



Repurposing Agrifood Policies for Biodiversity

REENA SINGH | PURVI THANGARAJ
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ABBREVIATIONS

AAGR	Average Annual Growth Rate	DIDF	Dairy Processing and Infrastructure Development Fund
AAJ	Antyodaya Anna Yojana	FAO	Food and Agriculture Organisation
AFBS	Agri-food Budgetary Support	FCI	Food Corporation of India
AISS	Agriculture Investment Support Scheme	Fe	Iron
APC	Agricultural Prices Commission	FPS	Fair Price Shops
APL	Above Poverty Line	FRP	Fair and Remunerative Price
ARDE	Agricultural Research, Development, Education, and Extension	FSI	Forest Survey of India
ARI	Agriculture Research Intensity	GCA	Gross Cropped Area
B	Boron	GERD	Gross Expenditure on Research and Development
BD	Biological Diversity	GHG	Greenhouse Gas
BPL	Below Poverty Line	GoI	Government of India
C	Carbon	GoMP	Government of Madhya Pradesh
CACP	Commission for Agricultural Costs and Price	GoP	Government of Punjab
CAG	Comptroller and Auditor General	GoT	Government of Telangana
CAMPA	Compensatory Afforestation Fund Management and Planning Authority	GSVA	Gross State Value Added
CBD	Convention on Biological Diversity	GVA	Gross Value Added
CCA	Cultivable Command Area	H	Hydrogen
CIP	Central Issue Price	ICAR	Indian Council of Agricultural Research
Cl	Chlorine	ICT	Information and Communication Technology
CO₂	Carbon dioxide	IEC	Information, Education, and Communication
COP	Conference of Parties	iFSM	Integrated Fertiliser Management System
CSS	Central Sector Scheme	ISAC	Integrated Scheme on Agriculture Cooperation
Cu	Copper	ISACES	Integrated Scheme on Agriculture Census, Economics and Statistics
DA&FW	Department of Agriculture and Farmers' Welfare	ISAM	Integrated Scheme of Agriculture Marketing
DAHD	Department of Animal Husbandry and Dairying	JGSY	Jawahar Gram Samridhi Yojana
DARE	Department of Agriculture Research and Education		

JRY	Jawahar Rozgar Yojana	N	Nitrogen
K	Potassium	NABARD	National Bank for Agriculture and Rural Development
K₂O	Potassium Fertiliser	NADCP	National Animal Disease Control Programme
KM-GBF	Kunming - Montreal Global Biodiversity Framework	NAIS	National Agriculture Insurance Scheme
LHDCP	Livestock Health and Disease Control Programme	NAPCC	National Action Plan on Climate Change
LULUCF	Land-Use and Land-Use Change and Forestry	NARS	National Agricultural Research System
mbgl	meters below ground level	NBA	National Biodiversity Authority
Mg	Magnesium	NBAGR	National Bureau of Animal Genetic Resources
MGNREGA	Mahatma Gandhi National Rural Employment Generation Guarantee Act	NBAIR	National Bureau of Agricultural Insect Resources
mha	Million hectares	NBAP	National Biodiversity Action Plan
MIDH	Mission for Integrated Development of Horticulture	NBPGR	National Bureau of Plant Genetic Resources
MIS	Market Intervention Scheme	NBS	Nutrient Based Subsidy
MMT	Million metric tonnes	NBSAP	National Biodiversity Strategy and Action Plan
Mn	Manganese	NBTs	National Biodiversity Targets
MNAIS	Modified National Agriculture Insurance Scheme	NDC	Nationally Determined Contribution
Mo	Molybdenum	NeGP-A	National e-Governance Plan in Agriculture
MoAFW	Ministry of Agriculture and Farmers' Welfare	NEP	National Environment Policy
MoCAFPD	Ministry of Consumer Affairs, Food and Public Distribution	NFSA	National Food Security Act
MoCF	Ministry of Chemical and Fertilisers	NFSM	National Food Security Mission
MoEFCC	Ministry of Environment, Forests and Climate Change	NFWP	National Food for Work Programme
MoF	Ministry of Finance	Ni	Nickel
MoFAHD	Ministry of Fisheries, Animal Husbandry and Dairying	NMOOP	National Mission on Oil Seeds and Palm
MoJS	Ministry of Jal Shakti	NMSA	National Mission on Sustainable Agriculture
MoRD	Ministry of Rural Development	NPDD	National Programme for Dairy Development
MRP	Maximum Retail Price	NREP	National Rural Employment Programme
MSP	Minimum Support Price		
MUs	Million units		

NRM	Natural Resource Management	PSS	Price Support Scheme
O	Oxygen	RKVY	Rashtriya Krishi Vikas Yojana
P	Phosphorus	RLEG	Rural Landless Employment Guarantee
P₂O₅	Phosphate Fertiliser	RRBs	Regional Rural Banks
PDPS	Price Deficit Payment Scheme	S	Sulphur
PDS	Public Distribution System	SAUs	State Agricultural Universities
PGRs	Plant Genetic Resources	SDGs	Sustainable Development Goals
PKVY	Paramparagat Krishi Vikas Yojana	SHC	Soil Health Cards
PM-AASHA	Pradhan Mantri Annadata Aay SanrakshAn Abhiyan	SHG	Self-Help Groups
PM-KISAN	Pradhan Mantri Kisan Samman Nidhi	SMAM	Sub-Mission on Agricultural Mechanization
PM-KMY	Pradhan Mantri Kisan Maandhan Yojana	SMPPQ	Sub-Mission on Plant Protection and Plant Quarantine
PM-PRANAM	PM-Programme for Restoration, Awareness, Nourishment and Amelioration of Mother Earth	SMSP	Sub-Mission on Seeds & Planting Materials
PMFBY	Pradhan Mantri Fasal Bima Yojana	SP	Strategic Plan
PMGKY	Pradhan Mantri Garib Kalyan Yojana	TDS	Total Dissolved Solids
PMKSY	Pradhan Mantri Krishi Sinchayee Yojana	TE	Triennium Ending
PPV&FRA	Protection of Plant Varieties and Farmers' Rights Authority	TOP	Tomato, Onion and Potato
PSF	Price Stabilization Fund	TPDS	Targeted Public Distribution System
PSPCL	Punjab State Power Corporation Limited	UN	United Nations
		WBCIS	Weather based Crop Insurance Scheme
		Zn	Zinc

FOREWORD

Humans benefit greatly from the many services that ecosystems provide for free. These ecosystems are the sources of our food, fuel, and building materials. Beyond these tangible goods, biodiversity plays a crucial role in purifying water, stabilizing and moderating the climate, and regulating floods, droughts, and epidemics. Simply put, biodiversity is essential for our survival. However, over the past few decades, there has been a rapid decline in biodiversity worldwide, raising concerns. With respect to agriculture, biodiversity loss poses a significant threat to global food security. Over the past century, approximately 75 percent of plant genetic diversity has been lost as farmers have increasingly cultivated high yielding, genetically uniform crops (FAO, 1999). Currently, just nine plant species account for 66 percent of global crop production, with rice, wheat, and maize providing more than 50 percent of the world's plant-derived calories (FAO, 2019). This heavy reliance on a limited variety of crops weakens the resilience of food systems, making them more susceptible to pests, diseases, and extreme climate conditions. However, farming and agriculture practices also contribute substantially to habitat destruction causing biodiversity losses.

The agriculture sector in India is largely driven by policy signals and incentives. The policymakers possess an underutilized field of investigation: closely examining public subsidies and incentives that may inadvertently harm biodiversity. This approach was deemed a priority at the 2010 United Nation Convention on Biological Diversity (CBD)

in Nagoya and its 2011-2020 Aichi Targets. Furthermore, the Kunming-Montreal Global Biodiversity Framework (KM-GBF) at December 2022 CBD called for the identification of biodiversity detrimental incentives including subsidies by 2025. KM-GBF has also set a target to eliminate, phase out or reform biodiversity detrimental incentives by progressively reducing them by at least US\$ 500 billion (bn) per year by 2030, in a proportionate, just, fair, effective and equitable way. At the national level, this goal is part of the commitments and is included in the National Biodiversity Strategy and Action Plan (NBSAP) launched at the 16th meeting of the Conference of Parties (COP 16) to the CBD.

This provided the context of the report, which is jointly prepared by Indian Council for Research on International Economic Relations (ICRIER) and United Nations Development Programme (UNDP). The report begins with a detailed analysis of the existing national level policies and budgetary allocations in the agrifood space from 2000-01 (FY01) to FY25. This is followed by the task of categorizing them as biodiversity positive, detrimental or neutral for which a proven causal link with the increase, decline or no impact of biodiversity can be shown to exist. The report concludes with possible courses of reform. This report will be useful for policymakers in reforming biodiversity detrimental support to those with positive or at least neutral outcomes for biodiversity, environment and human health while achieving food, nutritional and livelihood security.

Deepak Mishra
Director & Chief Executive
ICRIER

FOREWORD

Biodiversity and robust ecosystems are essential for agriculture and food security. They provide vital services like pollination, water purification, flood prevention, and carbon capture, valued at up to US\$ 140 trillion annually. However, the pursuit of higher farm yields and economic growth is increasingly harming nature.

Governments around the world provide subsidies to important sectors such as food and agriculture to promote economic growth and stability. While these are often well-intended, some subsidies over time can negatively impact the environment due to factors like groundwater extraction and fertilizer usage. It is estimated that such environmentally harmful subsidies globally amount to at least US\$ 2.6 trillion annually, which is equivalent to 2.5 percent of global GDP, contributing to pollution, ecosystem degradation, and biodiversity loss.

