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# Five Decades of India's Agricultural Growth Across Crops: Emerging Trends and Patterns

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# Five Decades of India's Agricultural Growth Across Crops: Emerging Trends and Patterns

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## SUMMARY

*This paper has analysed the trends and pattern in agricultural growth and crop output growth at the national level, using time series data from 1967-68 to 2020-21 from published sources. The area under foodgrains in gross cropped area (GCA) declined by 11.62% mainly due to the fall in area under coarse cereals by 16.78% between triennium ending (TE) 1970-71 and TE 2020-21. There was a definite shift from foodgrains to non-foodgrains, such as fruits and vegetables, oilseeds, fiber, and condiments and spices, whose share in both area and in value of output has been increasing during the study period. While the contribution of cereals declined from 32.46% in TE 1970-1971 to 27.41% in TE 2020-21, the share of fruits and vegetables increased considerably from 14.11% to 27.77% during the same period. In TE 2020-21, fruits and vegetables accounted for the largest share of the total value of crop output followed by cereals, oilseeds, fiber and pulses. The study also reveals that diversification towards high value crops (HVCs) offers great scope to enhance farmers' income. The staple crops such as cereals, pulses and oilseeds occupy 77.33% of the GCA but contribute only 46.37% of total value of output of crop sector. Interestingly, almost same value of output (43.58%) was contributed by HVCs (fruits and vegetables, fibres, condiments and spices and sugarcane) which occupy 20.12% of GCA during TE 2020-21. These changes in the relative shares of crops in agricultural growth provide a clear indication of the growing importance of high-value crops in Indian agriculture. However, the long-term growth rate (during 1967-68 to 2020-21) shows that not a single crop registered production growth of more than 4.0% per annum. The results of the crop output growth model indicate that better irrigation facilities, normal rainfall and improved fertilizer consumption will help boost crop output in the country. It may be concluded that there is also a need to improve productivity of small and marginal farmers through development and implementation of small holding farm technologies. The regenerative agriculture through suitable integrated farming system (IFS) models is the need of the hour to improve soil health, make agriculture profitable and sustainable in the long run. Crop diversification towards oilseeds, pulses and horticulture needs to be given priority by addressing the core issues of irrigation, investment, credit and markets in their cultivation. While the Government has adopted the use of MSP as signal to encourage crop diversification, there is also a need for coordinated action from the State Governments to facilitate the shift to high value and less water guzzling crops to enable realization of the objective of doubling farmers' income in a sustainable way.*

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## INTRODUCTION

Over the past seven decades, the Indian economy has undergone a significant structural transformation away from agriculture and towards non-agricultural sectors. The share of agriculture in the country's gross domestic product (GDP) has consistently declined, from an average 55.12 per cent in 1950-51 to 15.51 per cent in the 2021-22. Despite this rapid decline, agriculture continues to be a key sector of the Indian economy because of its strategic importance to food security, employment generation, exports and poverty reduction. The sector employs close to 49 per cent (Periodic Labour Force Survey, 2020) of the country's total workforce and has been important for poverty reduction, especially in the rural areas (Sharma 2011).

The experiences of developed countries show that the transfer of labour force from agriculture to non-agriculture, particularly manufacturing, has promoted production growth in agriculture and thus higher income (Gollin *et al.* 2002). However, India's manufacturing sector witnessed volatile growth and its share in total GVA at basic prices has almost remained constant at 18 per cent in the recent times. Further, since the present economic growth pattern in the country is driven by the services sector (53.74% share in 2021-22 at constant prices), labour absorption outside agriculture sector will continue to be slow until technical education and skill upgradation in rural area improve considerably.

Under these circumstances, higher agricultural growth is critical. It is a matter of concern for policy planners, planners and researchers in recent times (Chand *et al.* 2007; Bhalla and Singh 2009; Vaidyanathan 2010). Sustained agricultural growth, which is facilitated by constant policy and institutional support, could foretell growth in the rural economy and associated secondary activities (e.g., food processing and retail trading). However, policy makers in the country have not given enough attention to agriculture-led rural industrialization. This is despite the fact that agricultural growth per se was not visible during the 1990s (Rao 2003). It is pertinent to note that, the growth performance of agriculture was remarkable during the 1980s. In fact, deceleration during the 1990s was attributed to the reduction in and/or stagnation of public expenditure on agricultural infrastructure, defunct extension services, and biased economic reforms (Mahendra Dev,

2000). The first two decades of the twenty first century has shown the remarkable agriculture growth, particularly during COVID-19 period when other sectors of the economy contracted. This can be largely attributed to the renewed policy thrust from the government (since 2005) to revive agricultural growth through various development programmes, such as are Interest Subvention on crop loans and interest subvention on prompt repayment, National Food Security Mission, the National Agriculture Development Programme (Rashtriya Krishi Vikas Yojana), Pulses Development Programme, E-NAM, National Mission for Sustainable Agriculture, Pradhan Mantri Krishi SinchaiYojana, Paramparagat Krishi Vikas Yojana, Pradhan Mantri Fasal Bima Yojana, Gramin Bahndaran Yojana, Livestock Insurance Scheme, Micro Irrigation Fund, PM-Kisan, Soil Health Card (SHC) Scheme, Agricultural Export Policy-2018, Agri Startups, KCC scheme extended to animal husbandry and fishery farmers, Kisan Sampada Yojana, Mission for Integrated Development of Horticulture, Agriculture Infrastructure Fund, National Mission on Oilseeds and Oilpalm, Promotion of Farmer Producers Organisations, National Project on Organic Farming and MSP at levels of one and half times of the cost of production of 23 major crops, etc. Implementation of these programmes has contributed to agricultural growth and augmented farmers' income in the country while allowing state governments to better leverage and allocate resources to the priority areas of development.

In recent times, trends in India's agricultural growth are relatively well researched themes. Systematic efforts have been made to examine crop output growth and its elements through decomposition analysis (Joshi *et al.* 2006). The present paper is likely to contributes to the existing knowledge on Indian agriculture by estimating crop output growth through econometric methods. It also discusses the trends in agricultural growth at national levels.

## DATA AND METHODOLOGY

The present study is based on the secondary data compiled from various published sources. Data on area, production and yield were collected from the Directorate of Economics and Statistics (DES), Ministry of Agriculture and Farmers' Welfare. Data were collected for major crops for the period 1968-69 to 2020-21. The study period has been divided into five phases, viz., early green revolution (1967-68 to 1980-81), mature green

revolution (1981-82 to 1990-91), early economic reforms (1991-92 to 2000-01), economic reforms (2001-02 to 2020-21) and overall period (1967-68 to 2020-21). Compound annual growth rates (CAGR) have been calculated by using the semi-log method. State-wise and agriculture and allied sector data on value of crop output were compiled from the National Statistical Office, MoSPI, Government of India. Data on Agricultural Gross Value Added (AgGVA), value of output from agriculture and allied sector and capital formation in agriculture and allied sector were compiled from National Accounts Statistics, MoSPI and Agricultural Statistics at a Glance, MoAFW, GoI. For trend analysis, three years' average (triennium ending) of different variables were calculated to even out the inter-year fluctuations and then presented.

## Crop Output Growth Model

The growth performance of the crop sector is influenced by several factors such as use of physical inputs by farmers, markets, irrigation, credit availability, weather conditions and government policies. It is difficult to analyse the effect of all the variables in a simple framework because these variables affect crop output through various mechanisms. However, an attempt has been made here to examine the determinants of aggregate growth of crop output at the national level through the neo-classical growth model, which is described as follows.

The aggregate production function can be specified as

$$Y = F(F, K, R, CI, IRR) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where Y is the aggregate crop output value (2011-12 prices), F is fertiliser consumption, IRR is the gross irrigated area, CI is cropping intensity and R is the rainfall.

The basis for the inclusion of rainfall in the production function is that a significant proportion of cultivated area depends on rainfall and its variation affects crop output substantially. Similarly, as the net sown area remains more or less constant over time during the study period, cropping intensity is taken as proxy for land. The gross irrigated area represents use of water from all sources of irrigation for crop production. Gross capital formation in agriculture is considered as agricultural capital (2011-12 prices).

