

International Journal of Statistics and Applied Mathematics

ISSN: 2456-1452

Maths 2024; SP-9(1): 232-237

© 2024 Stats & Maths

<https://www.mathsjournal.com>

Received: 21-11-2023

Accepted: 26-12-2023

Vishnu S Meena

Assistant Professor, Department
of Agricultural Economics,
College of Agriculture, SKNAU,
Jobner, Rajasthan, India

Sweta Singh

Assistant Professor, Department
of Agricultural Economics
College of Agriculture, SKNAU,
Jobner, Rajasthan, India

Shirish Sharma

Assistant Professor, Department
of Agricultural Economics,
SKRAU, Bikaner, Rajasthan,
India

Sarita Meena

Assistant Professor, (Agricultural
Economics) Department of
Agriculture, Jagannath
University, Chaksu, Jaipur,
Rajasthan, India

Dr. Dushyant Verma

Assistant Librarian, College of
Agriculture, SKN Agriculture
University, Jobner, Rajasthan,
India

Corresponding Author:

Vishnu S Meena

Assistant Professor, Department
of Agricultural Economics,
College of Agriculture, SKNAU,
Jobner, Rajasthan, India

An analysis of doubling income from crop diversification in Haryana

**Vishnu S Meena, Sweta Singh, Shirish Sharma, Sarita Meena and Dr.
Dushyant Verma**

DOI: <https://dx.doi.org/10.22271/math.2024.v9.i1Sd.1592>

Abstract

This paper examines the change in Income of farmer's due to crop diversification trend in northern India i.e. Haryana during the recent period. It is based on secondary data collected from various sources. Findings suggest that share of forestry and logging has declined in agricultural income while fisheries have gained. Agriculture including livestock has also gained. Among crop groups, percent of GCA under sugarcane, spices, fibers and cotton has increased significantly whereas it has declined for fodder crops, pulses and cereal. However, paddy, maize and wheat gained. Further, results of change in area, production and yield exhibited gains for cotton, gram, sugarcane, wheat and maize. The future strategy towards crop diversification should favor sustainable crops instead of water incentive crops. Recently, agricultural diversification has attracted considerable attention. The term can be interpreted in several ways such as shift from agriculture to non-agriculture, crops to allied sectors and within crop sector, shift from food grains to high value crops i.e. fruits, vegetables, flowers and spices, etc. There have been significant changes in the pattern of agricultural diversification at the state and regional level. Crop diversification is intended to give a wider choice in the production of a variety of crops in a given area so as to expand production related activities for various crops and also to lessen risk.

Keywords: Crop diversification, agriculture, GCA, yield, income

Introduction

India is a country of billion plus population. More than 70 percent of India's population lives in rural areas whose main occupation of the workers in agriculture. Moreover, Indian agriculture is characterized by small farm holdings. The average farm size in the country is 1.57 hectares. Around 93 percent of farmers have land holdings smaller than 4 hectares and they cultivate nearly 55 percent of the arable land. On the other hand, only 1.6 percent of the farmers have operational land holdings above 10 hectares and they utilize 17.4 percent of the total cultivated land. Owing to diverse agro-climatic conditions in the country, a large number of agricultural items are produced. 'Self-reliance' in food grains has been the cornerstone of our policies in the past 50 years. As a result, around 63 percent of the gross cropped area is under food grain crops (cereals and pulses). The pattern of crops is increasingly influenced by economic and technological factors. This is due to expansion in irrigation, infrastructure development, penetration of rural markets, development and spread of short duration and drought resistant crop technologies of late, high value crops such as fruits and vegetables have attracted the farmers and acreage under these crops is increasing continuously.

Crop diversification in northern states of India i.e. Haryana is generally viewed as a shift from traditionally grown less remunerative crops to more remunerative crops. In this paper, we shall focus on crop diversification from one crop to other crop. The analysis in this article is based on secondary data collected from Agricultural Statistics at a Glance published by the Ministry of Agriculture, Government of India and Fertilizer statistics published by Fertilizer Association of India, New Delhi. We have covered a period from 2004-05 to the recent period. The crop sub-sector has been steadily diversifying in northern states of India i.e. Haryana. Evidences show that the non-foodgrain crops have gradually replaced food grain crops.