In India, agricultural subsidies have significantly enhanced food production and supported livelihoods over the years. However, certain measures—such as price incentives, power subsidies, and fertiliser support—are now leading to the excessive use of inputs, reduced crop diversity, and degradation of soil and water systems.

To better understand these impacts, UNDP India, through the global Biodiversity Finance Initiative (BIOFIN), partnered with the Indian Council for Research on International Economic

Relations (ICRIER) to study the impact of agricultural subsidies on biodiversity and ecosystems across India with a special focus on three states: Punjab, Madhya Pradesh, and Telangana. The analysis reveals how public spending can unintentionally drive land degradation, overextraction of resources, and increased greenhouse gas emissions.

Significantly, the report suggests practical steps to reform these subsidies, including rationalizing fertiliser use, encouraging diverse and nutritious crops through public procurement, promoting climate-resilient farming practices, and scaling sustainable technologies.

This aligns with India's commitment to the Kunming-Montreal Global Biodiversity Framework, especially Target 18 on repurposing harmful subsidies and its leadership in aligning development with environmental sustainability. This report provides a roadmap for turning that commitment into action, offering adaptable insights for other countries facing similar challenges.

At UNDP, we are proud to support the Government of India in combatting biodiversity loss. It is preventable with informed choices and smarter policies that restore ecosystems while continuing to meet food and development needs.

We hope this report serves as a valuable tool for policymakers and partners working to secure a nature-positive future.

Dr. Angela Lusigi
Resident Representative
UNDP India

PREFACE

Biological diversity is humanity's natural legacy and crucial for achieving sustainable development. The loss of biodiversity ranks among the most significant global risks to society. Our planet is currently experiencing its sixth mass extinction, with far reaching consequences that will impact all life forms, both immediately and for millions (mn) of years into the future. India is one of the 17 megadiverse country that contains 7–8 percent of the world's species, despite only having 2.4 percent of the world's land area. The country is also home to four global biodiversity hotspots and is one of the world's eight Vavilov centres of crop plant origin and diversity. India has placed legal, policy and institutional frameworks targeting the sustainable use and conservation of biodiversity as a whole. India, being a signatory to several international conventions, multi-lateral environmental agreements and national commitments, is adopting approaches to conserve biodiversity. However, these efforts need strengthening.

The United Nation CBD adopted the KM-GBF in December 2022 with a Mission 2030 and Vision 2050. Aligning with KM-GBF, India has launched its updated NBSAP on 30th October 2024. Agrifood systems are vital for the achievement of 2030 NBSAP National Biodiversity Targets (NBTs), particularly Target 18 “Repurpose detrimental incentives for biodiversity”. To facilitate the same, UNDP's flagship programme, Biodiversity Finance Initiative (BIOFIN), in collaboration with Ministry

of Environment, Forests and Climate Change (MoEFCC) and the National Biodiversity Authority (NBA), conducted a nationwide study and identified select schemes with substantial biodiversity attributable budget and scope for mainstreaming agrobiodiversity. Further, to establish a robust baseline and optimize budget allocation towards biodiversity-positive outcomes, a study on programmes, incentives and subsidies impacting agricultural biodiversity (or agrobiodiversity) is being conducted jointly by ICRIER and UNDP.

This report is the part of the phase I project “Repurposing public policies and programmes for protecting biodiversity” led by ICRIER and commissioned by UNDP in June 2023. This work was undertaken under UNDP's global flagship programme BIOFIN-Biodiversity Finance Initiative. At the national level, the initiative supports KM-GBF and NBSAP, through assessing agrifood budgetary support (AFBS) by centre and state governments (three selected pilot states - Punjab, Madhya Pradesh and Telangana) as well as defining resource repurposing strategy in consultation with the stakeholders. The studied pilot states provided evidence about the general linkages between agrifood incentives and their potential adverse effects on agrobiodiversity. The results from this phase will be useful in the second phase for preparing a roadmap to repurpose agricultural programmes and policies for biodiversity positive outcomes.

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ABSTRACT

Agrifood systems are vital for the achievement of 2030 NBSAP National Targets, particularly Target 18 “Repurpose detrimental incentives for biodiversity”.

Indian agrifood incentives were instrumental in transforming the nation from “foodgrain deficient” to “foodgrains exporter” to feed a growing population. However, the same mechanisms are not contributing to enhance (or maintain) the agrobiodiversity from which the food is produced. This report inform about the general linkages between agrifood incentives and their potential adverse effects on agrobiodiversity. It synthesizes, calculates, and assesses the extent and impact of biodiversity detrimental AFBS provided by Government of India (GoI) and state governments of pilot states — Punjab, Madhya Pradesh, and Telangana. The AFBS has been divided into three categories: (i) individual farmer-centric budgetary support (e.g. direct income support, input subsidies, risk cover, etc.) to boost farmers' income; (ii) those delivering public goods that enhance the overall capacity of the sector through sector-wide improvements in infrastructure and agricultural technologies (e.g. research and extension, irrigation, connectivity through roads, etc.) and (iii) safety net budgetary support (e.g. food subsidy) that are aimed at improving the access and affordability of food products to consumers. Bringing forward the detrimental biodiversity effects from support may be the critical dimension that affects the decision about whether to remove, keep or repurpose the agrifood support.

AFBS increased from ₹355 bn (US\$ 7.9 bn) per annum (FY01) - representing 1.67 percent of GDP to ₹6,328 bn (US\$ 76 bn) per annum (FY25, BE) - representing 1.99 percent of GDP. In triennium ending (TE) 2024, the average AFBS was ₹7,076 bn (US\$ 90 bn) per annum. Of this, about ₹3,507 bn

(US\$ 45 bn) is provided as safety nets, i.e., food subsidy and rural employment (Mahatma Gandhi National Rural Employment Generation Guarantee Act, MGNREGA) that ensures food security and minimum livelihood opportunities to rural population. About ₹3,132 bn (US\$ 40 bn) was provided as income support and input subsidies, while ₹436 bn (US\$ 6 bn) was used to fund transfers to the agriculture sector for development activities. As this report demonstrates, the unconditional subsidies linked to the inputs can lead to detrimental environmental and biodiversity outcomes.

In TE 2024, GoI provided 28 percent (₹1,980 bn, US\$ 25 bn) AFBS in the form of fertiliser subsidies that continue to promote the overuse of fertiliser inputs and is detrimental to biodiversity. The support provided to producers as income support (crop insurance, credit subsidy, PM-KISAN, etc.) comprised 13 percent (₹940 bn, US\$ 12 bn) and is neutral with respect to biodiversity outcomes. Support for the provision of general sector development services are the least distorting measures, and are likely to foster sustainability and is positive with respect to biodiversity outcomes. It comprised 21 percent (₹1,483 bn, US\$ 19 bn). Incentives supporting irrigation and procurement for distribution of a few cereals (for example, wheat and rice through food subsidies) to ensure adequate supplies to the consumers encourages monocropping. Support to irrigation and food subsidy comprised 38 percent (₹2,673 bn, US\$ 34 bn) of the total AFBS and helps the country achieve food security target and is categorized to have a mixed impact on biodiversity outcome. Instead of incentivizing biodiversity detrimental practices, India should assess options to repurpose subsidy policies to neutralize their effects on biodiversity. This is critical to the resource mobilization to implement the KM-GBF.