Assuming the Cobb-Douglas Production Function and taking differentiation of equation (1), the following equation is obtained.

$$\Delta Yt = ß0 + ß1\Delta Ft + ß2\Delta Kt + ß3\Delta IRRt + ß4\Delta CI + ß5\Delta R + ei$$

## RESULTS AND DISCUSSION

### Trends in Gross State Domestic Product and Agricultural Gross Value Added

The share of Agricultural Gross Value Added (AgGVA) in gross state domestic product (GSDP) during 2011-12 to 2019-20 have continuously decreased in all states except in Manipur and Meghalaya. The GSDP at constant prices has been grew at compound annual growth rate (CAGR) of 6.03 per cent per annum during 2011-12 to 2019-20, which has given a positive signal regarding the economic growth of the states. Out of 29 states, while CAGR of 20 states are grew more than the national average, CAGR of rest of the states were still at less than 6 per cent (Table 1). During 2011-12 to 2019-20, the agricultural gross value added (AgGVA) in the country showed an increasing trend and grew at the rate of 3.63 per cent per annum, which, though appreciable is still below the target of 4 per cent set by the India's policymakers. Further, the trend in agricultural growth differs significantly (-15.74% in Chhattisgarh to 8.53% in Maharashtra) across the states. While 4 states, viz., Kerala, Maharashtra, Rajasthan and Telangana have agricultural growth rates more than the national average, the rest of the states have shown less than 3.5 per cent growth in AgGVA. Interestingly, states like Kerala (5.72%), Maharashtra (8.53%), Rajasthan (6.81%) and Telangana (5.90%) have shown an impressive performance in terms of agricultural growth rate, However, the progress of these states are not reflected in terms of percentage share of AgGVA in GSDP in 2019-20 (4-12%).

Some of the major states like Gujarat, Haryana, Madhya Pradesh, Punjab, and Tamil Nadu though displaying steady growth for the entire state economy, have failed to achieve even 3 per cent growth in agriculture and it is a cause of concern. The agricultural sector in the states of Andhra Pradesh, Assam, Bihar, Chhattisgarh, Jammu and Kashmir,

Karnataka, Odisha and Uttar Pradesh needs special attention as their growth rates are negative.

**Table 1: State-wise Share of AgGVA in GSDP in the Economy at Constant (2011-12) Prices (%)**

| State | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 | 2016-17 | 2017-18 | 2018-19 | 2019-20 | Share of AgGVA in SGDP in 2019-20 | CAGR of Ag GVA | CAGR of GSDP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Andhra Pradesh | 13.72 | 13.81 | 14.89 | 13.72 | 11.72 | 11.90 | 12.46 | 11.12 | 11.58 | 11.58 | -4.64 | 8.15 |
| Arunachal Pradesh | 23.12 | 24.87 | 23.97 | 21.12 | 18.80 | 12.80 | 12.49 | 11.78 | 12.72 | 12.72 | 2.36 | 6.16 |
| Assam | 14.40 | 16.95 | 15.35 | 14.79 | 13.39 | 12.99 | 12.11 | 11.77 | 10.70 | 10.70 | -1.38 | 7.41 |
| Bihar | 17.24 | 18.49 | 13.76 | 12.61 | 11.92 | 12.16 | 12.13 | 10.30 | 8.97 | 8.97 | -1.27 | 6.58 |
| Chhattisgarh | 11.38 | 11.59 | 10.86 | 11.01 | 10.38 | 11.48 | 9.06 | 9.53 | 9.17 | 9.17 | -15.74 | 5.87 |
| Goa | 2.42 | 2.87 | 3.48 | 2.66 | 2.23 | 2.16 | 2.08 | 1.94 | 1.90 | 1.90 | 2.18 | 6.15 |
| Gujarat | 12.92 | 9.23 | 11.78 | 10.38 | 8.71 | 8.53 | 8.62 | 6.64 | 7.06 | 7.06 | 1.46 | 9.63 |
| Haryana | 13.74 | 12.02 | 11.27 | 9.71 | 8.85 | 8.93 | 8.62 | 8.29 | 7.84 | 7.84 | 0.58 | 8.41 |
| Himachal Pradesh | 9.26 | 9.59 | 10.51 | 8.87 | 9.15 | 7.53 | 6.53 | 6.03 | 6.94 | 6.94 | 1.08 | 6.91 |
| Jammu and Kashmir | 10.16 | 9.08 | 9.29 | 7.04 | 8.31 | 7.98 | 7.44 | 6.91 | 6.75 | 6.75 | -1.28 | 5.86 |
| Jharkhand | 8.89 | 9.18 | 8.63 | 8.08 | 6.48 | 7.56 | 7.43 | 5.49 | 5.10 | 5.10 | 2.60 | 5.76 |
| Karnataka | 8.81 | 7.65 | 7.66 | 7.55 | 5.81 | 5.23 | 6.24 | 5.38 | 5.72 | 5.72 | -3.61 | 8.87 |
| Kerala | 7.98 | 7.40 | 6.45 | 5.89 | 5.05 | 4.78 | 4.56 | 4.09 | 3.78 | 3.78 | 5.72 | 5.96 |
| Madhya Pradesh | 23.24 | 26.72 | 25.23 | 24.31 | 21.37 | 25.02 | 23.15 | 21.08 | 21.59 | 21.59 | 0.70 | 7.76 |
| Maharashtra | 7.96 | 7.37 | 8.17 | 6.40 | 5.53 | 6.33 | 5.67 | 5.06 | 5.23 | 5.23 | 8.53 | 6.83 |
| Manipur | 10.67 | 12.27 | 11.86 | 11.62 | 9.29 | 8.31 | 14.27 | 12.27 | 14.14 | 14.14 | 2.55 | 6.45 |
| Meghalaya | 8.19 | 9.54 | 9.57 | 10.33 | 10.34 | 9.82 | 9.58 | 8.86 | 8.47 | 8.47 | 3.38 | 2.78 |
| Mizoram | 10.45 | 9.38 | 9.17 | 7.72 | 6.79 | 6.39 | 6.00 | 5.97 | 5.46 | 5.46 | 2.89 | 12.35 |
| Nagaland | 16.78 | 18.30 | 20.03 | 20.22 | 19.81 | 18.86 | 17.48 | 15.91 | 15.32 | 15.32 | -0.25 | 4.84 |
| Odisha | 11.06 | 12.96 | 10.77 | 11.65 | 8.40 | 8.97 | 6.68 | 6.82 | 7.50 | 7.50 | -1.20 | 4.86 |
| Punjab | 18.78 | 17.86 | 17.28 | 15.46 | 14.53 | 14.51 | 14.11 | 13.33 | 12.72 | 12.72 | 0.56 | 5.78 |
| Rajasthan | 16.90 | 16.64 | 16.85 | 15.01 | 12.99 | 12.73 | 11.62 | 11.65 | 12.33 | 12.33 | 6.81 | 6.14 |
| Sikkim | 7.00 | 7.15 | 6.90 | 6.48 | 5.95 | 6.21 | 6.28 | 6.67 | 6.55 | 6.55 | -1.05 | 8.07 |
| Tamil Nadu | 7.15 | 5.33 | 5.93 | 5.87 | 5.17 | 3.38 | 3.99 | 3.84 | 3.93 | 3.93 | 0.75 | 7.05 |
| Telangana | 9.01 | 9.60 | 9.55 | 7.10 | 5.21 | 5.61 | 5.63 | 4.82 | 7.05 | 7.05 | 5.90 | 8.30 |
| Tripura | 16.61 | 16.18 | 16.10 | 13.79 | 13.74 | 12.88 | 12.80 | 12.83 | 13.39 | 13.39 | 2.23 | 9.64 |
| Uttar Pradesh | 17.15 | 17.20 | 15.89 | 14.45 | 13.92 | 13.32 | 13.22 | 12.96 | 12.66 | 12.66 | -1.17 | 6.60 |
| Uttarakhand | 6.62 | 6.24 | 5.41 | 5.06 | 4.27 | 4.13 | 3.85 | 3.63 | 3.56 | 3.56 | 2.16 | 7.39 |
| West Bengal | 13.92 | 13.91 | 13.25 | 13.78 | 12.89 | 12.33 | 12.19 | 11.45 | 10.86 | 10.86 | 2.16 | 5.37 |
| **India** | **17.19** | **16.54** | **16.42** | **15.25** | **14.21** | **14.02** | **14.00** | **13.43** | **13.66** | **14.62** | **3.63** | **6.03** |

*Source:* Author's estimates from Handbook of Statistics on Indian States, 2020-21, Reserve Bank of India.