Non-foodgrain crops, like oilseeds, fruits, vegetables, spices and sugarcane are primarily substituted for coarse cereals in search of higher incomes. We have covered a period from 2004-05 to 2011-12 because significant change in crop pattern has taken place after 2000. A comparison of changes in these two years 2004-05 and 2011-12 is expected to provide some useful insights for future sustainability of agriculture.

Methodology

This study is conducted in the state of Haryana. It is based on published and un-published sources of secondary and primary data. The relevant information about the state and districts was obtained from various issues of the Statistical Abstract of Haryana, Government of Haryana, Panchkula. Further, the time series data on area, production and yield of paddy and alternative crops for selected districts and state were also culled out from this source. The required preliminary information regarding the selection of blocks and villages was obtained from the district officials. The meetings with the Deputy Directors of Agriculture of selected districts were useful and informative. The crops for the study were decided as per the study design according research.

were selected on the same criterion. A questionnaire was canvassed to the farmers growing these crops. All farm size categories i.e. small, medium and large were covered in the sample. The number of farm households in each category was decided according to their proportion at the district level. The primary data pertaining to the year 2012-13 were collected from 210 farmers.

Haryana has introduced progressive agricultural schemes to boost sustainable growth in agriculture. There are over three dozen schemes aimed at agricultural development in Haryana which are being implemented by the state directly or in collaboration with the central government. Major thrust of these schemes and policies are to make agricultural production more sustainable, remunerative and climate resilient by promoting location specific integrated/composite farming. For instance, the objective of the Scheme for Promotion of Crop Diversification is to promote the alternate crops like summer moong, sunflower and maize in order to reduce wheat and paddy crop rotation. Cultivation of rice and wheat over a prolonged period has caused degradation of natural resources to a great extent.⁵ The major rationales for promotion of crop diversification are as follows: a.) due to extensive specialised cultivation ground water table has significantly deteriorated; b.) government procurement agencies are facing challenge in procuring and storage of conventional cereals; c.) central agencies are not able to procure 100 percent wheat and rice based on MSP; d) due to high dependence on import to meet the shortage of pulses and edible oil seeds etc.; and e.) change in consumption pattern especially among middle- and high-income groups. ⁵Brief description of schemes for the year 2015-16, Government of Haryana. ⁴ Objectives of the Study Against this background, the present study has been conducted to assess the prospects and challenges as also to evaluate the success of diversification of agricultural crops in Haryana. The present study postulated the following objectives keeping in mind that the changing cropping pattern is thought to be determined by the interactive effects of several factors:

1. To access the status and magnitude of crop diversification in the state;
2. To analyse the impact of physical, socio-economic and technological factors on crop diversification;

3. To analyse the status of utilization of cropping intensity and crop diversification schemes accessible to all categories of farmers;
4. To study the feasibility of changing crop patterns in respect of improvement in productivity of other crops in rotation;
5. To examine the impact of input and resource-related factors like irrigation, rainfall, soil fertility and availability of high yielding seeds and fertilizers on crop diversification;
6. To study the farmers' perception on institutional and infrastructure related challenges in the process of diversification of crops; and
7. To critically study the viability of cropping diversification related to house hold requirements including food and fodder self-sufficiency requirement, investment capacity; training of farmers, storage and processing. Sample Organisation and Size The study aimed at assessing the determinants, prospects and challenges as also to evaluate the success of diversification of agricultural crops in Haryana in general and evaluation of Crop Diversification Program (CDP) 2016-17, in the Original Green Revolution Districts of Haryana in particular where CDP was rolled out. These districts were Yamunanagar, Ambala, Karnal, Kurukshetra, Kaithal, Panipat and Sonapat in agroclimatic zone I6 and Jind Fatehabad, Sirsa in agro-climatic zone II. Apart from the secondary sources, the study needed evidence from the field for which an intensive field survey was conducted in ten sampled villages in the districts of Yamunanagar, Kurukshetra, Kaithal, Fatehabad, Sirsa and Sonapat. These districts were selected on the basis of average of paddy and wheat concentration which has been discussed in detail in the chapter IV. The purpose of choosing ten villages through the above mentioned method is to study the level, reason, prospects and challenges of crop diversification longitudinally and horizontally and to locate the current trends in crop diversification, and to seek factors endorsing the ensuing trends. The state of Haryana as compared to many other states is geographically relatively uniform. Although the study proposes to cover ten villages, it has state-wide relevance. The justification for selecting these villages lies in the fact that these villages represent the level of crop diversification at all levels representing the entire state as a sample. A combination of probability and non-probability sampling methods including random, stratified random, purposive and snowball sampling have been used for the purpose of generating holistic information for the study. Villages were selected randomly with the help of personnel of Department of Agriculture of the respective Districts of Yamunanagar, Kurukshetra, Kaithal, Fatehabad, Sirsa and Sonapat. Further, thirty farmers in each of the sampled villages (total one hundred and eighty farmers) were chosen for interview based on a stratified layers of their land holding sizes ranging from marginal, small, medium to large. Informal interactions and interviews were conducted to a number of officials from department of agriculture including Deputy Directors (Agriculture), ATMs (Assistant Technology Manager), TA (Technical Advisors), Block Officers, Agriculture Development Officers, Quality Control Inspectors; Members of Village Panchayat, Village Level Voluntary Groups, Members of