EXECUTIVE SUMMARY

Overview

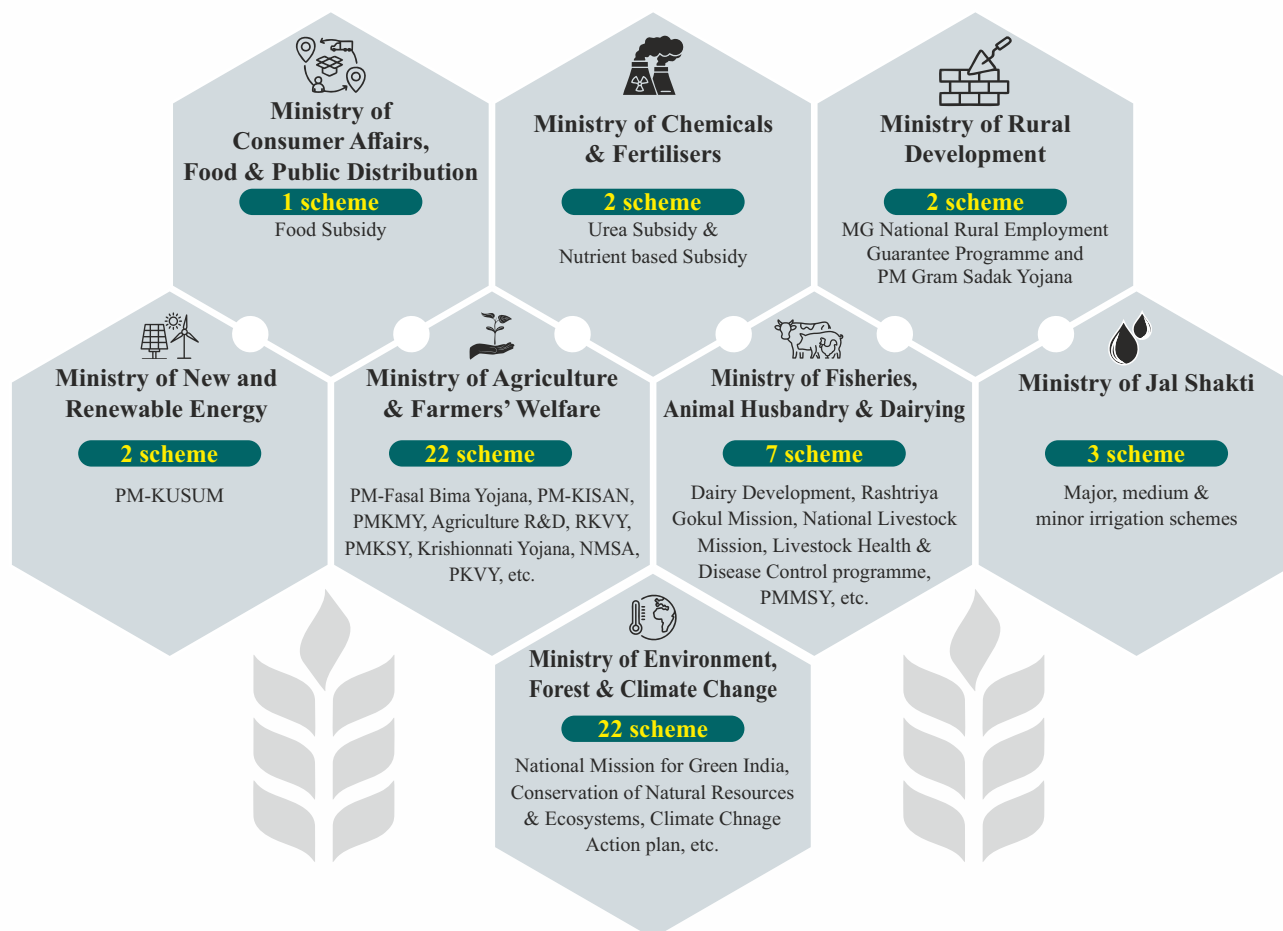
Biodiversity forms the foundation of agriculture, facilitating the evolution of farming systems since agriculture began about 10,000 years ago. It is the source of all crop species and domesticated livestock, and their variations. Additionally, biodiversity underpins the ecosystem services vital for sustaining agriculture and human well-being. Over the last fifty years, excessive consumption and unsustainable production have intensified biodiversity loss. In 2023, over half of the world's GDP, approximately US\$58 trillion (tn), was generated by economic activities moderately to highly dependent on nature, with critical sectors like agriculture being particularly vulnerable to biodiversity loss and nature's decline. In 2020, industries with high dependence on nature generate around US\$13 tn (15 percent of global GDP), while those with moderate dependence account for US\$31 tn (37 percent of global GDP). Externalities (i.e., effects of an economic activity affecting the environment, such as the greenhouse gas emissions, water pollution, or soil degradation, but not reflected in market prices) associated with sectors contributing to biodiversity loss—such as agriculture, livestock, fisheries, forestry and fossil fuels—are estimated to total US\$10.7 tn inflation-adjusted to 2023 (IPBES, 2024).

Examples of agroecosystem services negatively affected by biodiversity loss—and their financial implications—include pollination, climate regulation, and soil fertility. Essential pollinators like bees, butterflies, and birds support plant reproduction and contribute significantly to agricultural productivity. However, declining populations of some pollinator species, driven by

biodiversity loss, could result in reduced crop yields and increased food costs. Their role in global crop production is valued at approximately US\$235 to US\$577 bn each year. Natural ecosystems, including forests play a vital role in climate regulation by storing carbon and producing oxygen. However, as biodiversity declines, these ecosystems lose their ability to effectively store carbon, contributing to climate change. Estimates suggest that the financial impact of deforestation and other land-use changes could reach US\$3.3 tn annually by 2030. Similarly, biodiversity loss negatively affects soil fertility, leading to degradation that reduces agricultural productivity. The estimated annual cost of soil erosion and degradation is around \$300 bn, reflecting its significant economic consequences (Kumar et al. 2024).

The efforts in restricting the loss of global biodiversity have remained insufficient; also the Aichi Targets 2020 set by the Convention on Biological Diversity have not resulted in the expected response from the member countries. As a result, the Kunming-Montreal Global Biodiversity Framework (KM-GBF) was adopted at the 15th Meeting of the Conference of the Parties to the Convention on Biological Diversity (COP 15) in December 2022. It includes a monitoring framework to track progress towards its goals and targets. India is committed to KM-GBF 2030 targets including Target 18 “Repurpose detrimental incentives for biodiversity”. Agriculture sector in India is largely driven by policy signals and incentives, thus identification of incentives that are detrimental to biodiversity is the first step to define its repurposing strategy.

Policies & Budgetary Support for the Agrifood sector



India has experienced an impressive transformation since then from being a ‘foodgrain deficient’ to a food sufficient and food surplus economy. Foodgrain production in India has increased from a mere 50.8 MMT in 1950-51 to 332.3 MMT in 2023-24 with per capita net foodgrain availability increasing from 144.1 kg per year in 1951 to 207.6 kg per year in 2023. The major change took place in the period of green revolution and the transformation is attributed to high yielding varieties of seeds, along with irrigation, and fertiliser usages. This was made possible by agriculture policies that provided various input and output subsidies and incentives to ensure food security. The agrifood policies and incentives from GoI and states have helped to grow the agriculture and allied sector of

India, which has made impressive strides in producing food to feed a growing population (1.4 bn), reducing real food prices for consumers (particularly of wheat and rice), providing livelihood opportunities for 46.1 percent of the workforce, and contributing 17.8 percent of the country’s gross value added in FY24.

Supporting agriculture through various incentives and support was a necessary step during a period of hunger. However, agriculture incentives, when they lower input costs and/or enhance output prices can result in greater levels of input such as fertilisers, pesticides, other chemicals, irrigation or more mechanization. This can have various impacts on biodiversity such as the loss of non-target species

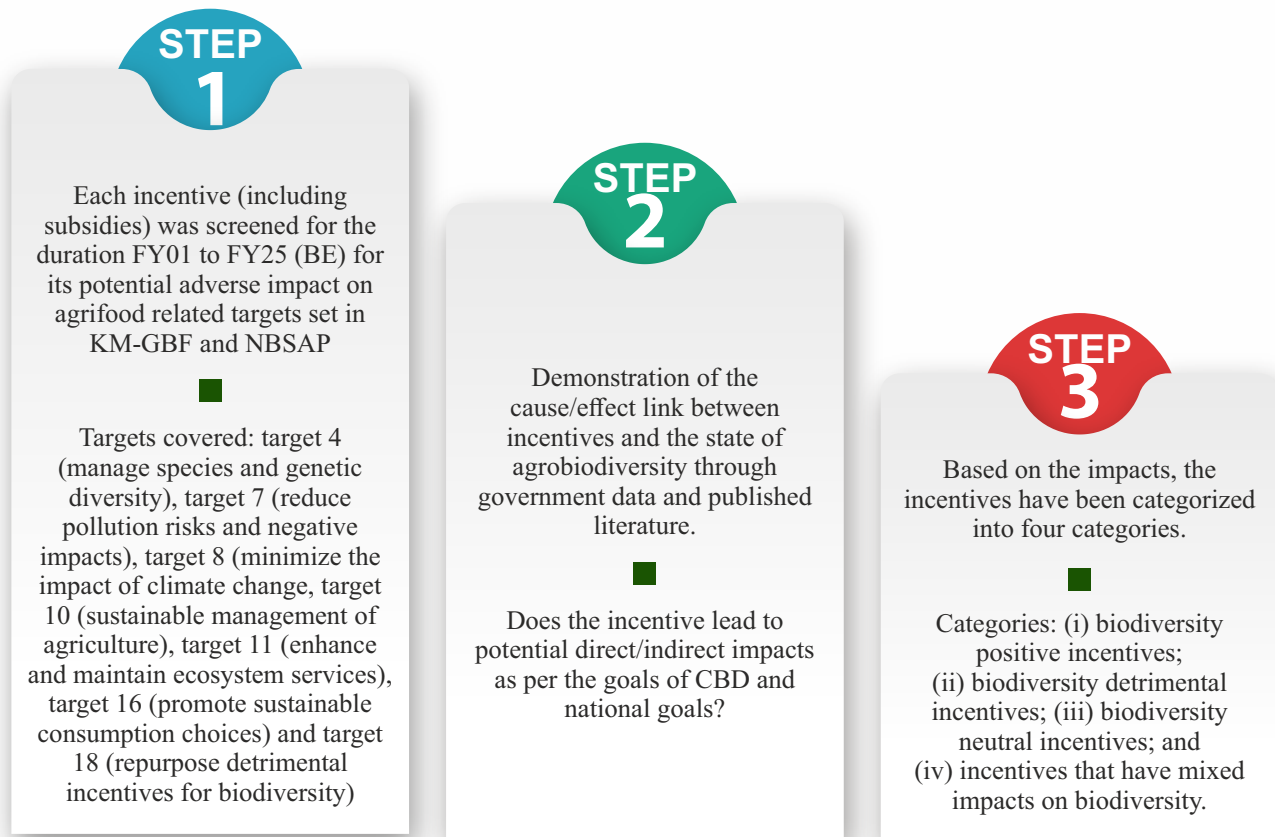
(pollination from bees), eutrophication of various ecosystems, soil degradation and erosion leading to loss of beneficial soil microbiota. This may also lead to the conversion of more natural land into agricultural land through land use change leading to loss of natural biodiversity. Further, agricultural incentives may influence cropping choices (spatial and temporal diversity), which may impact biodiversity.