## Share of Agriculture Sector in Total GVA

The share of agriculture, forestry & fishing sectors in total GVA at 2011-12 basic prices has seen a steady decrease over the years from 18.53 per cent in 2011-12 to 16.27 per cent in 2020-21, growing with Compound Annual Growth Rate (CAGR) of 3.63 per cent. The decline was mainly due to the decline in the share of crops in AgGVA from 65.39 per cent in 2011-12 to 55.06 per cent in 2020-21. The share of the fisheries in AgGVA has increased to 6.72 per cent in 2020-21 from 4.53 per cent in 2011-12. The share of the livestock in AgGVA has also increased significantly from 21.79 per cent in 2011-12 to 30.13 per cent 2020-21. The share of forestry & logging has remained constant at about 8 per cent during the entire period (Table 2). The livestock and fishing sectors have grown at a CAGR of 7.66 per cent and 8.90 per cent over the last ten years ending 2020-21. Development of livestock sector has led to the improvement in per capita availability of milk, eggs and meat.

The Gross Value of Output (GVO) at constant (2011-12) prices of the four main sub-sectors, namely crop, livestock, forestry and logging and fishing and aquaculture which together are called as agriculture and allied sectors are presented in Table 3. It may be observed that the crops sub-sector which had accounted for 62.44 per cent of the agriculture and allied sectors in 2011-12, consistently declined to 55.05 per cent in 2020-21. The GVO of livestock sector increased steadily from 25.56 per cent in 2011-12 to 30.98 per cent in 2020-21. During this period, the output of milk, meat and eggs also recorded an increasing trend. The share of milk, meat and eggs in output of livestock sub-sector was 66.71 per cent, 23.12 per cent and 3.57 per cent, respectively in 2020-21, compared to 67.20 per cent, 19.73 per cent and 3.41 per cent, respectively in the base year 2011-12. The output of fishing and aquaculture sub-sector increased steadily from about Rs.80105 crore in 2011-12 to Rs.162449 crore in 2020-21. In percentage terms, the output of fishing and aquaculture sub-sector has increased from 4.20 per cent in 2011-12 to 6.30 per cent in 2020-21. However, the share of inland fisheries decreased from 57.65 per cent to 51.45 per cent during the period 2011-12 to 2020-21. The share of value of output of forestry and logging is remained constant at around 8 per cent during the period.

## Table 2: Share of Agriculture, Forestry & Fishing at 2011-12 Prices

(Rs.crore)

| Item | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 | 2016-17 | 2017-18 | 2018-19 | 2019-20 | 2020-21 | CAGR(%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry & fishing | 1501947 (18.53) | 1524288 (17.84) | 1609198 (17.75) | 1605715 (16.53) | 1616146 (15.40) | 1726004 (15.24) | 1840023 (15.29) | 1878598 (14.75) | 1982303 (16.27) | 2048032 (16.27) | 3.63 |
| Crops | 982151 (65.39) | 983809 (64.54) | 1037060 (64.45) | 998425 (62.18) | 969344 (59.98) | 1020258 (59.11) | 1075111 (58.43) | 1049211 (55.85) | 1106545 (55.82) | 1127575 (55.06) | 1.46 |
| Livestock | 327334 (21.79) | 344375 (22.59) | 363558 (22.59) | 390449 (24.32) | 419637 (25.97) | 461572 (26.74) | 497830 (27.06) | 540970 (28.80) | 581450 (29.33) | 617117 (30.13) | 7.66 |
| Forestry & logging | 124436 (8.28) | 124743 (8.18) | 132093 (8.21) | 134609 (8.38) | 136960 (8.47) | 144547 (8.37) | 152351 (8.28) | 163949 (8.73) | 164416 (8.29) | 165624 (8.09) | 3.71 |
| Fishing & aquaculture | 68027 (4.53) | 71362 (4.68) | 76487 (4.75) | 82232 (5.12) | 90205 (5.58) | 99627 (5.77) | 114730 (6.24) | 124468 (6.63) | 129893 (6.55) | 137716 (6.72) | 8.90 |
| **Total GVA at basic prices** | **8106946** | **8546275** | **9063649** | **9712133** | **10491870** | **11328285** | **12034171** | **12733798** | **13219476** | **12585074** | **5.88** |

*Source:* National Accounts Statistics 2022, MoSPI, Government of India.
Figures in parentheses indicate the percentage share in the total GVA.

## Table 3: Value of Output from Agriculture and Allied Sectors at Constant (2011-12) Prices

(Rs. crore)

| Items | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 | 2016-17 | 2017-18 | 2018-19 | 2019-20 | 2020-21 | CAGR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Crop Sector | 1191483 (62.44) | 1198611 (61.79) | 1257133 (61.75) | 1228006 (59.97) | 1206717 (58.23) | 1277532 (57.83) | 1331828 (55.39) | 1317811 (55.42) | 1382420 (55.47) | 1419431 (55.05) | 1.90 |
| Livestock Sector | 487751 (25.56) | 508074 (26.19) | 530953 (26.08) | 562026 (27.44) | 595242 (28.72) | 641217 (29.06) | 671244 (28.92) | 717125 (30.16) | 760025 (30.50) | 798726 (30.98) | 5.84 |
| Fishing & Aquaculture | 80105 (4.20) | 83911 (4.33) | 89865 (4.41) | 96648 (4.72) | 106504 (5.14) | 117573 (5.32) | 135811 (5.85) | 147275 (6.19) | 153326 (6.15) | 162449 (6.30) | 8.97 |
| Forestry & Logging | 148748 (7.80) | 149062 (7.68) | 157748 (7.75) | 161184 (7.87) | 163778 (7.90) | 172821 (7.82) | 181894 (7.84) | 195801 (8.23) | 196282 (7.88) | 197773 (7.67) | 3.70 |
| Ag, Forestry & Fishing | 1908087 (100) | 1939658 (100) | 2035699 (100) | 2047864 (100) | 2072241 (100) | 2209144 (100) | 2320777 (100) | 2378013 (100) | 2492053 (100) | 2578378 (100) | 3.50 |

*Source:* National Accounts Statistics 2022, MoSPI, Government of India.
Figures in parentheses indicate the percentage share in the total GVA.

## Investment in Agriculture and Allied Sectors

Investment is critical to the sustained growth of any sector. The Gross Capital Formation (GCF) in agriculture and allied sectors relative to AgGVA in the sector has been showing a fluctuating trend as shown in Table 4. Fluctuation in the GCF in the sector arises mainly because of wide fluctuations in private investment in agriculture and allied sectors. As may be observed from the table, while public investment has remained stable between 2-3 per cent during 2011-12 to 2020-21, the private investment has fluctuated and the total agricultural GCF has moved in sync with variation in private investment. Recognising that there exists a direct correlation between capital investments in agriculture and its growth rate, there should be a focused and targeted approach to ensure higher public and private investment in the sector. Higher access to concessional institutional credit to farmers and greater participation of private corporate sector, whose investment rates are currently as low as 2 to 3 per cent in agriculture (Report on Doubling of Farmers' Income, 2018), may help in improving private investment in agriculture. Private corporate investments need to be roped in by offering appropriate policy framework coupled with increase in public investment in the entire agricultural value system. Further, Gross Capital Formation (GCF) in agriculture and allied sectors relative to AgGVA has been showing a fluctuating trend from 14.70 per cent in 2015-16 to 15.94 per cent in 2020-21. The GCF in agriculture and allied sectors in absolute terms increased from Rs.237648 crore in 2015-16 to Rs.326533 crore in 2020-21 at 2011-12 prices. Further, public investment in and for agriculture have remained low as only 2.28 per cent of AgGVA at constant (2011-12) prices is spent for infrastructure development in agriculture in 2020-21. This must be raised to 4 per cent as recommended by the high empowered committee (GoI, 2007). That a deficit in public expenditure on agricultural infrastructure and extension services substantially contributed to the slowdown in agricultural growth has been pointed out by studies such as Mahendra Dev (2000), Vyas (2001), Rao (2003) and Chand and Kumar (2004).

Ensuring steady investment in agriculture is crucial to ensure that quality inputs are made available for agriculture production while also addressing the infrastructural bottlenecks. Quality seed and optimum use of fertilisers are important pillars of growth in agricultural productivity. It is also observed that a steady supply of electricity to agriculture brings economic efficiency in production. Supply adequate and quality power (electricity) to

agriculture sector is very low in most of states. These three inputs should be promoted appropriately to raise output and farmers' income.