Farmer's Associations, Farm Entrepreneurs, Agricultural Experts, Academicians, Trader, Manufacturers of agricultural implements and Labourers etc. In this way the sample size of the present study went beyond the originally stipulated 234 samples and tried as much as possible to cover a vast range of views and information from different stakeholders. 6 Methodological Approach The study followed both quantitative and qualitative methods for an extensive analysis of the issue at hand and to arrive at the concluding observations. Structured and semi structured schedules with both open and closed ended questions were used to gather both quantitative and qualitative data. Interviews were conducted with the target population as mentioned above. One to one interviews and Focus Group Discussions (FGDs) were also held comprising the research team, government officials and the various categories of respondents. The filled-in questionnaires were coded with the support of the data experts and field investigators. Thus, the report highlights various aspects of geographical variations,

issues, prospects and challenges in crop diversification in the state with plausible trends. The report is prepared in a precise manner so as to help policy makers to identify specific issues and challenges and take concrete steps towards the success of crop diversification in Haryana. 7 Chapter II Status, Trend and Impact of Mono-cropping in Haryana Overview of Crop Intensity The share of agriculture in the SGDP rose significantly in the subsequent

Results and Discussion

At the outset, we present income drawn from sub-sectors of agriculture. Table 1 indicates the share of income from sub-sectors of agriculture in India from 2004-05 and 2011-12. These include (a) agriculture, (b) forestry & logging, (c) fishing. It may be observed that percent share of crops and livestock increased marginally between 2004-05 and 2011-12. It has increased from 84.30 percent of total agriculture in 2004-05 to 84.95 percent in 2011-12.

Table 1: Share of income from sub-sectors of Agriculture in India (2004-05 to 2011-12)

Year	Agriculture	Forestry and logging	Fishing	Agriculture, forestry and fishing
2004-05	476634 (84.30)*	61640 (10.90)	27152 (4.80)	565426 (100.00)
2005-06	502996 (84.61)	62742 (10.55)	28749 (4.84)	594487 (100.00)
2006-07	523745 (84.59)	64795 (10.46)	30650 (4.95)	619190 (100.00)
2007-08	556956 (85.02)	65697 (10.03)	32427 (4.95)	655080 (100.00)
2008-09	555442 (84.71)	66932 (10.21)	33315 (5.08)	655689 (100.00)
2009-10	557715 (84.38)	68877 (10.42)	34395 (5.20)	660987 (100.00)
2010-11	610905 (85.11)	70509 (9.82)	36400 (5.07)	717814 (100.00)
2011-12	643543 (85.37)	71816 (9.53)	38473 (5.10)	753832 (100.00)
2012-13*	649424 (84.95)	73864 (9.66)	41222 (5.39)	764510 (100.00)

Source: Government of India, 2014.

* Denotes percentages of Total Agriculture.

Base Year: 2004-05.

Evidently, this is not a major shift. On the other hand, proportion of income from forestry and logging has declined through this period. Fisheries emerged as the rising sub-sector of agriculture. The higher growth in inland fisheries was basically attributed to the overwhelming progress in aquaculture, both in fresh and brackish waters.

