eight villages namely Teha, Tajpur, Pinana, Kheri Mana Jat, Sehari, Garhi Ujalekhan, Isspur Kheri and Rindhana. Twenty five agriculturists were selected arbitrarily from every sample village to engage in the examination. In this manner, 200 participants were

encompassed in the sample of the study. A premeditated and meticulously organised interview agenda was employed to obtain the data. The objective of the survey was to collect relevant information on the cultivation patterns and related factors in the Sonipat district. The interview timetable ensured that data collection was standardised and steady. After its gathering, the data was scrutinized utilising SPSS (Statistical Package for Social Sciences), a well-liked statistical analysis software. SPSS provided the tools necessary to analyse the data collected and offer enlightening discoveries on the cultivation patterns in the Sonipat district.

However secondary data is collected from published and unpublished sources of various offices like District Statistical Office, Sonipat, Census Handbook district Sonipat and Deputy Director of Agriculture office, Sonipat etc.

A comprehensive understanding of the cultivation patterns and the factors influencing them in the Sonipat district can be achieved by conducting this investigation with a sample size of 200 participants. The discoveries of this investigation may assist in the establishment of policies, the formulation of agricultural strategies, and knowledgeable decision-making in the region.

### Results and Discussion

The table provides data on the cultivation of various crops in study area during two different agricultural years, 1970-71 and 2000-01. It presents the total hectare of land cultivated for each crop, along with the percentage of Total Cropped Area (TCA) that each crop occupies in both years. Additionally, the table shows the percentage change in cultivation from 1970-71 to 2000-01 for each crop.

The table reveals important insights into the changes in crop cultivation patterns in Sonipat district over a span of three decades.

#### A) Cereals

- **Wheat:** Wheat cultivation experienced significant growth, increasing from 90500 hectares (37.77% of TCA) in 1970-71 to 139,500 hectares (49.29% of TCA) in 2000-01, representing a remarkable growth of 30.50%.
- **Barley:** Barley cultivation decreased significantly from 6800 hectares (2.84% of TCA) in 1970-71 to 400 hectares (0.14% of TCA) in 2000-01, showing a sharp decline of 95.07%.
- **Rice:** The tremendous positive change (861.6%) is noted in rice cultivation which increased from 2.84% of TCA in 1970-71 to 27.31% in 2000-01.
- **Bajra:** Bajra cultivation decreased significantly from 23,000 hectares (9.60% of TCA) in 1970-71 to 7600 hectares (2.69% of TCA) in 2000-01, showing a sharp decline of 71.98%.
- **Maize:** Maize cultivation, on the other hand, declined from 7,900 hectares (3.30% of TCA) in 1970-71 to 200 hectares (0.07% of TCA) in 2000-01, representing a decline of 78.79%.
- **Other Cereals:** The cultivation of other cereals also declined significantly from 2,700 hectares (1.12% of TCA) in 1970-71 to 300 hectares (0.11% of TCA) in 2000-01, showing a substantial decline of 90.10%.

**Table 1:** Changes in Crop Cultivation in Sonipat district from 1970-71 to 2000-01

Crops	1970-71		2000-01		% Change 1970-71 to 2000-01
	Total Hectarge	% of TCA	Total Hectarge	% of TCA	
A) Cereals	137700	57.47	225300	79.16	+ 38.52
Wheat	90500	37.77	139500	49.29	+ 30.50
Barley	6800	2.84	400	0.14	- 95.07
Rice	6800	2.84	77300	27.31	+861.60
Bajra	23000	9.60	7600	2.69	- 71.98
Maize	7900	3.30	200	0.07	- 78.79
Other Cereals	2700	1.12	300	0.11	- 90.10
B) Pulses	22300	9.31	2200	0.78	- 91.62
Gram	19300	8.06	200	0.07	- 99.13
Other pulses	3000	1.25	2000	0.71	- 43.12
C) Fodder Crops	46800	19.53	33400	11.80	- 39.58
Jowar	23600	9.85	12300	4.35	- 55.84
Other fodder crops	23200	9.68	21100	7.45	- 23.04
D) Cash Crops	31600	13.19	21700	7.67	- 41.85
Sugar cane	22900	9.56	8500	3.00	- 68.62
Cotton	3400	1.42	800	0.28	- 80.28
Oilseeds	2200	0.92	4000	1.41	+ 53.26
Fruits & Vege.	3100	1.29	8400	2.98	+131.00
Other M. Crops	1200	0.50	400	0.14	- 72.00