**Table 4: Gross Capital Formation (GCF) in Agriculture and Allied Sectors Relative to Agriculture Gross Value Added (AgGVA) at 2011 -12 Basic Prices**

| Year | GCF in Agriculture & Allied Sector (Rs. crore) | | | GVA of Agriculture & Allied Sector (Rs. crore) | GCF of Agriculture & Allied Sector as percentage of GVA of Agriculture & Allied Sector (%) | | |
|---|---|---|---|---|---|---|---|
| | Public | Private | Total | | Public | Private | Total |
| 2011-12 | 35696 | 238175 | 273870 | 1501947 | 2.38 | 15.86 | 18.23 |
| 2012-13 | 36019 | 215075 | 251094 | 1524288 | 2.36 | 14.11 | 16.47 |
| 2013-14 | 33925 | 250499 | 284424 | 1609198 | 2.11 | 15.57 | 17.67 |
| 2014-15 | 37172 | 235491 | 272663 | 1605715 | 2.31 | 14.67 | 16.98 |
| 2015-16 | 42522 | 195127 | 237648 | 1616146 | 2.63 | 12.07 | 14.70 |
| 2016-17 | 47767 | 219386 | 267153 | 1726004 | 2.77 | 12.71 | 15.48 |
| 2017-18 | 46032 | 226290 | 272321 | 1840023 | 2.50 | 12.30 | 14.80 |
| 2018-19 | 53493 | 243138 | 296631 | 1878598 | 2.85 | 12.94 | 15.79 |
| 2019-20 | 47040 | 254632 | 301671 | 1982303 | 2.37 | 12.85 | 15.22 |
| 2020-21 | 46728 | 279805 | 326533 | 2048032 | 2.28 | 13.66 | 15.94 |

*Source:* National Accounts Statistics 2022, MoSPI, Government of India and Agricultural Statistics at a Glance, 2021.

## Changes in Cropping Pattern at All India Level

The cropping pattern in India has undergone significant changes over time. As the cultivated area remains more or less constant, the increased demand for food due to increase in population and urbanisation and change in food habits puts agricultural land under stress resulting in crop intensification and substitution of food crops with high value commercial crops. In fact, it is remarkable to observe that area under foodgrains in gross cropped area (GCA) declined by 11.62 per cent mainly due to fall in area under coarse cereals by 16.78 per cent between triennium ending (TE) 1970-71 and TE 2020-21 (Table 5). Wheat has gained importance with area allocation of only 10.42 per cent in TE 1970-71, and it steadily increased to 15.45 per cent in TE 2020-21. Area under rice remained more or less constant during the period under study. Interestingly, area lost by foodgrains was used for the cultivation of oilseeds, fruits and vegetables and non-food crops to the extent of 3.67 per cent, 6.40 per cent and 3.79 per cent, respectively, between TE 1970-71 and TE 2020-21. Although the shift from coarse cereals to high value crops is likely to increase farm output and income to farmers, in rainfed areas it will expose

cultivators to serious weather related risks because high value crops have a high water requirement (Bhalla and Singh, 2009).

**Table 5: Share of Area Under Major Crops in India (Percentage of GCA)**

| Crops | TE 1970-71 | TE 1980-81 | TE 1990-91 | TE 2000-01 | TE 2010-11 | TE 2020-21 |
|---|---|---|---|---|---|---|
| Rice | 23.03 | 23.18 | 23.01 | 23.82 | 21.89 | 22.27 |
| Wheat | 10.42 | 12.98 | 13.04 | 14.28 | 15.18 | 15.45 |
| Coarse cereals | 28.48 | 24.25 | 20.48 | 16.17 | 14.38 | 11.70 |
| Total cereals | 61.93 | 60.41 | 56.53 | 54.27 | 51.45 | 49.41 |
| Total pulses | 13.50 | 13.23 | 12.94 | 11.49 | 12.68 | 14.40 |
| Total foodgrains | 75.43 | 73.64 | 69.47 | 65.76 | 64.13 | 63.81 |
| Total oilseeds | 9.85 | 10.11 | 12.51 | 12.96 | 14.36 | 13.52 |
| Groundnut | 4.42 | 4.14 | 4.64 | 3.68 | 2.90 | 2.62 |
| Cotton | 4.70 | 4.27 | 4.08 | 4.70 | 5.50 | 6.55 |
| Total fibers | 5.41 | 5.08 | 4.64 | 5.27 | 6.01 | 6.89 |
| Sugarcane | 1.62 | 1.62 | 1.90 | 2.23 | 2.46 | 2.43 |
| Tobacco | 0.27 | 0.25 | 0.22 | 0.21 | 0.20 | 0.20 |
| Condiments & spices | 1.04 | 1.23 | 1.32 | 1.52 | 1.71 | 2.16 |
| Potato | 0.31 | 0.43 | 0.51 | 0.69 | 0.91 | 1.08 |
| Onion | - | 0.14 | 0.17 | 0.24 | 0.51 | 0.72 |
| Total fruits & vegetables | 2.24 | 2.77 | 3.57 | 4.35 | 4.78 | 8.64 |
| Fodder crops | 4.15 | 4.50 | 4.59 | 4.55 | 3.98 | 4.53 |
| Gross Cropped Area (GCA) | 100 | 100 | 100 | 100 | 100 | 100 |

*Source:* Authors' estimates from Directorate of Economics and Statistics, Ministry of Agriculture and Farmers' Welfare, GoI.

**Changes in Cropping Area at All India Level**

Increase in area under total oilseeds is not reflective of general rise in area across all oilseed crops, but seemed to be limited only to rapeseed and mustard and soybean. The Technology Mission on Oilseeds launched in 1986 coupled with price support and favourable market conditions for refined oil and protein-rich soya food encouraged the shift in the area towards oilseeds. The area under groundnut came down from 4.42 per cent in TE 1970-71 to 2.62 per cent in TE 2020-21. However, the area under commercial crops like cotton and sugarcane registered significant increase from 4.70 per cent to 6.55 per cent and from 1.62 per cent to 2.43 per cent during TE 1970-71 to TE 2020-21, respectively. Assured prices by Cooperatives and Sugar mills for sugarcane and

guaranteed price for cotton through the government's monopoly procurement scheme encourage the production of these crops while various schemes announced by the National Horticulture Board accelerated the expansion of area under fruits and vegetables.

It is quite understandable from the above discussion that high value commercial crops are taking the lead in terms of area share. However, it would be interesting to analyse the contribution of different crops in total value of output. Besides the level of physical output, this will also capture the producer price of various crops in the country. Among crop groups, fruits and vegetables accounted for the largest share of total value of crop output followed by cereals, oilseeds, fiber and pulses in TE 2020-21 (Table 6). While the contribution of cereals declined from 32.46 per cent in TE 1970-1971 to 27.41 per cent in TE 2020-21, the share of fruits and vegetables increased considerably from 14.11 per cent to 27.77 per cent during the same period. The change in share was determined largely by commodity price, which rose proportionately higher for fruits and vegetables than cereals in the recent decade (Chand et al. 2011). The growth in the horticultural sector has been largely demand-driven and has been facilitated by improvements in roads, transportation, communication, and electricity (Joshi et al. 2004) and the development of retail chains that could establish linkages with farmers for procurement of their crops through institutions such as contract farming and producers' organizations (Birthal, Joshi, and Gulati 2005; Roy and Thorat 2008). Further, to cater to the rising demand for horticultural products without importing as much, the government of India has been promoting the horticultural sector by establishing the National Horticulture Board (NHB) in 1985 and then launching the National Horticulture Mission (NHM) in 2005.