Its share increased from 4.80 to 5.39 percent during this period. The remarkable progress in fisheries sector was the outcome of a well-knit strategy to accomplish multiple goals of augmenting production, enhancing export, and overcoming poverty of fishermen. Several production and development-oriented programs were launched in the potential areas. To sum up, some change in shares of sub-sectors could be

observed but it cannot be termed as a major shift. After analyzing share of income from agriculture, forestry and fishing, we have examined percentage share of important crop groups during 2004-05 and 2011-12.

We have included important crop groups ranging from cereals (51.57%), pulses (12.43%) to fodder crops (5.01%). The data clearly indicate that cereals occupying an area of 51.57 percent of GCA in 2004-05 are dominant crops in India. Oilseeds and pulses were allotted 15.89 and 12.43 percent respectively. Fodder crops (5.01%) and fibers including cotton (4.92%) fall next. Vegetables (2.86%), sugarcane (2.50%) and fruits (2.04%) received more than 2 percent of cultivated area.

Table 2: Percentage of GCA under Important Crops in India (2004-05 and 2011-12)

Crop	% share in 2004-05	% share in 2011-12	% change
Cereals	51.57	51.20	-0.72
Pulses	12.43	11.98	-3.62
Sugarcane	2.50	2.82	12.80
Spices	1.6	1.86	16.25
Fruits	2.04	2.03	-0.49
Vegetables	2.86	2.79	-2.45
Oilseed	15.89	14.43	-9.19
Fibers including cotton	4.92	6.73	36.79
Plantation crops	1.16	1.33	14.66
Fodder crops	5.01	3.96	-20.96
Others	0.2	0.87	335.00
All crops	100.00	100.00	0.00
Source: Fertilizer Statistics, FAI, 2013-14		Base Year: 2004-05	

It may be observed that share of GCA under cereals (-0.72%) and pulses (-3.62%) declined in 2011-12 but the pattern remains by and large the same. An analysis of percentage change in share of GCA under important crop groups between

2004-05 and 2011-12 indicates that highest percentage change could be noticed in case of fibers (36.79%) followed by spices (16.25%) and plantation crops (14.66%).

Table 3: Percentage of GCA under Important Food Grains in India (2004-05 and 2011-12) (Base Year: 2004-05)

Crop	% share in 2004-05	% share in 2011-12	% change
Rice	22.33	22.33	0.00
Jowar	4.76	3.17	-33.40
Bajara	4.86	4.51	-7.20
Maize	3.94	4.41	11.93
Wheat	13.89	15.41	10.94
Gram	3.52	3.37	-4.26
Tur	1.84	1.93	4.89
Source: FAI, 2013-14			

Nevertheless, percentage change under fodder crops (-20.96%), oilseeds (-9.19%) and pulses (-3.62%) was found negative. It could be due to variety of factors such as relative profitability, irrigation and availability of technology.

It would be interesting to analyze differences of GCA in important cereal crops. Table 3 demonstrated percentage change in share of important cereal crops in gross cropped area during 2004-05 and 2011-12. We have included major food grains such as rice, jowar, bajra, maize, wheat, gram and tur. An analysis of data for the years 2004-05 and 2011-12

indicates nil change in area under rice. Maize (11.93%) followed by wheat (10.94%) occupied the highest percentage of GCA in 2004-05 as well as in 2011-12. Among coarse cereals, bajara and jowar were found important. Further results depict a negative trend in percentage change of GCA for jowar (-33.40%) followed by bajra (-7.20%) and gram (-4.26%). After analyzing the GCA for major food grains, it is important to analyze the percentage of area irrigated under important crops in India during 2004-05 and 2011-12.

Table 4: Percentage of Area Irrigated under Important Crops in India (2004-05 and 2011-12)

Crop	% share in 2004-05	% share in 2011-12	% change
Rice	52.60	58.70	11.60
Jowar	7.50	9.70	81.33
Bajara	6.30	8.5	96.83
Maize	19.1	25.30	31.94
Wheat	88.4	92.90	6.90
Barley	63.8	74.80	9.56
Total Cereals	49.1	57.70	12.42
Gram	30.2	33.50	20.20
Total Pulses	13.6	16.10	44.85
Total Foodgrains	42.2	49.80	14.45
Total Oilseeds	24.7	27.60	24.70
Sugarcane	92.3	94.30	6.61
Cotton	34.1	30.40	17.89
All Crops	40.3	45.80	15.14
Source: Fertilizer Statistics, FAI, 2013-14 Base Year: 2004-05			