**Total:** 239600 /100.00 /283000 /100.00

**Source:** Statistical Abstracts of Haryana 1970-71 to 2004-05.

TCA=Total Cropped Area

**B) Pulses**

- **Gram:** Gram cultivation witnessed a dramatic decrease from 19,300 hectares (9.31% of TCA) in 1970-71 to 200 hectares (0.78% of TCA) in 2000-01, indicating a substantial decline of 99.13%.
- **Other Pulses:** The cultivation of other pulses also decreased significantly from 3000 hectares (1.25% of TCA) in 1970-71 to 2000 hectares (0.71% of TCA) in 2000-01, showing a decline of 43.12%.

**C) Fodder Crops**

- **Jowar:** Jowar cultivation experienced a notable decline from 23600 hectares (9.85% of TCA) in 1970-71 to 12,300 hectares (4.35% of TCA) in 2000-01, indicating a decline of 55.84%.
- **Other Fodder Crops:** The cultivation of other fodder crops also decreased from 23,200 hectares (9.68% of TCA) in 1970-71 to 21100 hectares (7.45% of TCA) in 2000-01, showing a decline of 23.04%.

**D) Cash Crops**

- **Sugar Cane:** Sugar cane cultivation declined from 22900 hectares (9.56% of TCA) in 1970-71 to 8500 hectares (3.00% of TCA) in 2000-01, indicating a decline of 68.62%.
- **Cotton:** Cotton cultivation also witnessed significant decline from 3,400 hectares (1.42% of TCA) in 1970-71 to 800 hectares (0.28% of TCA) in 2000-01, indicating a decline of 80.28%.
- **Oilseeds:** The cultivation of oilseeds experienced increased from 2,200 hectares (0.92% of TCA) in 1970-71 to 4,000 hectares (1.41% of TCA) in 2000-01, showing a growth of 53.26%.
- **Fruits & Vegetables:** Interestingly, the cultivation of fruits and vegetables experienced significant growth increasing from 3100 hectares (1.29% of TCA) in 1970-71 to 8400 hectares (2.98% of TCA) in 2000-01, showing a growth of 131%.
- **Miscellaneous Crops:** The cultivation of other

miscellaneous crops decreased from 1,200 hectares (0.50% of TCA) in 1970-71 to 400 hectares (0.14% of TCA) in 2000-01, indicating a substantial decline of 72.00%.

Overall, the data indicates significant changes in crop cultivation patterns in Sonipat district over the period, with some crops experiencing remarkable growth, while others faced substantial declines due to various factors such as changing agricultural practices, market demands, and policy interventions.

**Table 2:** Distribution of respondents according to their crop rotation in the last 5 years

“Crop Rotation	No.	Percentage
Wheat-rice	122	61.0
Wheat-Bajra	24	12.0
Wheat-maize	56	28.0
Sugarcane(Annual crop)	46	23.0
Fruits & Vegetables-Pulses	35	17.5
Fodder-Oilseeds	58	29.0
Tobacco-peas	32	16.0
Peas-potato	45	22.5
Tobacco-maize	10	5.0
Radish-onion	26	13.0
Onion-maize	8	4.0
Cabbage-cucumber	39	19.5”

The crop rotations embraced by the farmers over the previous five years encompass wheat following rice, wheat following bajra, wheat succeeding maize, sugarcane annual crop, fruits & vegetables following pulses, tobacco succeeding peas, peas succeeding potato, maize succeeding tobacco, radish following onion, onion succeeding maize, and cabbage following cucumber. The corresponding proportions from the total of 200 respondents are 61.0, 12.0, 28.0, 23.0, 17.5, 29.0, 16.0, 22.5, 5.0, 13.0, 4.0, and 19.5, respectively.



These discoveries emphasise the varied crop rotation practices among the participants and showcase their acknowledgment of the advantages linked with implementing crop rotation tactics. Crop rotation not only enhances soil vitality and fecundity but also contributes to sustainable agricultural methodologies by diminishing dependence on chemicals and pesticides. The implementation of diverse crop rotations by the farmers showcases their dedication to optimising efficiency and safeguarding the enduring viability of their agricultural systems.