**Changes in Crop Output at All India Level**

Among individual crops, rice accounted for the major share in the total value of crop output but declined from 2000 onwards. Similarly, the value of wheat output reported a steady increase until 2000-01 and declined thereafter. Pulses which registered a drop in their contribution to the total value of output from 8.39 per cent in TE 1970-1971 to 4.45 per cent in TE 2010-11, however increased to 5.26 per cent in TE 2020-2021, due to significant increase in the MSP of pulses. Meanwhile, the value of output of cotton

increased to 5.15 per cent in TE 2020-21 from 3.11 per cent in TE 2000-01. Cotton production escalated primarily because of the widespread cultivation of Bt cotton. It was found that productivity and profit from cultivation of Bt Cotton is substantially higher than the conventional hybrid cotton varieties (Naik *et al.* 2005). The share of condiments and spices in the total value of crop output also increased from 2.17 per cent in TE 1970-71 to 5.45 per cent in TE2020-21. Overall, data analysis shows that agricultural production in the 1980s was broad. However, commercialization of agricultural production seems to have gained momentum in the early 1990s. There was a definite shift from foodgrains to non-foodgrains such as fruits and vegetables, oilseeds, fiber, and condiments and spices, whose share in both area and in value of output has been increasing during the study period. Further, the study reveals that diversification towards high value crops (HVCs) offers great scope to increase farmers' income. The staple crops such as cereals, pulses and oilseeds occupy 77.33 per cent of the gross cropped area (GCA) but contribute only 46.37 per cent of total value of output of crop sector. Interestingly, almost same value of output (43.58%) was contributed by HVCs (fruits and vegetables, fibres, condiments and spices and sugarcane which occupy 20.12 per cent of GCA during TE 2020-21. These changes in the relative shares of crops in agricultural growth provide a clear indication of the growing importance of high-value crops in Indian agriculture.

**Table 6: Share of Various Crops in Value of Output (at 2011-12 prices)**

(Per cent)

| Crops | TE 1970-71 | TE 1980-81 | TE 1990-91 | TE 2000-01 | TE 2010-11 | TE 2020-21 |
|---|---|---|---|---|---|---|
| Rice | 17.26 | 17.23 | 18.14 | 16.67 | 14.68 | 13.96 |
| Wheat | 6.67 | 9.09 | 10.05 | 10.63 | 9.87 | 9.68 |
| Coarse Cereals | 8.93 | 7.66 | 6.28 | 4.47 | 4.26 | 3.78 |
| Cereals | 32.46 | 33.60 | 34.24 | 31.74 | 28.81 | 27.41 |
| Gram | 3.50 | 2.54 | 2.03 | 1.71 | 1.98 | 2.28 |
| Arhar | 1.51 | 1.33 | 1.34 | 1.02 | 0.80 | 0.94 |
| Pulses | 8.39 | 6.53 | 6.23 | 4.73 | 4.45 | 5.26 |
| Groundnut | 4.70 | 3.91 | 4.40 | 2.79 | 2.27 | 2.28 |
| Rapeseed and Mustard | 1.33 | 1.31 | 2.15 | 1.90 | 2.26 | 2.22 |
| Oilseeds | 8.27 | 7.30 | 9.79 | 8.75 | 9.11 | 8.44 |
| Sugarcane | 5.35 | 4.74 | 5.05 | 5.09 | 4.37 | 4.93 |
| Sugars | 6.20 | 5.47 | 5.78 | 7.64 | 6.47 | 6.13 |
| Cotton | 3.22 | 3.62 | 3.55 | 3.11 | 5.11 | 5.15 |
| Fibres | 3.78 | 4.25 | 4.03 | 3.57 | 5.52 | 5.43 |
| Tea | 0.59 | 0.63 | 0.57 | 0.58 | 0.58 | 0.62 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Coffee | 0.42 | 0.51 | 0.49 | 0.66 | 0.58 | 0.46 |
| Tobacco | 0.96 | 0.96 | 0.84 | 0.68 | 0.73 | 0.40 |
| Tomato | 0.75 | 0.87 | 0.80 | 1.03 | 1.37 | 1.65 |
| Onion | 0.44 | 0.52 | 0.48 | 0.57 | 0.90 | 1.71 |
| Potato | 0.77 | 1.16 | 1.33 | 1.63 | 1.84 | 2.12 |
| Fruits & Vegetables | 14.11 | 16.73 | 15.88 | 20.55 | 23.58 | 27.77 |
| Condiments & Spices | 2.17 | 2.57 | 2.80 | 3.36 | 3.79 | 5.45 |
| Others* | 21.63 | 20.68 | 18.47 | 15.45 | 14.51 | 11.48 |
| **Total value of crop output** | **100** | **100** | **100** | **100** | **100** | **100** |

*Source:* Author's estimates from National Statistical Office data, MoSPI, Government of India.
Note. *includes other crops, by-products, kitchen garden, indigo, dyes and tanning materials.

## Growth Performance of Major Crops at National Level

It is well documented in the literature that growth in area was the major source of production growth until early 1960s (Bhalla and Singh, 2001; Vaidyanathan, 2010). The high yielding varieties introduced in wheat and rice during the late Sixties heralded India's green revolution. Along with technology, new institutional structures enabled the farmers to adopt improved methods of cultivation. The major changes included provision of better irrigation facilities, government procurement system, guaranteed minimum support price and supply of inputs at subsidized rates. As evident from Table 7, wheat production registered compound annual growth of 5.48 per cent during the early green revolution period (1967-68 to 1980-81). Both yield and area contributed to higher growth in production. In the case of rice, growth in yield contributed to production growth of 2.18 per cent per annum. For foodgrains as a whole, the growth in area and yield were 0.39 per cent and 1.87 per cent, respectively and resulted in production growth of 2.27 per cent.

## Table 7: Compound Annual Growth Rates of Area, Production and Yield of Major Crops in India

(Per cent)

| Crops | 1967-68 to 1980-81 | | | 1981-82 to 1990-91 | | | 1991-92 to 2000-01 | | | 2001-02 to 2010-11 | | | 2011-12 to 2020-21 | | | 1967-68 to 2020-21 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Area | Prod | Yield | Area | Prod | Yield | Area | Prod | Yield | Area | Prod | Yield | Area | Prod | Yield | Area | Prod | Yield |
| Rice | 0.75 | 2.18 | 1.42 | 0.60 | 4.20 | 3.58 | 0.78 | 1.87 | 1.08 | 0.11 | 1.71 | 1.60 | 0.24 | 3.58 | 1.54 | 0.34 | 2.22 | 1.87 |
| Wheat | 2.96 | 5.48 | 2.45 | 0.37 | 3.39 | 3.02 | 1.37 | 3.11 | 1.69 | 1.36 | 2.51 | 1.16 | 0.24 | 3.02 | 1.65 | 1.09 | 3.21 | 2.10 |
| Coarse Cereals | -1.00 | 0.71 | 1.74 | -1.49 | 0.72 | 2.24 | -1.60 | 0.36 | 1.99 | -0.50 | 3.10 | 3.62 | -1.13 | 2.24 | 3.28 | -1.39 | 1.01 | 2.43 |
| Cereals | 0.38 | 2.59 | 2.20 | -0.25 | 3.12 | 3.38 | 0.18 | 2.03 | 1.84 | 0.27 | 2.25 | 1.98 | -0.10 | 3.38 | 1.99 | -.08 | 2.25 | 2.33 |
| Pulses | 0.43 | -0.53 | -0.95 | 0.13 | 1.50 | 1.41 | -0.63 | 0.15 | 0.68 | 1.45 | 3.09 | 1.62 | 2.71 | 1.41 | 1.86 | 0.29 | 1.28 | 0.98 |
| Foodgrains | 0.39 | 2.27 | 1.87 | -0.19 | 2.99 | 3.18 | 0.04 | 1.91 | 1.87 | 0.49 | 2.31 | 1.80 | 0.49 | 3.18 | 1.59 | 0.00 | 2.17 | 2.18 |
| Groundnut | -0.30 | 0.64 | 0.94 | 1.70 | 2.92 | 1.20 | -2.75 | -2.27 | 0.51 | -0.81 | 1.95 | 2.77 | 0.60 | 4.74 | 4.36 | -0.77 | 0.72 | 1.49 |
| Rapeseed & Mustard | 1.34 | 1.50 | 0.17 | 3.55 | 9.10 | 5.36 | -1.78 | -1.15 | 0.63 | 2.59 | 4.85 | 2.20 | 0.83 | 4.06 | 3.16 | 1.54 | 3.79 | 2.22 |
| Oilseeds | 1.12 | 1.66 | 0.53 | 3.02 | 5.80 | 2.70 | -0.87 | 0.56 | 1.45 | 2.21 | 5.37 | 3.09 | 0.19 | 1.70 | 1.57 | -0.73 | 3.06 | 1.87 |
| Sugarcane | 1.65 | 2.64 | 1.38 | 1.35 | 2.97 | 1.61 | 1.91 | 2.74 | 0.82 | 1.30 | 2.31 | 1.01 | -0.73 | 1.34 | 2.12 | 1.48 | 2.38 | 0.91 |
| Cotton | 0.08 | 2.62 | 2.55 | -0.97 | 3.32 | 4.31 | 2.18 | 0.24 | -1.90 | 3.17 | 14.20 | 10.70 | 0.95 | -0.55 | -1.58 | 1.02 | 3.91 | 2.87 |

*Source:* Author's estimates from Directorate of Economics and Statistics, Ministry of Agriculture and Farmers' Welfare, Government of India.