Table 4 indicates percentage change of area irrigated under important crops in India during 2004-05 and 2011-12 for fourteen major crops which show that sugarcane (92.3%) has the highest percentage share followed by wheat (88.4%), barley (63.8%), rice (52.60%) and total cereals (49.1%) during 2004-05. The same pattern of percentage share was found in the year 2011-12. Further, the analysis of percentage change of area irrigated indicates that the highest change occurred in bajra (96.83%) followed by jowar (81.33%) and total pulses (44.85%) whereas the least change in percentage area irrigated could be observed for sugarcane (6.61%), wheat (6.90%) and barley (9.56%).

For understanding of changes in the area, production and yield of important crops in India, it is important to calculate

the percentage change in area, production and yield between 2004-05 and 2011-12. Table 5 demonstrates a percentage change in area, production and yield of major crops like rice, jowar, bajra, maize, wheat, barley, total cereals, gram, total pulses, total food grains, total oilseeds, sugarcane and cotton. An analysis of table 5 clearly indicates highest percentage change in area during this period under sugarcane (36.53%) followed by cotton (36.31%), gram (26.91%) whereas there is a negative percentage change in jowar (-31.65%), bajra (-20.96%) and total oilseeds (-3.77%). In terms of production, highest percentage change occurred in cotton (108.30%) followed by gram (61.49%), maize (57.06%) whereas there is a negative percentage change in production of bajra (27.09%).

Table 5: Percentage change in Area, Production and Yield of Important Crops in India (2004-05 and 2011-12)

Crop	Area- '000 has								
	Production- '000 Tonnes								
	Yield- Kgs/ha								
Crop	2004-05			2012-13			Percentage Change		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
Rice	41907	83131.7	1984	42753.90	105231.60	2461	2.02	26.58	24.04
Jowar	9092.30	7244.30	797	6214.40	5281.50	850	-31.65	-27.09	6.65
Bajara	9232.90	7931.30	859	7297.40	8742.00	1198	-20.96	10.22	39.46
Maize	7430	14172	1907	8672.6	22258.2	2566	16.72	57.06	34.56
Wheat	26383	68636.9	2602	30003.3	93506.5	3177	13.72	36.23	22.10
Barley	616.5	1207.1	1958	695.1	1752.4	2521	12.75	45.17	28.75
Total Cereals	97315	185233.3	1903	97518.9	238782.3	2449	0.21	28.91	28.69
Gram	6714.6	5469.4	815	8521.8	8832.5	1036	26.91	61.49	27.12
Total Pulses	22763	13129.5	577	23256.8	18342.5	789	2.17	39.70	36.74
Total Foodgrains	120078	198362.8	1652	120776	257124.7	2129	0.58	29.62	28.87
Total Oilseeds	27523	24353.5	885	26484.4	30939.7	1168	-3.77	27.04	31.98
Sugarcane	3661.5	237088.4	64752	4998.9	341199.7	68254	36.53	43.91	5.41
Cotton	8786.6	16428.6	318	11977	34220	486	36.31	108.30	52.83

Source: Fertilizer Statistics, FAI, 2013-14 Base Year: 2004-05

After analyzing, area and production of these important crops, we found an increasing trend in yield. A positive percentage change occurred in the yield of all major crops. The highest percentage change was recorded in the productivity of cotton (52.83%) followed by bajra (39.46%), total pulses (36.74%) whereas the least percentage change could be observed in case of sugarcane (5.41%), jowar (6.65%) and wheat (22.10%).

After measuring the percentage change in GCA, irrigated area and area, production and yield for the major crops in India during 2004-05 and 2011-12 it is important to analyze achievement of the targets. Table 6 predicts information about achievements of targets of production of major crops in India during study period. It shows that production of cotton (109.53%) exhibited a commendable progress in terms of achieving the target followed by oilseeds (92.94%) and coarse cereals (90.92%) during 2004-05.