**Table 3:** Distribution of respondents according to the adoption of new technology introduced in their area during the last 5 years

New Technology	Yes	No
Hybrid seeds	46	154
Potato sower	38	162
Laser land leveling	32	168

The updated information suggests the embrace of novel technology among the participants. Out of the 200 participants, 46 (23%) embraced hybrid seeds, while the vast majority of 154 respondents (77%) did not. Likewise, 38 participants (19%) embraced the utilisation of a potato disseminator, whereas 162 participants (81%) abstained from it. For laser terrain flattening, 32 participants (16%) embraced the innovation, whereas 168 participants (84%) did not.

These discoveries imply that the implementation of novel technology in the region over the past 5 years has been comparatively restricted. Only a limited quantity of farmers have adopted the utilisation of hybrid seeds, potato planters, and laser land flattening technology. The majority of participants either lacked knowledge about these technologies or encountered limitations in resources, hindering them from embracing novel progressions.

These findings underscore the necessity for heightened endeavours in technology transference and outreach amenities to distribute knowledge and furnish essential provisions to farmers. Promoting the acceptance of novel technologies can amplify agricultural productivity, efficacy, and sustainability in the area.

**Table 4:** Distribution of the respondents according to the reasons for change in cropping pattern

Reason	Yes	No
Adoption of new technology	68	132
Shift in consumption patterns	54	146
Growing trend of vegetable consumption	94	106

The adoption of new technology was regarded as a rationale by 68 participants (34%), whereas the vast majority of 132 participants (66%) did not deem it a noteworthy element. Likewise, 54 participants (27%) cited a change in consumption habits as a rationale, whereas 146 participants (73%) did not perceive it as a significant impacting element. The increasing tendency of vegetable consumption was deemed a cause for alterations in cropping patterns by 94 participants (47%), whereas 106 participants (53%) did not perceive it as a noteworthy factor. These updated discoveries offer valuable perspectives into the perceptions of participants regarding the rationales behind alterations in cropping patterns. It emphasises the diverse significance ascribed to distinct elements such as, implementation of

novel technology, consumption behavior and the increasing inclination towards vegetable intake.

**Table 5:** Distribution of respondents according to the factors affecting the choice of grown crops in their area

“Factors	Yes	No
Climate	145	55
Cost	113	87
Production/yield	88	112
Labor cost	62	138
Marketing	128	72
New crops	9	191
Other income opportunity	23	177
Water availability	142	58
Soil condition	126	74
Perishability	6	194”

The showcased chart emphasises the elements impacting the selection of cultivated plants among the participants. Out of the 200 participants, 145 (72.5%) regarded climate as a determinant impacting their crop selection, whereas 55 respondents (27.5%) did not. Expense was recognised as a determinant by 113 participants (56.5%), whereas 87 participants (43.5%) did not perceive it as impactful. Likewise, 88 participants (44%) perceived that production/yield impacted their crop selection, whereas 112 participants (56%) did not.

Regarding labour cost, 62 participants (31%) recognised it as a factor impacting their crop selection, while 138 participants (69%) did not perceive it as noteworthy. Marketing was deemed a determinant by 128 participants (64%), while 72 participants (36%) did not ascribe their crop selection to marketing considerations. Only 9 participants (4.5%) cited the incorporation of novel crops as a contributing element, whereas 191 participants (95.5%) did not. Additional revenue possibilities were perceived as a determinant by 23 participants (11.5%), whereas 177 participants (88.5%) did not regard it as impactful.

Water accessibility played a noteworthy role, with 142 participants (71%) perceiving it as a factor influencing their crop selection, whereas 58 participants (29%) did not. Likewise, 126 participants (63%) recognised soil condition as a determinant, whereas 74 participants (37%) did not. Fascinatingly, only 6 participants (3%) indicated perishability as a determinant impacting their selection of crops, whereas 194 participants (97%) did not.

These discoveries illustrate the varied elements that impact the selection of cultivated crops among the participants. Climate, expenditure, output, promotion, water accessibility, and soil quality surfaced as notable factors influencing crop selection. The consciousness of these elements can aid farmers in making knowledgeable choices and implementing appropriate crop selection tactics for enhanced agricultural efficiency and sustainability.