However, it is interesting to observe a relatively higher growth in yield of all major crops during 1981-82 to 1990-91, i.e., the mature green revolution period. It indicates that crops other than rice and wheat shared the technological benefits. With decline in area, impressive growth in production of most crops was mainly contributed by growth in yield. Rice registered production and yield growth rate of 4.20 per cent and 3.58 per cent, respectively. Wheat yield also showed splendid growth of 3.02 per cent. Growth in yield of pulses (1.41%) and coarse cereals (2.24%) was significant. However, negative growth (-0.19%) was reflected in the decline in area under foodgrains. Despite this, production of foodgrains was high at 2.99 per cent, which was contributed by yield growth of 3.18 per cent. Oilseeds recorded a growth rate of 5.80 per cent in production and 2.70 per cent in yield. This could be attributed to Technology Mission on Oilseeds launched in 1986, which laid emphasis on increasing productivity of oilseeds and bridging yield gaps between experimental stations and farmers' fields by adopting improved package of practices. Similarly, cotton showed high growth in production by 3.32 per cent and yield by 4.31 per cent. However, the impressive growth in crop production observed during the 1981-82 to 1990-91 was not sustained during the 1990-91 to 2000-01. Growth in the yield of almost all crops declined during 1991-92 to 2000-01, i.e., the early economic reforms period. This was, in fact, a alarming scenario, which resulted in low growth in crop output. However, there was increase in area for rice and wheat during this period. Growth in area under sugarcane and cotton increased during this period. Even though recording almost the same level of growth in yield, the negative growth in area (-1.60%) resulted in a fall in production for coarse cereals. In the case of pulses, the decline in the growth of yield and negative growth in area (-0.63) led to fall in production. Consequently, growth in foodgrains production declined to 1.91 per cent during the economic reforms period when compared to 3.18 per cent in the mature green revolution period. There was significantly improvement in production and yield of all most all crops during 2001-02 to 2010-11 and 2011-12 to 2020-21. Growth in yield of rice increased at 1.60 per cent but very low growth in area resulted in sluggish growth in production when compared to the early economic reforms period. In contrast, growth in both area and yield of wheat declined. Impressive growth in yield of coarse cereals at 3.62 per cent and 3.28 per cent led to 3.10 per cent and 2.24 per cent growth in production during 2001-02 to 2010-11 and 2011-12 to 2020-21, respectively. Groundnut, which witnessed negative growth in area and production in

the previous decade (1991-92 to 2000-01), registered growth of 1.95 per cent and 4.74 per cent in production due to high growth in yield (2.77% and 4.36%) during 2001-02 to 2020-21. Thus, impressive growth in groundnut along with rapeseed and mustard led to increase in production of oilseeds. Cotton witnessed a whopping growth of 14.20 per cent in production as a result of impressive growth of 10.70 per cent in yield during 2001-02 to 2010-11. The India's policymakers have envisaged an annual growth rate of 4 per cent in agriculture and allied sectors since the 9th Five-Year Plan (1996-97 to 2001-02). As the crop sector constitutes over three-fourth of total output its growth performance assumes great importance in achieving this target. However, the long-term growth rate (during 1967-68 to 2020-21) shows that not a single crop registered production growth of more than 4.0 per cent annum. However, few crops that showed decent growth in production were cotton, rapeseed and mustard, wheat and rice. Further, growth in foodgrains production was 2.17 per cent, which was only a little higher than the annual population growth of 1.64 per cent as per Census 2011. This implies that production of foodgrains has to be enhanced to achieve long-term sustainable food and nutritional security in the country. It is also noticeable from the long term growth that area shifts have been taking place from coarse cereals and oilseeds towards high value crops like sugarcane and the more remunerative cotton.

Indian agriculture is dominated by small and marginal farmers (86.21%), who suffer serious disadvantage in terms of scale, small farm size discourages many farmers to go for diversification of fruits and vegetables mainly because of the price risk and uneconomic lot for marketing. Most of the SMF have been facing several major constraints such as input supply, credit availability, proper transport, and market facility, etc. Their share nearly 60 per cent in total foodgrains production: 49 per cent rice, 40 per cent wheat, 29 per cent coarse cereals and 27 per cent pulses as well as over half of the country’s fruits and vegetable production, according to Agricultural Census 2015-16. Small sized of farmers are also disadvantaged in terms of bargaining power in various transactions in the inputs and output markets (Chand, 2017). These constraints can be resolved with the promotion of farmer producers organisations (FPOs). SFAC and NABARD are promoting FPOs to enable small and marginal farmers to reduce transaction costs, access technology, raise bargaining power and integrate with value chains.

Similarly, policy interventions are required to encourage production of oilseeds and coarse cereals. Further, crop productivity has to be improved through better soil and water management, profitable crop rotation, innovative marketing and investment in farm education and rural infrastructure. Among these factors, the former two are essential in ensuring sustainability of agricultural production through effective maintenance of soil fertility through balancing use of chemical and organic fertilisers and developing drought and pests and diseases varieties. The latter factors are important in making agriculture more profitable through efficient marketing, access to and adoption of new technologies like artificial intelligence, internet of things, block chain technology, agri drone and providing incentives for making on-farm investment.

## Analysis of Agriculture Performance in Indian States

### *State-wise CAGR of Value of Output from Agriculture and Allied Sectors*

State-wise CAGR of value of output from agriculture and allied sectors during the period between 2011-12 to 2018-19 at constant (2011-12) prices are presented in Table 8 and Figure 1. It may be seen that the value of output from crop sector was grew highest in Madhya Pradesh (6.59%) and followed by Andhra Pradesh (4.48%) and Chhattisgarh (3.00%). In case of livestock sector, highest growth was observed in Tamil Nadu (11.97%) and followed by Madhya Pradesh (9.93%) and Andhra Pradesh (8.40%). The fisheries and aquaculture, Andhra Pradesh grew highest (22.92%) followed by Jharkhand (12.90%) and Madhya Pradesh (12.07%). Forestry and logging sector grew highest in Goa (24.54%) and followed by Sikkim (9.18%) and Chhattisgarh (7.77%). Total agriculture and allied sectors grew highest in Mizoram with CAGR of 14.97 per cent due to diversification towards high value crops followed by Andhra Pradesh (9.18%) and Madhya Pradesh (6.97%). At the all India level, crop, livestock, fishing, forestry and tot al agriculture and allied sectors grew by 1.53 per cent, 5.76 per cent, 9.48 per cent, 3.91 per cent and 3.27 per cent, respectively during the period 2011-12 to 2018-19.

**Table 8: State-wise CAGR of Value of Output of Agriculture and Allied Sectors During 2011-12 to 2018-19 at Constant (2011-12) Prices (%)**