Therefore, the budgetary provisions for this sector need to be understood from the long-term perspective of their impact on biodiversity. Against this backdrop, the main objective of this report is to explore the linkages between AFBS and the possible detrimental biodiversity consequences. This report synthesizes, calculates, and critically assesses the extent and impact of biodiversity detrimental AFBS provided by GoI and state governments of pilot states: Punjab, Madhya Pradesh, and Telangana.

Bringing forward the detrimental biodiversity effects from support may prove to be the critical dimension that affects the decision about whether to remove, keep or repurpose the AFBS.

Three categories of budgetary support are provided to the agrifood sector of the country: (i) providing individual farmer centric budgetary support (e.g. direct income support, input subsidies, risk cover etc.) to boost farmers' income; (ii) those delivering public goods that enhance the overall capacity of the sector through sector-wide improvements in infrastructure and agricultural technologies (e.g. research and extension, irrigation, connectivity through roads, etc.) and (iii) safety net (e.g. food subsidy, employment guarantee). The support has been analyzed (qualitative and quantitative) for the duration FY01 to FY25 (BE), in the three step process:

Methodological Framework for evaluation of AFBS detrimental to biodiversity



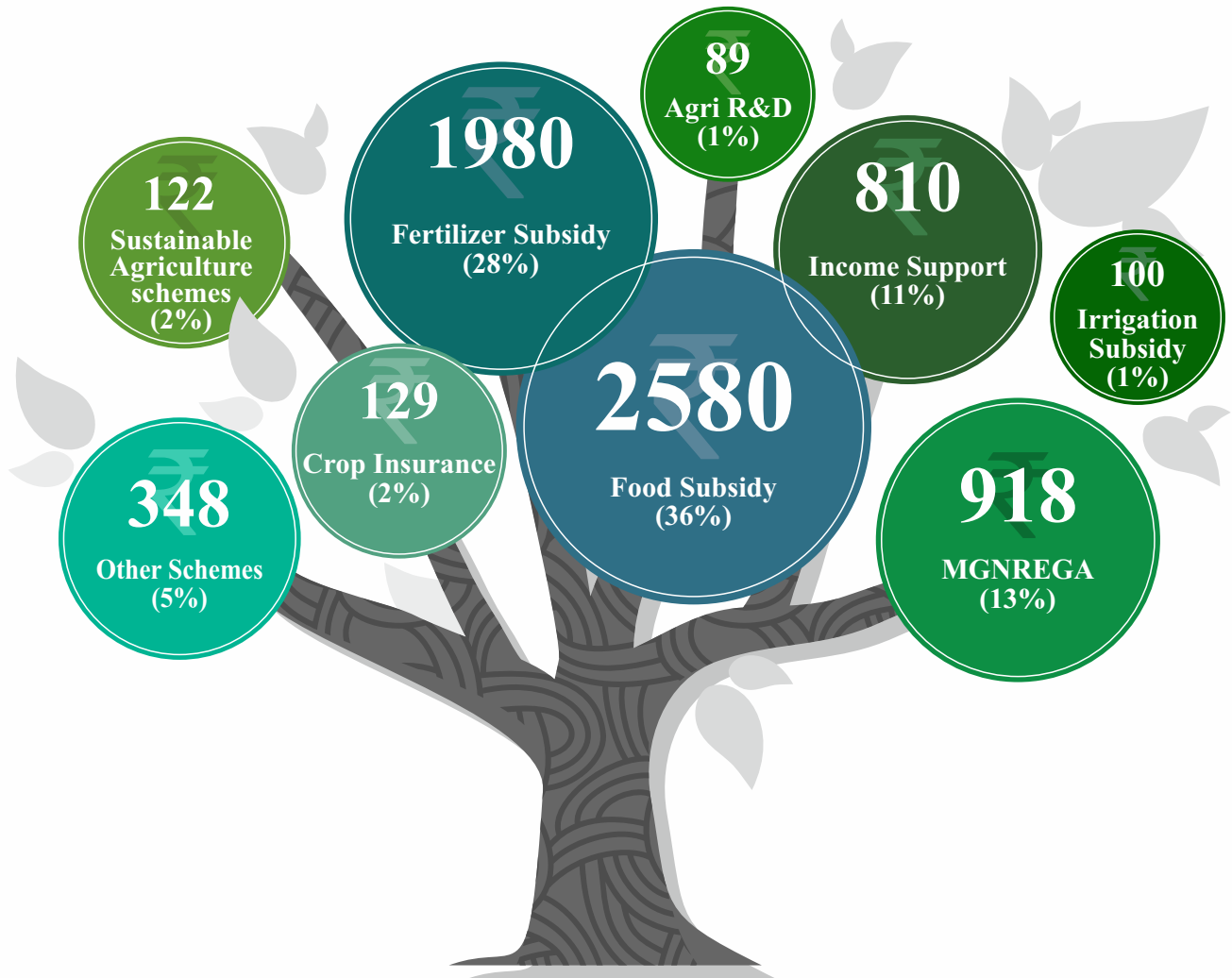
Key Findings

AGRIFOOD BUDGETARY SUPPORT (AFBS) BY GOI

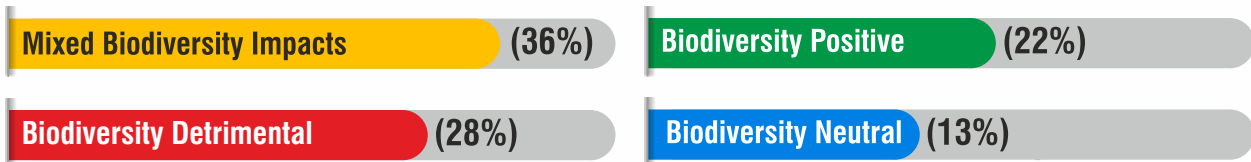
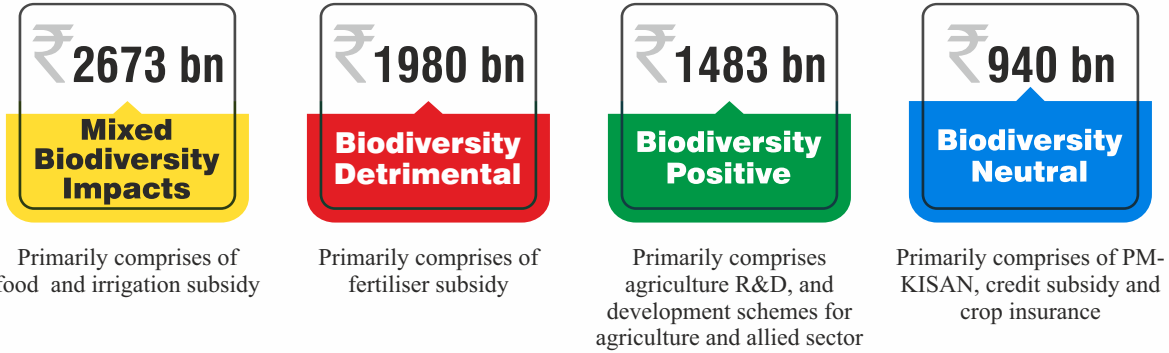
AFBS increased from ₹355 billion to ₹6328 billion per annum between FY01 to FY25 (BE)



COMPOSITION & MAGNITUDE OF AFBS (TE 2024)



IMPACT ON AGROBIODIVERSITY (TE 2024)



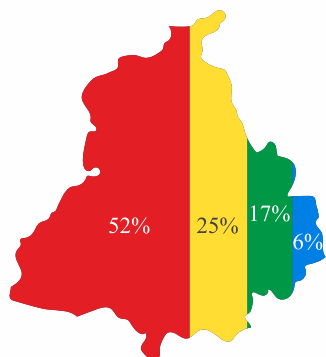
WHY AGROBIODIVERSITY MATTERS?

The Indian gene centre is among the 12 megadiversity regions of the world. India is also one of the world's eight Vavilov centres of crop plant origin and diversity and has composite mosaic of distinct agroecosystems (20 broad agro-ecological zones). At least 166 food/crop species including rice (with around 15,658 rice landraces), many legumes (e.g., chickpea, pigeon pea), vegetables (e.g., eggplant, cucumber), tubers (e.g., taro, yam), fruits (mango, citrus tamarind), spices and dyes have been originated in India. India also has one of the world's largest diversities of domesticated animals, with 30 breeds of cattle, 10 breeds of buffalo, 40 of sheep, 20 of goats, 8 of camels, 6 of horses, and 18 of poultry, and nearly 11 percent of the world's fish resources are reported to occur in India.

Modern farming systems, which evolved in response to the growing needs of the human society to ensure food and nutritional security have progressively replaced traditional agriculture. More than half of the cultivated area under major crops is now covered by improved varieties and farming practices with high inputs of fertilisers, pesticides, water and electricity as well as mechanization. Agriculture incentives and subsidies has encouraged this trend. However, the heavy reliance on a few species, varieties and breeds and the vanishing pollinators and other beneficial organisms that support food and agriculture can pose serious threats to food security and economic stability, disrupting the resilience of the agriculture system.