**Discussion**

**Factors Affecting the Cropping Pattern:**

- **Climate:** The majority of respondents (145 out of 200) expressed that their selection of crops was impacted by the climate. The assortment of crops that may thrive in these conditions is impacted by the unique climatic characteristics of the Sonipat district, encompassing temperature, precipitation patterns, and water scarcity.
- **Expense:** 113 participants (56.5%) expressed that

expense played a significant role in their selection of crop. The profitability and viability of cultivating specific crops are greatly impacted by economic aspects, such as input expenses, workforce expenses, and market pricing.

- **Production/Yield:** 88 respondents (44%) expressed that crop selection was influenced by potential production and output. To ensure a steady revenue, farmers prioritise crops that yield enhanced productivity and profitable returns.
- **Labour Expense:** Among the 62 participants, or 31%, labour expense was cited as a factor in their selection of crop. Cultivating crops that require ample manpower or employing automation and modern farming methods relies on the expense and accessibility of workforce.
- **Marketing:** 128 participants (64%) indicated they deliberated on marketing facets when selecting their crop. Farmers' selections to opt for crops with superior market prospects and fiscal feasibility are impacted by market demand, price fluctuations, and availability of market avenues.
- **Novel Crops:** Merely 9 participants (or 4.5% of the sample) mentioned the incorporation of novel crops as a determining element. Farmers may have opportunities to access specialised markets or adapt their crop production to accommodate evolving consumer preferences through the introduction of novel crop varieties or crop diversification.
- **Additional Revenue Streams:** 23 participants (11.5%) admitted that alternative income opportunities influenced their decision of crop. Crops that offer supplementary earnings through value-enhanced products, agritourism, or alternative revenue streams might be contemplated by farmers.
- **Water Accessibility:** 142 participants (71%) cited water accessibility as a determining aspect for choosing their crop. Farmers select crops that are highly resistant to drought or require minimal water because of the region's arid weather conditions, reliance on precipitation, or restricted water resources.
- **Soil Characteristic:** Out of the 200 participants, 126 (63%) expressed that soil characteristic had an influence on their selection of crop. Farmers consider factors such as soil fecundity, consistency, and suitability for specific crops as diverse crops possess distinct soil requirements.
- **Perishability:** 6 participants mentioned that it impacted their selection of crop in any manner. This demonstrates that in the crop selection procedure in the Sonipat district, spoilage might not be a significant element.
- **Use of Novel technologies:** Only 68 respondents (34%) ascribed alterations in cropping patterns to the use of novel technologies. This demonstrates that the participants' embrace of modern farming techniques has been rather sluggish.
- **Alterations in Consumption Patterns:** Among the 54 participants, or 27%, who engaged in this practise, cropping patterns were modified due to shifts in consumption patterns. Farmers' crop decisions are influenced by changing dietary preferences as well as increasing consumer demand for specific commodities, such as produce.
- **Escalating Vegetable Consumption Trend:** In

accordance with 94 participants (47%), cultivation patterns have altered due to the surging vegetable consumption trend. This is in line with the requirement for new sustenance and the increasing focus on nourishing consumption habits.

These findings exhibit the intricacy of the factors influencing cultivation patterns in the Sonipat district. Farmers' choices are impacted by a multitude of elements, such as weather conditions, expenses, output, workforce, promotion, innovative advancements, water availability, soil condition, and evolving consumer inclinations. Comprehending these components is crucial for formulating resource-effective agricultural strategies, upholding the socioeconomic triumph of the nearby farming community, and advocating for sustainable agricultural methodologies.

### Conclusion

In conclusion, the purpose of this research was to investigate the variables that influence cropping patterns in the Sonipat district of Haryana in India. A poll with 200 participants revealed that changes in cropping patterns are most significantly influenced by marketing and climatic change. This was discovered via the findings of the survey. Crop selection was also influenced by socioeconomic factors, such as the amount of land held by individuals. The selection of crops that are suited for a semi-arid climate was heavily impacted by a number of geo climatic parameters, including temperature, rainfall, soil type, and the availability of water. Cropping patterns have been further influenced by factors like as government policy, market demand, and the growing effect of climate change. According to the findings of the study, it is essential for decision-makers, researchers, and farmers in the area to have a comprehensive knowledge of these aspects in order to design environmentally responsible agricultural policies and improve the quality of people's lives in the region.

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