| State | Crops | Livestock | Fisheries | Forestry | Total agriculture and allied sectors |
|---|---|---|---|---|---|
| Andhra Pradesh | 4.48 | 8.40 | 22.92 | 2.02 | 9.18 |
| Arunachal Pradesh | -5.94 | 5.07 | 5.72 | 5.76 | 0.37 |
| Assam | 1.98 | 2.15 | 4.52 | -0.41 | 2.15 |
| Bihar | 1.20 | 5.56 | 7.89 | 4.12 | 3.13 |
| Chhattisgarh | 3.00 | 4.06 | 11.77 | 7.77 | 4.64 |
| Goa | 0.47 | -3.81 | 4.31 | 24.54 | 3.86 |
| Gujarat | -0.14 | 4.43 | 3.52 | 5.47 | 1.40 |
| Haryana | 0.33 | 6.22 | 9.52 | -1.26 | 2.42 |
| Himachal Pradesh | 1.02 | 3.53 | 7.90 | 4.50 | 2.68 |
| Jammu & Kashmir | 1.34 | 4.80 | 0.10 | 6.76 | 3.05 |
| Jharkhand | 0.59 | 3.76 | 12.90 | 6.47 | 2.68 |
| Karnataka | 2.08 | 4.36 | 2.20 | 2.22 | 2.59 |
| Kerala | -3.13 | 0.37 | 2.87 | 2.91 | -1.15 |
| Madhya Pradesh | 6.59 | 9.93 | 12.07 | 3.12 | 6.97 |
| Maharashtra | 0.60 | 4.92 | 0.85 | 6.01 | 2.20 |
| Manipur | 2.18 | 0.90 | 4.70 | 7.53 | 2.83 |
| Meghalaya | 0.89 | 2.95 | 20.46 | 4.33 | 2.47 |
| Mizoram | 2.62 | 15.41 | 5.38 | 29.37 | 14.89 |
| Nagaland | 3.26 | -10.59 | 4.41 | 6.10 | 1.64 |
| Odisha | -0.17 | 2.36 | 12.26 | 5.55 | 2.09 |
| Punjab | 1.20 | 4.09 | 5.81 | 0.39 | 2.02 |
| Rajasthan | -0.27 | 7.48 | 9.74 | 4.58 | 3.00 |
| Sikkim | 3.26 | 3.07 | 2.04 | 9.18 | 3.50 |
| Tamil Nadu | -0.30 | 11.97 | 3.48 | 1.57 | 4.82 |
| Telangana | -1.92 | 6.57 | 3.94 | 0.28 | 1.75 |
| Tripura | 3.17 | 7.18 | 5.28 | 3.89 | 4.08 |
| Uttar Pradesh | 2.77 | 3.29 | 6.87 | 2.09 | 2.95 |
| Uttarakhand | -1.02 | 3.19 | 3.42 | 0.62 | 0.48 |
| West Bengal | 1.93 | 3.31 | 2.92 | 1.42 | 2.35 |
| **All India** | **1.53** | **5.76** | **9.48** | **3.91** | **3.27** |

*Source*. Authors' estimates using National Statistical Office data, MoSPI, GoI.

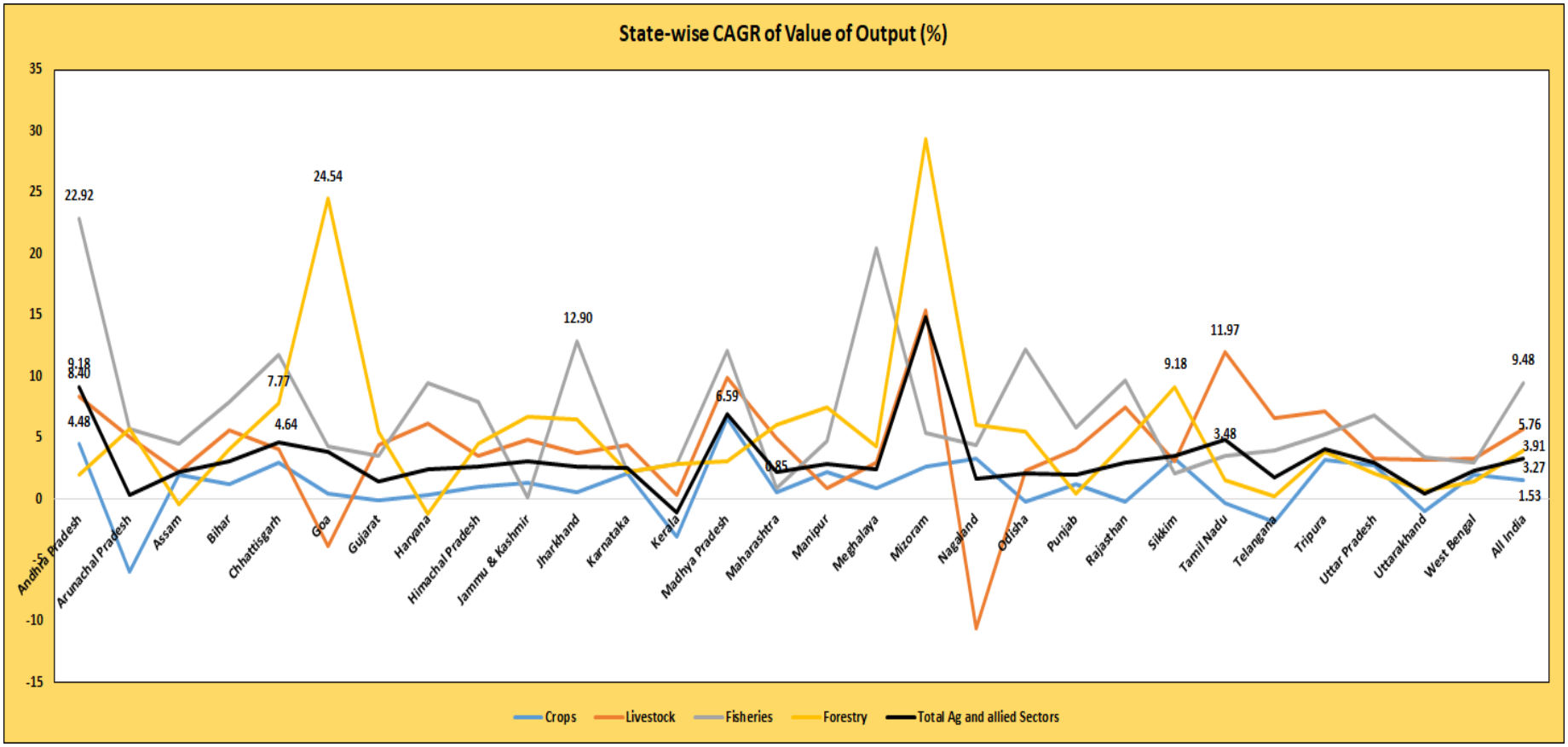


Figure 1: State-wise CAGR of value of output from agriculture and allied sectors

### *State-wise Value of output of Agriculture and Allied Sectors at Constant (2011-12) Prices for Top Six States*

State-wise percentage share of crops, livestock, forestry& logging, fishing & aquaculture and total agriculture and allied sectors during the period 2011-12 to 2018-19 for top-6 States have been presented in Figure 2. Uttar Pradesh recorded the highest output of crops in all the years, although its share in all India output has marginally increased from 12.96 per cent in 2011-12 to 14.05 per cent in 2018-19. The share of Madhya Pradesh has gone up considerably from 7.06 per cent in 2011-12 to 10.28 per cent in 2018-19. The share of Gujarat in all India output reduced from 8.87 per cent in 2011-12 to 6.84 per cent in 2018-19. Uttar Pradesh and Rajasthan together accounted for about a quarter of output of livestock at constant prices. The output of Tamil Nadu has increased faster during this period.

Maharashtra and Rajasthan have together accounted for 25.87 per cent of output of forestry and logging. The share of Assam and Uttar Pradesh has decreased during this period. West Bengal has reported the increasing output in fishing and aquaculture yet its share in all India output has reduced from 24.63 per cent in 2011-12 to 16.39 per cent in 2018-19. The total share of Assam and Kerala in all India output has reduced in 2018-19 compared to that in 2011-12. Andhra Pradesh share in all-India output increased significantly from 17.74 per cent in 2011-12 to almost 37.52 per cent in 2018-19. The share of Assam and Kerala in all India output reduced during these years, although these recorded a small increase in value of output.

Among the top 6 states, Andhra Pradesh and Madhya Pradesh share in the total Agriculture and allied sectors has increased from 5.55 per cent and 6.16 per cent in 2011-12 to 7.97 per cent and 8.09 per cent in 2018-19, respectively.