Source: National Bureau of Plant Genetic Resources (NBPGR)

PUNJAB



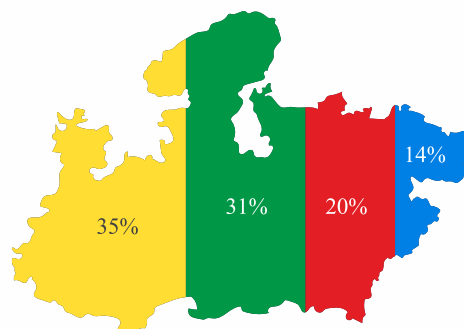
AFBS (together from GoI and GoP) in Punjab has increased from ₹139 bn (US\$ 2.3 bn), accounting for 3.9 percent of GSDP in FY15 to ₹397 bn (US\$ 4.7 bn), accounting for 5.3 percent of GSDP in FY25. GoI support grew from ₹86 bn (US\$ 1.4 bn) to ₹229 bn (US\$ 2.7 bn), and GoP support from ₹53 bn (US\$ 0.9 bn) to ₹168 bn (US\$ 2 bn) over the same period, with a share of approximately 60:40 between GoI and GoP.

Of the total ₹399 bn (US\$ 5.1 bn) in TE 2024: Biodiversity detrimental (52 percent) - ₹209 bn (US\$ 2.7 bn); Mixed impacts on biodiversity (25 percent) - ₹98 bn (US\$ 1.3 bn); Biodiversity positive (17 percent) - ₹69 bn (US\$ 0.9 bn) and Biodiversity neutral (6 percent) - ₹22 bn (US\$ 0.3 bn).

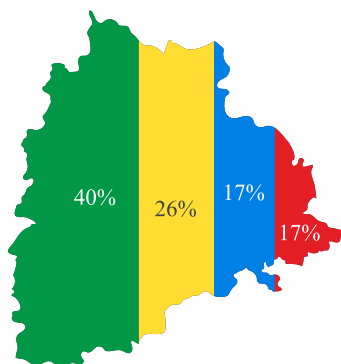
AFBS (together from GoI and GoMP) in Madhya Pradesh has increased from ₹516 bn (US\$ 8.5 bn), accounting for 10.7 percent of GSDP in FY15 to ₹1024 bn (US\$ 12.4 bn) accounting for 8.3 percent of GSDP in FY25. GoI support grew from ₹306 bn (US\$ 5 bn) to ₹654 bn (US\$ 7.8 bn), and GoMP support from ₹210 bn (US\$ 3.4 bn) to ₹388 bn (US\$ 4.6 bn) over the same period, with a share of approximately 60:40 between GoI and GoMP.

Of the total ₹1111 bn (US\$ 14.2 bn) in TE 2024: Mixed impacts on biodiversity (35 percent) - ₹391 bn (US\$ 5 bn); Biodiversity positive (31 percent) - ₹346 bn (US\$ 4.4 bn); Biodiversity detrimental (20 percent) - ₹219 bn (US\$ 2.8 bn) and Biodiversity neutral (14 percent) - ₹155 bn (US\$ 2 bn).

MADHYA PRADESH



TELANGANA



AFBS (together from GoI and GoT) in Telangana has increased from ₹371 bn (US\$ 6.1 bn) accounting for 8.9 percent of GSDP in FY15 to ₹1451 bn (US\$ 17.3 bn) accounting for 16.6 percent of GSDP in FY25. GoI support grew from ₹143 bn (US\$ 2.3 bn) to ₹417 bn (US\$ 5 bn), and GoT support from ₹228 bn (US\$ 3.7 bn) to ₹1034 bn (US\$ 12.4 bn) over the same period, with a share of approximately 40:60 between GoI and GoT.

Of the total ₹1135 bn (US\$ 14.5) in TE 2024: Biodiversity positive (40 percent) - ₹459 bn (US\$ 5.9 bn); Mixed impacts on biodiversity (26 percent) - ₹291 bn (US\$ 3.7 bn); Biodiversity neutral (17 percent) - ₹197 bn (US\$ 2.5 bn) and Biodiversity detrimental (17 percent) - ₹187 bn (US\$ 2.4 bn).

Repurposing for Resilient Agriculture



Repurposing fertiliser subsidy

The subsidies on fertilisers, which are currently skewed towards urea, should be rationalized to have parity in nutrient pricing to promote balanced fertiliser use. Under PM-PRANAM scheme, 50 percent of the fertiliser subsidy saved by a State/UT by way of reduction in chemical fertilisers consumption compared to previous 3 years' average consumption, has a provision to be provided to State/UT. This scheme has not yet taken off and needs to be monitored for states which are using high dosages of fertilisers.



Reorienting agricultural priorities away from 'more' food grains and towards 'diverse' food

Policies related to contracts and procurement can be used to encourage diverse diets from sustainable food systems in places like workplaces, schools, and public meal venues. Public distribution programmes aimed at low-income households and individuals can enhance diversity in diets. Under PMGKY, the procured foodgrains are distributed through fair price shops (FPS) in India, which are 0.54 mn in number (NFSA Portal). These are operated by 0.29 mn individuals; 83000 co-operatives; 9700 Panchayat; 26,000 self-help groups and 92,000 other FPS. To increase the consumption diversity from wheat-rice to other nutritious crops – biofortified rice and wheat, millets, pulses, edible oils, soybean products, fortified milk, eggs etc. – these FPS needs to be upgraded. At least 10 percent of these FPS may be declared as nutrition food hubs containing diversified food basket, from which the consumers can chose using electronic vouchers, similar to e-food coupons in a food court (Gulati, 2023).



Premium Support Price for low-carbon crops

The GoI procures foodgrains (wheat and rice) at MSP for buffer stock requirements for Targeted Public Distribution System (TPDS) and other welfare schemes. Every year Commission for Agricultural Costs and Price (CACP) provides recommendations for MSP of various crops to the central government. At present, CACP is not accounting carbon cost while recommending MSP for various commodities. To encourage farmers to shift to low-carbon cultivation practices and crops (such as legumes and oilseeds), premium prices (which can be linked to the carbon price and can be recommended by CACP) should be offered to the farmers. This measure will not only address food security objective but will encourage farmers to grow low-carbon and diverse crops (Singh and Gulati, 2025).



Practice precision agriculture

Scaling up and subsidizing precision agriculture techniques is essential. To maximize water efficiency, selecting the right crop cultivar, planting density, timing, and rotation is crucial. Practices such as water capture (to increase reliance on green water), soil restoration, drip irrigation, soil water harvesting, and soil conservation are also important. This approach will require reducing nutrient applications in some states while increasing them in others. As the technologies needed for precision agriculture are currently expensive, private sector companies should help scale them for affordability. Government should provide subsidies to enable their adoption in the country.



Introduction

Agrobiodiversity at Crossroads: Why Repurposing Matters?

India launched updated National Biodiversity Strategy and Action Plan (NBSAP) at 16th meeting of the Conference of Parties (COP 16) to the Convention of Biological Diversity (CBD). NBSAP is the Roadmap for achieving the Kunming-Montreal Global Biodiversity Framework (KMGBF) targets to address the strategies to halt and reverse biodiversity loss by 2030. Agrifood systems are vital for the achievement of NBSAP and KMGBF Targets. This chapter starts with the overview of agrobiodiversity and its importance, India's agrobiodiversity status and various policies measures related to biodiversity. The chapter then delves into the objectives and the detailed methodology that was undertaken for the study.



1.1 Agrobiodiversity and its importance

Biodiversity encompasses all variety and variability of living organisms. The biodiversity profile of a country at any point of time is a reflection of the presence of this kind of diversity, the consequences of the way it has been utilized and how it has been conserved through legal or other measures. Food and agriculture production is dependent on biodiversity, and vice versa, biodiversity conservation is dependent on food and agriculture production systems. Biodiversity generates critical ecosystem services necessary for human well-being that include support to food and feed production, energy, medicines, materials, pollination, pest control, heat regulation, carbon sinks, and soil moisture feedback for rainfall amongst others. The diversity and richness of all living organisms, ranging from animals, trees, plants to microorganisms, on land and in water, is vital for the ecosystems' health, stability, and functionality (Cardinale et al., 2012) and for the productivity and resilience of food production systems.

There are increasing evidences of global rate of species extinction already at least tens to hundreds of times higher than the average rate over the past 10 mn years and is accelerating (IPBES, 2019). This loss of biodiversity, including agricultural biodiversity (**Box 1.1**) is an increasing threat to the planet, and global food security and can undermine our ability to sustainably feed a global population of nearly 10 billion people by the mid-century. International Union for Conservation of Nature Red List has made global conservation assessments of 30 percent of known edible plant species, out of which 11 percent are classified as threatened and at risk of extinction (Ulian et al., 2020).

Presently, 26 percent of the world's 7,745 local livestock breeds are facing risk of extinction, and 33 percent of fish stocks are overfished (FAO, 2019). The likelihood of a bee, one of the world's primary crop pollinators, has declined by a third since the 1970s (Seroya et al., 2020).

Despite the fact that more than 6,000 different plant species are cultivated for food and traditional crop varieties persists, just nine (sugarcane, maize, rice, wheat, potatoes, soybeans, oilpalm fruit, sugar beet and cassava) accord approximately 66 percent of total crop production (FAO, 2019).

The heavy reliance on a few species, varieties and breeds and the vanishing pollinators and other beneficial organisms that support food and agriculture risk the security and sustainability of our food system and adversely impact human and environmental health (Willett, 2019). Diets low in diversity have lesser micronutrients and are at increased malnutrition risk (Lachet et al., 2019). Monocultures and other simplified production systems are more vulnerable to outbreaks of pest and disease, lower soil quality, and unstable yields (Jones et al., 2021). Famines such as the Irish famine (by potato blight in 1845) or the Panama crisis (banana disease in 1950s) indicate that overdependence on a single crop species or a few varieties can pose serious threats to food security and economic stability, disrupting the resilience of the agriculture system. The efforts in restricting the loss of global biodiversity have remained insufficient; also, the targets being set at the CBD in 2010 and Aichi Targets 2020 have not resulted in the expected response from the member countries. Building on the Strategic Plan for Biodiversity 2011–2020, KM-GBF was launched in December 2022, which sets out an ambitious plan to implement broad-based action to bring about a transformation in our societies' relationship with biodiversity by 2030, in line with the 2030 Agenda for Sustainable Development and its Sustainable Development Goals, and ensure that, by 2050, the shared vision of living in harmony with nature is fulfilled.