Table 6: Achievement of Targets of Production of Major Crops in India (2004-05 & 2011-12)

Item	2004-05			2011-12		
	Target	Achievement	% achieved	Target	Achievement	% achieved
Rice	93.5	83.13	88.91	102	105.3	103.24
Wheat	79.5	68.64	86.34	84	94.88	112.95
Coarse Cereals	36.8	33.46	90.92	42	42.01	100.02
Pulses	15.3	13.13	85.82	17	17.09	100.53
Foodgrains	225.1	198.36	88.12	245	259.29	105.83
Oilseeds	26.2	24.35	92.94	33.6	30.01	89.32
Sugarcane	270	237.09	87.81	350	361.04	103.15
Cotton	15	16.43	109.53	34	35.2	103.53
Jute & Mesta	11.8	10.27	87.03	12.3	11.4	92.68

Source: Agriculture Statistics at a Glance MoA, GoI 2005-06 & 2013-14 Base Year: 2004-05

During 2011-12 wheat has the best recorded for the achievement of the target (112.95%) followed by food grains (105.83%) and cotton (103.53%).

strategy through research and development in agriculture in India.

Policy implications

In view of climate change, problems of sustainability of agriculture and shift in pattern of food consumption by the population towards high value foods, it is essential to diversify the crop pattern in favor of these crops including pulses and oilseeds in which country is export dependent. The sector is already facing the problem in terms of improving food and nutritional security with declining share of cultivable area in India.

In recent years, agriculture in the country has experienced significant shifts in area under commercial crops, fruits and vegetables. The crop diversification is also essential for small and marginal farmers who constitute four-fifths of the actual numbers of the operational holdings. These developments have significant implications for diversification of agriculture. Judicious use of environmental resources such as water which is already scarce shall become significant in the further

References

1. BIRTHAL PS, JOSHI PK, ROY D, THORAT A. Diversification in Indian Agriculture towards High-Value Crops (Vol. 727). Intl Food Policy Res Inst; c2007.
2. BIRTHAL PS, JOSHI PK, ROY D, THORAT A. Diversification in Indian Agriculture toward High-Value Crops: The Role of Small Farmers. Can J Agr Econ/Revue Canadienne d'agroeconomie. 2013;61(1):61-91.
3. BHALLA GS, GURMAIL SINGH. Economic liberalization and Indian agriculture: A statewide analysis. Econ Political Weekly; c2009. p. 34-44.
4. BHALLA GS, GURMAIL SINGH. Recent developments in Indian agriculture: A state level analysis. Econ Political Weekly. 1997:A2-A18.
5. HEGDE DM, TIWARI SP, RAI M. Crop diversification in Indian Agriculture. Agric Situat India. August 2003:351-354.

6. Jha B. Agricultural Diversification in India with special reference to Haryana.
7. Joshi PK, Gulati A, Birthal PS. Agricultural diversification in India. 2007;219-242.
8. Joshi PK, Joshi L, Birthal PS. Diversification and its impact on smallholders: Evidence from a study on vegetable production. *Agric Econ Res Rev.* 2006;19(2):219-236.
9. Kalaiselvi V. Patterns of crop diversification in Indian scenario. *Ann Biol Res.* 2012;3(4):1914-1918.
10. Mehra S. Instability in Indian agriculture in the context of the new technology. *Intl Food Policy Res Inst.* 1981;25.
11. Munshi K. Social learning in a heterogeneous population: technology diffusion in the Indian Green Revolution. *J Dev Econ.* 2004;73(1):185-213.
12. Murgai R, Ali M, Byerlee D. Productivity growth and sustainability in post-Green Revolution agriculture: the case of the Indian and Pakistan Punjab. *World Bank Res Obs.* 2001;16(2):199-218.
13. Pandey VK, Sharma KC. Crop Diversification and Self-Sufficiency in Foodgrains. *Indian J Agric Econ.* 1996;51(4):644.
14. Satyasai KJS, Viswanathan KU. Diversification of Indian agriculture and food security. *Indian J Agric Econ.* 1996;51(4):674.
15. Sharma N, Mohan H. Diversification of agricultural sector in Punjab: Growth and challenges. *Agric Situat India.* 2013;69(11):21-31.
16. Singh S. Contract farming for agricultural diversification in the India Punjab: A study of performance and problems. *Indian J Agric Econ.* 2000;55(3):283.
17. Singh S. Crisis and diversification in Punjab agriculture: Role of state and agribusiness. *Econ Political Weekly.* 2004;5583-5590.