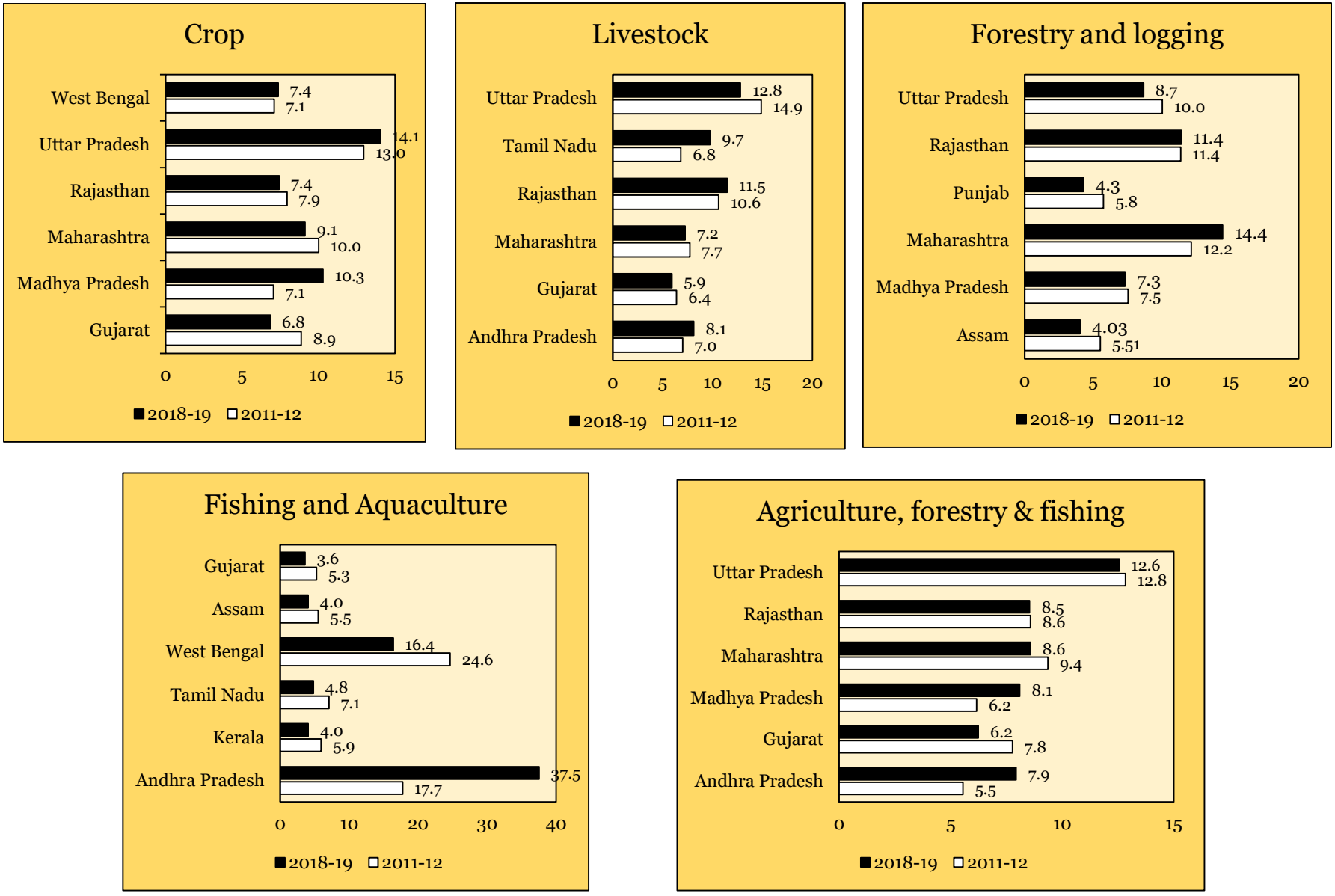


Figure 2. State-wise Value of Output of Agriculture and Allied Sectors in Percentage.

## Crop Output Growth Model

The ordinary least squares (OLS) approach was used to estimate the model, and all the variables are in logarithmic form. It may be observed from the model that effect of gross irrigated area and rainfall was positive and significant on crop output growth while the effect of fertilizer was negative and significant on crop output growth (Table 9). Rainfall and gross irrigated area were found to be significant at 1 per cent, while fertiliser was significant at 5 per cent level of significance. In the model, the variable cropping intensity was not significant. This might be as a result of the more or less fixed nature of cultivated land. Additionally, the value of crop output is not considerably impacted by the intensification of land use. The regression results model shows that normal rainfall and better irrigation facilities have a positive and significant impact while improved fertiliser consumption have negative but significant impact on the crop output growth in the country.

**Table 9: Regression Results of Agricultural Growth Model: Regression Results for Crop Output Value: 1992-93 to 2020-21**

| Dependent Variable: $\Delta^2$ Crop Output Value | |
|---|---|
| Variables | |
| Constant | 0.002427 |
| $\Delta^2$Fertiliser | -0.267648**<br>(-2.424380) |
| $\Delta^2$Capital_Formation | 0.018726<br>(0.473433) |
| $\Delta^2$Cropping_Intensity | -0.778854<br>(-1.121397) |
| $\Delta^2$Rainfall | 0.196410***<br>(3.780314) |
| $\Delta^2$Gross_Irrigated_Area | 1.376566***<br>(6.765945) |
| R-squared | 0.874118 |
| Durbin-Watson Statistics | 2.543177 |
| No. of Observations | 29 |

*Note*: Figures in parentheses are t values, *** significant at 1%, **Significant at 5%.

## CONCLUSIONS

There has been significantly changes in the cropping pattern in India with a noticeable shift from foodgrains cultivation to commercial and high value crops. Among foodgrains, the area for coarse cereals declined by 16.78 per cent between TE 1970- 1971 and TE 2020-2021 due to the lack of appropriate technological breakthrough. The performance of pulses in terms of area and output was not impressive during the study period. However, increase in crop yield was a major factor in accelerating crop production in the country since the green revolution. High yielding varieties/improved varieties, increased irrigation facilities particularly precision irrigation, and adequate and timely availability of fertilizers have impressively contributed to higher crop production growth in the country. The results of the crop output growth model indicate that better irrigation facilities, normal rainfall, and improved fertilizer consumption will help boost crop output in the country.

Technology and institutional support for a few crops such as wheat, rapeseed and mustard, sugarcane and cotton brought significant changes in crop area and output composition in the country. Wheat occupied only 10.42 per cent of GCA in TE 1970-71 and this increased to 15.45 per cent in TE 2020-21 in the country. The expansion of area for wheat, rapeseed and mustard, sugarcane and cotton crops resulted in a reduction of area planted to coarse cereals and groundnut. The share of wheat, cotton, fruits and vegetables and condiments and spices in the total value of crop output increased from 6.67 per cent, 3.22 per cent, 14.11 per cent and 2.17 per cent, respectively in TE 1970-71 to 9.68 per cent, 5.15 per cent, 27.77 per cent and 5.45 per cent, respectively in TE 2020-21. Further, the share of rice, coarse cereals and pulses in the total value of crop output has decreased from 17.26 per cent, 8.93 per cent and 8.39 per cent, respectively in TE 1970-71 to 13.96 per cent, 3.78 per cent and 5.26 per cent, respectively in TE 2020-21. The area for cotton increased from the 1980s and constituted about 5 per cent of the total value of crop output in recent years. Meanwhile, the annual yield growth during 1967-1968 to 2020- 2021 for major crops was low.

International comparisons based on Food and Agriculture Organization (FAO) data for the year 2019 (Agricultural Statistics at a Glance, 2021) show that yield per hectare of rice was 7060 kg in China and 5837 kg in Indonesia against the all-India average of 4058 kg. Similarly, the yield of wheat was 5630 kg in China and 7743 kg in France against the all-India average of 3533 kg. In case of pulses, yield per hectare was 2050 kg in Canada against the all-India average of 697 kg only. Hence, there is potential for enhancing the yield of major crops through better soil and water management, profitable crop rotation, innovative marketing, genetic engineering, and investment in farm education, research and development and rural infrastructure. It may be concluded that there is also a need to improve productivity of small and marginal farmers through development and implementation of small holding farm technologies. The regenerative agriculture through suitable integrated farming system (IFS) models is the need of the hour to improve soil health, make agriculture profitable and sustainable in the long run.

## WAY FORWARD

Crop diversification towards oilseeds, pulses and horticulture needs to be given priority by addressing the core issues of irrigation, investment, credit and markets in their cultivation. While the Government has adopted the use of MSP as signal to encourage crop diversification, there is also a need for coordinated action from the State Governments to facilitate the shift to high value and less water guzzling crops to enable realization of the objective of doubling farmers' income in a sustainable way. Research shows that every rupee spent on agricultural research and development, yields better returns compared to returns on money spent on subsidies or other expenditures on inputs. The increase in agriculture research and development (R&D), from the present 0.65 per cent of GDP to at least one per cent, therefore, may improve productivity in crop and allied sectors. Further, integrated farming on small farm holdings – crop, horticulture, household dairy, backyard poultry, small pond-culture, and home-grown ducks – will cross-hold risks and pave the way for farmer doubling his income erelong. Sustainability of agricultural growth is assured thus through heavy capital investments in climate resistant technologies, cashing in carbon credits sooner than later.

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