Box 1.1

Agrobiodiversity

Biological Diversity (referred as biodiversity) is defined in Article 2 of the CBD as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species (genetic diversity), between species (Species diversity) and of ecosystems (ecosystem diversity)". Biodiversity for food and agriculture (agrobiodiversity) is a subcategory of biodiversity to correspond to "the variety and variability of animals, plants and micro-organisms at the genetic, species and ecosystem levels that sustain the ecosystem structures, functions and processes in and around production systems, and provides food and non-food agricultural products" (FAO, 2013). It includes:

- **Plant genetic resources**, that include crops, wild plants harvested and managed for food, trees on farms, pasture, and rangeland species;
- **Animal genetic resources**, that include animal species (livestock, aquatic species), breeds and strains that are of economic, scientific, and cultural interest to humankind in terms of food and agricultural production for the present or the future.
- **Microorganisms**, that include all living organisms other than plants and animals and are mostly microscopic cellular organisms that include bacteria, mycoplasmas, protozoa, fungi, and some algae used in various agro-industrial processes.
- **Components of biodiversity that support ecosystem services upon which agriculture is based:** These include a diverse range of organisms (plants, animals, microorganisms) that contribute to nutrient cycling, pest and disease regulation, pollination, pollution and sediment regulation, maintenance of the hydrological cycle, erosion control, carbon sequestration and climate regulation.
- **Agro-ecosystems**, local climatic and chemical factors and the physical structure and functioning of ecosystems, which have a determining effect on agrobiodiversity.
- **Traditional and indigenous knowledge related to food and agriculture production**

1.2 India's agrobiodiversity wealth

With approximately 46 percent of reporting area for land utilization, agriculture dominates the Indian landscape. Today, India is the world's largest producer of milk, pulses, and jute, and ranks as the second largest producer of rice, wheat, sugarcane, groundnut, vegetables, fruit, and cotton. The country is also one of the leading producers of

spices, fish, poultry, livestock, and plantation crops (ICAR, 2022).

The Indian gene centre is among the 12 megadiversity regions of the world. India is also one of the world's eight Vavilov centres of crop plant origin and diversity and has composite mosaic

At least 166 food/crop species including rice (with around 15,658 rice landraces), many legumes (e.g., chickpea, pigeon pea), vegetables (e.g., eggplant, cucumber), tubers (e.g., taro, yam), fruits (mango, citrus tamarind), spices and dyes have been originated in India (NBPGR).

of distinct agroecosystems (20 broad agro-ecological zones).

The country is rich in food crops, oilseed crops, horticultural crops, spices, lichens, algae, fungi, insects, and medicinal plants. In addition, 320 wild relatives of crops have also originated in India.

As per NBPGR, India is reported to be:

- Primary centre of diversity for crops, such as rice, moth bean, black gram, pigeon pea, cucurbits, jute, tree cotton, jack fruit, mango, banana, jamun, large cardamon, black pepper, minor millets, and medicinal plants.
- Secondary centre of diversity for African crops such as sorghum, finger millet, cluster bean, cowpea, sesame, okra, and safflower; tropical American types such as tomato, maize, pumpkin, chayote, chilli, Amaranthus
- Regional (Asiatic) centre of diversity for crops such as barley, maize, buckwheat, amaranth, prosomillet, chickpea, mungbean, bitter guard, bottle guard, snake gourd and Brassicacea.

Approximately 1,500 wild edible plant species are widely exploited by native tribes. These include, 145 species of roots and tubers, 521 of leafy

vegetables/greens, 101 of buds and flowers, 647 of fruits and 118 of seeds and nuts (NAAS, 1998). In addition, nearly 9,500 plant species of ethnobotanical uses have been reported from the country, of which around 7,500 are for ethno-medicinal purposes and 3,900 are multipurpose/edible species. India also has one of the world's largest diversities of domesticated animals, with 30 breeds of cattle, 10 breeds of buffalo, 40 of sheep, 20 of goats, 8 of camels, 6 of horses, and 18 of poultry, and nearly 11 percent of the world's fish resources are reported to occur in India (NBPGR).

The traditional farming systems of India are relatively stable and in equilibrium. The species complexes in traditional farming systems exemplify the coexistence of plants and human tribes, draught animals, friendly birds, beneficial insects, pollinators, earthworms, soil microorganisms and biocontrol agents. Modern farming systems, which evolved in response to the growing needs of the human society to ensure food and nutritional security have progressively replaced traditional agriculture. More than half of the cultivated area under major crops is now covered by improved varieties and farming practices with high inputs of fertilisers and pesticides. Biotic diversity is maintained in modern agricultural systems primarily through cultivation of 'mosaic of improved varieties.' It is important that diversity is assured while attaining high production levels and profitability. There is no available figure for the overall loss of crop diversity in India, as for the other countries and the world. Some idea can be gauged by the fact that a handful of High Yielding Varieties are now grown over 70 percent of the paddy area in Punjab (MoAFW, 2021). Thousands of varieties of cereals (rice, wheat, etc.), cotton, minor millets, pulses, and other crops are no longer use on farms.

1.3 Global biodiversity targets, national targets and Sustainable Development Goals

India has placed legal, policy and institutional frameworks targeting the sustainable use and conservation of biodiversity as a whole. Protection of the environment is enshrined in the Constitution of India under Article 48-A and under Article 51-A(g) and to meet the requirement of the Fundamental Rights (under Article 21- 'Right to life') and the concept of "Public Trust Doctrine" in which certain common properties such as rivers, seashores, forests, and air are held by the government in trusteeship for the free and unimpeded use by the general public. For conserving its unique agrobiodiversity, India is adhering to various global and national governance mechanisms and commitments.

The CBD provides a global framework for conservation and sustainable use of biodiversity. The Food and Agriculture Organization's (FAO) commission on Genetic Resources for Food and Agriculture is an intergovernmental permanent forum to discuss and negotiate matters relevant to agrobiodiversity. The International Treaty on Plant Genetic Resources (PGRs) of FAO facilitates conservation and sustainable use of all PGRs, and fair and equitable sharing of the benefits. The Nagoya Protocol is a legally binding framework to promote transparent and effective implementation of the access and benefit-sharing concept at the regional, national and local level. India developed a 'National Policy and Macro-Level Action Strategy on Biodiversity' in the year 1999. Subsequent to the adoption of the National Environment Policy (NEP) in 2006, a National Biodiversity Action Plan (NBAP) was prepared through a comprehensive inter-ministerial process in 2008. The NBAP 2008 was updated in 2014 to prepare an Addendum, 2014 to NBAP 2008 by incorporating the 12 NBTs, developed in line with the 20 Aichi Global Biodiversity Targets of the Strategic Plan (SP) for Biodiversity 2011-2020. Further, India has launched its updated NBSAP with 23 NBTs in 2024

at CoP 16. The updated NBSAP aligns with the KM-GBF, an agreement to halt and reverse biodiversity loss that was adopted by countries in 2022.

Some of the national frameworks in India dealing with agriculture and the food sector include: National Agricultural Policy, 2000; National Policy for Farmers, 2007; National Seed Policy 2002; National Policy on Agroforestry, 2014; National Policy on Biofuels 2009; Insecticides Act, 1968; Livestock Importation Act, 2001; Protection of Plant Varieties and Farmers' Rights Act (PPV&FRA), 2001 and Biological Diversity (BD) Act, 2002.

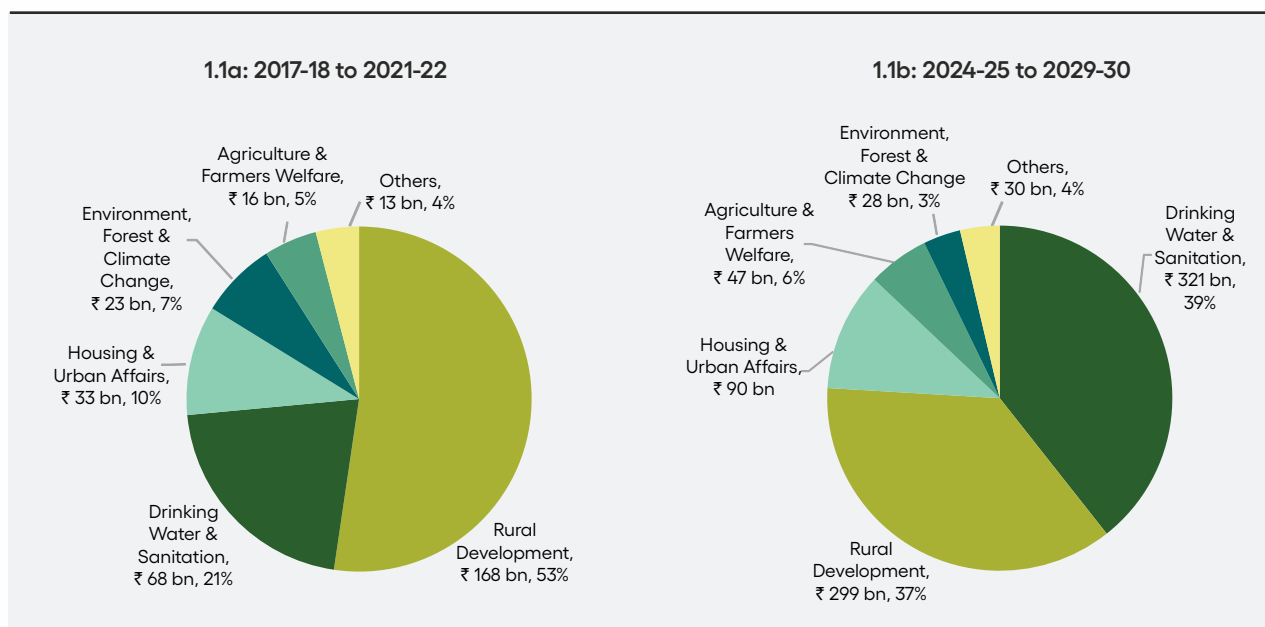
Food production and agriculture have significant implications for all the 23 NBTs and in particular the target 2 (ecosystem restoration), target 3 (conserve biodiversity in land, water and sea), target 4 (manage species and genetic diversity), target 7 (reduce pollution risks and negative impacts), target 8 (minimize the impact of climate change), target 9 (sustainable use of wild species for multiple benefits), target 10 (sustainable management of agriculture, animal husbandry, fisheries, aquaculture and forest areas), target 11 (enhance and maintain ecosystem services and regulate air and water quality, hazards and extreme events), target 13 (access and benefit sharing), target 14 (mainstreaming biodiversity), target 16 (promote sustainable consumption choices), and target 18 (repurpose detrimental incentives for biodiversity). The Sustainable Development Goals (SDGs) relevant to the agricultural sector include SDG 2 (end hunger, achieve food security, improve nutrition and sustainable agriculture); SDG 12 (ensure sustainable consumption and production patterns) and SDG 15 (halt biodiversity loss).

Financing NBSAP is a joint responsibility of various Central Ministries, State Governments & the civil society at large. India implemented the

UNDP global programme on BIOFIN for measuring expenditures on biodiversity, calculating investment required for implementation of NBSAPs and NBTs, and developing nationally appropriate resource mobilisation strategy. A total of 124 schemes from 21 ministries and 2 Departments were identified that attributed average annual biodiversity expenditure of ₹322 billion for

the period 2017-18 to 2021-22. Of the total biodiversity attributable expenditure, MoAFW has 5 percent share (Figure 1.1a). The projected annual average expenditure attributable to biodiversity from 2024-25 to 2029-30 is estimated to be ₹817 bn (Figure 1.1b). However, the expenditure on incentives including subsidies that are detrimental to biodiversity has not been evaluated so far.

Figure 1.1: Average of biodiversity attributable expenditure



Source: MoEFCC 2024

1.4 Objectives

India holds the world's largest crop land of 168 million hectares (mha) (FAOSTAT), with 20 agro-climatic regions. Agriculture plays a vital role with 46.1 percent of workforce depending on it and the sector contributed to 17.7 percent of the country's Gross Value added (GVA) in FY24. This sector also has the responsibility to feed 1.4 bn population. The sector continues to operate in the realities of a moderate growth rate and widely documented challenges, which are being compounded by

climate change and dwindling natural resources and its stability and sustainability is therefore of paramount importance.

At the time of independence, India was challenged to feed 347 mn people, while the grain consumption was just 45 million metric tonnes (MMT). India experienced an impressive transformation since then from being a 'food deficient' to a food sufficient and food surplus economy. Foodgrain production in India has increased from a mere 52 MMT in 1951-


52 to 316 MMT in 2021-22 with per capita net foodgrain availability increasing from 144.1 kg per year in 1951 to 187.8 kg per year in 2022. The major change took place in the period of green revolution and the transformation is attributed to high yielding varieties of seeds, along with irrigation, and fertiliser usages. This was made possible by agriculture policies that provided various input and output subsidies and incentives to ensure food security. Supporting agriculture through various subsidies and support was a necessary step during a period of hunger.

However, some subsidies and policies can have detrimental effects on agrobiodiversity. From the viewpoint of biodiversity, incentive/subsidy is detrimental to biodiversity if it harms the biodiversity compared with the case when the subsidy does not exist (OECD, 2005). Agriculture subsidies/incentives, when they lower input costs and/or enhance output prices, can have an impact on agriculture intensification and extensification (OECD, 2022):

- Intensification can indicate greater levels of input such as fertilisers, pesticides, other chemicals, irrigation or more mechanization. This can have various impacts on biodiversity such as the loss of non-target species (pollination from bees), eutrophication of various ecosystems, and soil degradation and erosion leading to loss of beneficial soil micro-biota
- Extensification may lead to the conversion of more natural land into agricultural land through land use change leading to loss of natural biodiversity.

Further, agricultural subsidies/incentives may influence cropping choices (spatial and temporal diversity), which may impact biodiversity.

While India's NEP, 2006 recognizes implicit and explicit subsidies for water, power, fertiliser and pesticides, broadly falling under the domain of agriculture, as one of the proximate causes of land degradation, the NBAP 2008, its addendum, 2014



India is committed to KM-GBF 2030 targets including Target 18 “Repurpose detrimental incentives for biodiversity”.

and the 12 NBTs have not adequately addressed the issue of subsidies that are detrimental for biodiversity despite a biodiversity target (Aichi Target 3) being adopted under the Strategic Plan for Biodiversity 2011-2020.

Given this backdrop, the question arises are following:

- i. What are the trends in AFBS in India?
- ii. Are there any detrimental consequences of AFBS on agrobiodiversity in India?
- iii. Is India's AFBS in lines with NBSAP's targets?

The main objective of this report is to explore the linkages between AFBS and the possible detrimental biodiversity consequences. This report synthesizes, calculates, and critically assesses the extent and impact of biodiversity detrimental AFBS provided by GoI and state governments of pilot states — Punjab, Madhya Pradesh, and Telangana. Bringing forward the detrimental biodiversity effects from support may prove to be the critical dimension that affects the decision about whether to remove, keep or repurpose the biodiversity detrimental incentives.

The results from this exercise should be interpreted as approximate analysis of the trade-offs from the fiscal support provided to agrifood sector, and in the later step, will be useful for making the repurposing strategy. Although private sector is enabling agrifood system transformation, the report does not cover their role to bring about this change. Moreover, the scope of agricultural support analyzed in the report is limited to land-based agriculture and fisheries support is not a part of the report discussion.

1.5 Key terms and definitions

“This report provides a quantitative appraisal of past 25 years' trends of magnitude and composition of various types of incentives and subsidies provided to agrifood sector at the national level and three pilot states - Punjab, Madhya Pradesh and Telangana.

This analysis relies on estimates from Union budget documents, state budget documents and the audited accounts of Comptroller and Auditor General (CAG) of India from FY01 to FY25 (BE).

GoI and state governments acknowledge that the public expenditure on agrifood sector is necessary to ensure food security and providing livelihood opportunities, especially to marginal and small farmers. Therefore, the budgetary provisions for this sector need to be understood from the long-term perspective of agriculture development. How much incentives do the government provide to agrifood sector? The answer is not as straightforward as one might think. This is because spending relevant to agriculture takes place through multiple ministries.

Agriculture, technically speaking, is under the state list in the Constitution. However, strategic considerations of food security and the sector's political importance have made sure that the GoI spends significantly on this sector. GoI puts total agricultural and allied ministries (MoAFW, MoFAHD and MoEFCC) activities spending every year. However, the actual central government spending on agriculture is much more than this amount. This is because of spending on two major subsidy heads, food, and fertilisers. India's PDS distributes foodgrains (mainly wheat and rice) procured from farmers at MSP, which is distributed to beneficiaries at a negligible cost. Similarly, the government subsidises fertiliser manufacturers to provide cheap fertilisers to farmers. MoJS also

spends on major, medium, and minor irrigation projects that benefit this sector. MoRD spend on construction of roads for rural areas, that connects farmers with the markets. Through MGNREGA, there is spending by MoRD on agriculture related work. While all of this spending does not directly reach farmers, a large part of it does benefit them. A holistic measure of GoI support to farmers, should therefore, include the money spent on these heads. It shows that total spending on agriculture has been significantly larger than what the MoAFW annual allocation is. This report provides a disaggregated classification of AFBS on agriculture and allied activities under various heads of GoI (**Figure 1.2**).

Of the total AFBS, biodiversity detrimental subsidies/incentive and their scale has been assessed. While there is no universally accepted definition of a subsidy, the one most commonly used is that of (OECD, 2005) which states that “In general, a subsidy is the result of a government action that confers an advantage on consumers or producers, in order to supplement their income or lower their costs” This report also provides overview of the AFBS and their impacts on biodiversity for three states: Punjab, Madhya Pradesh, and Telangana. We have shortlisted 10 schemes from the different ministries/department which fulfil either of the two criteria: (i) Schemes with budgetary support of ₹ 100 bn or more; (ii) Schemes with potential positive impact on biodiversity. These schemes were evaluated in detail on their potential impacts on targets set by NBSAP and KM-GBF.

1.6 Methodological framework

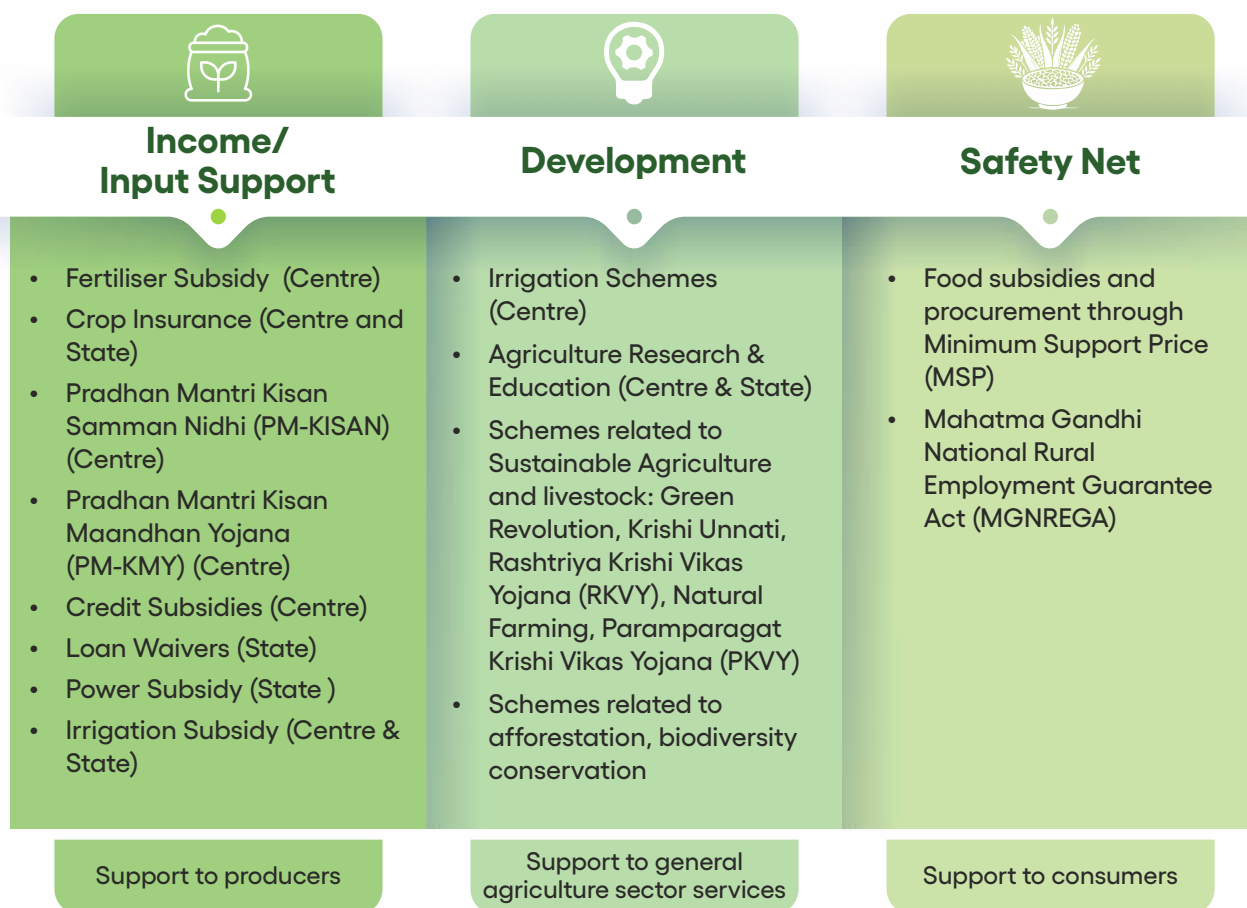
1.6.1 Quantitative evaluation

This report provides 25 years estimate of AFBS in the country (Figure 1.2), which include: (i) providing individual farmer-centric budgetary support (e.g. direct income support, input subsidies, risk cover etc.) to boost farmers' income; (ii) those delivering public goods that enhance the overall capacity of the sector through sector-wide improvements in infrastructure and agricultural

technologies (e.g. research and extension, irrigation, etc.) and, (iii) safety net budgetary support (e.g. food subsidy, employment guarantee). Out of the total value of the agrifood support, biodiversity detrimental subsidy (as identified during qualitative estimation in above section) was estimated.

Figure 1.2: Agrifood Budgetary Support (AFBS)

MONETARY TRANSFERS (OR PUBLIC EXPENDITURE)



Source: Authors Creation

The budgetary expenditures were collected from the union budget, respective state budget and CAG documents of India. The entire expenditure head under various Ministries under a scheme may not have “all positive or detrimental impacts on biodiversity”, therefore the concept of “attributable share” for “positive and detrimental impact on biodiversity” is ideally to be worked out for each scheme separately. However, to arrive at the net impact of the scheme, the quantitative estimation of the agrobiodiversity services also needs to be known, which is not available in literature. Therefore, in the first approach, we have taken the total expenditure the schemes. These schemes need to be un-bundled for their “attributable biodiversity positive” and “attributable biodiversity detrimental share” in the second phase.

The state-wise subsidies were estimated as described:

■ Calculation of state-wise irrigation subsidy

The expenditures and receipts of major, medium, and minor irrigation projects were obtained from state budget documents. The difference between expenditure and receipts is the irrigation subsidy.

■ Calculation of state-wise fertiliser subsidy

Fertiliser consumption (kg/ha) for each state was obtained from the agriculture statistics till FY23 (the most recent data available). The values for FY24 and FY25 were extrapolated from triennial averages of TE 2022-23. From the fertiliser consumption values, the percentage share of state wise fertiliser consumption was calculated. Then, total fertiliser subsidy was allocated across states based on percentage share of states in total fertiliser consumption. Dividing state-wise subsidy by gross cropped area, per hectare fertiliser subsidy was calculated for each state.

■ Calculation of state-wise food subsidy

Total food subsidy to Food Corporation of India (FCI) was obtained from the Union Budgets, Ministry of Finance (MoF). State-wise offtake data

of foodgrains (wheat and rice) was obtained from the FCI. From the foodgrains offtake, the percentage share of state-wise food subsidy was calculated. In addition, state-wise food subsidy for decentralized procurement of foodgrains was obtained from CAG documents. For FY25, the offtake data is available till 14th November, thus the food subsidy calculations for FY25 were extrapolated from the triennial averages of TE 2023-24.

■ Calculation of state-wise Pradhan Mantri Kisan Samman Nidhi (PM-KISAN)

The data on number of beneficiaries for each state (year-wise) was collected from PM-KISAN website. The number of beneficiaries were multiplied by ₹ 6,000 (the total amount that each beneficiary receives per year in three instalments). For FY25, the number of beneficiary data was available till November and accordingly the calculations were done.

■ Calculation of state-wise crop-insurance

The data on GoI premium (Kharif and Rabi) for Pradhan Mantri Fasal Bima Yojana (PMFBY) and Weather Based Crop Insurance Scheme (WBCIS) was collected from PMFBY website for each state (year-wise). Then state's share in the insurance subsidy was calculated by taking each state's share of GoI premium in total GoI premium. Applying that state wise share, the total central insurance subsidy was calculated across states.

■ Calculation of state-wise spending on MGNREGA

The financial statement data on central government as well as state government's share for MGNREGA was collected from MGNREGA website for each state (year-wise) and state budget documents.

■ Calculation of state-wise credit subsidies

Credit subsidy under the Interest Subvention Scheme of the centre (now the Modified Interest Subvention Scheme) was allocated across states based on the percentage share of flow of

institutional credit to the agriculture sector for short-term loans. Data for credit to the agriculture sector for short term loans was obtained from the Agricultural Statistics at a Glance and Reserve Bank of India and that of credit subsidy from the Union Budget, Ministry of Finance.

1.6.2 Qualitative Evaluation

This comprised three major steps:

Step 1: From the inventory of agriculture subsidies/incentives that are listed in Figure 2, each subsidy/incentive was screened for its potential adverse impact on agriculture related targets set in KM-GBF and NBSAP:

- target 4 (manage species and genetic diversity),

Indicator: Number of plant and animal genetic resources secured in medium or long-term conservation facilities

- target 7 (reduce pollution risks and negative impacts),

Indicators: Fertiliser use

- target 8 (minimize the impact of climate change),

Indicator: National greenhouse inventories from land use and land-use change, Carbon stocks and annual net greenhouse gas emissions, by land-use category

- target 10 (sustainable management of agriculture, animal husbandry, fisheries, aquaculture and forest areas),

Indicators: Proportion of agricultural area under productive and sustainable agriculture, changes in soil organic carbon stocks, changes in nutrient content, proportion of land that is degraded over total land area

- target 11 (enhance and maintain ecosystem services and regulate air and water quality, hazards and extreme events),

Indicator: water stress, water quality, air quality

- target 16 (promote sustainable consumption choices)

Indicator: Environmental impacts of consumption

- target 18 (repurpose detrimental incentives for biodiversity)

Indicator: Positive incentives in place to promote biodiversity conservation and sustainable use, Value of subsidies and other incentives detrimental to biodiversity that have been eliminated, phased out or reformed.

Step 2: Demonstration of the cause / effect link between subsidies/incentives and the state of agrobiodiversity corresponding to step 1 – Does the subsidy/incentive lead to potential direct / indirect biodiversity impacts as per CBD's goals?

Step 3: Identification of subsidies/incentives corresponding step 2 into the following four categories:

- **Category 1:** Biodiversity detrimental subsidy/incentives - those subsidies that are detrimental for biodiversity as per CBD's goals.
- **Category 2:** Subsidies/incentives with mixed impacts on CBD's goals.
- **Category 3:** Biodiversity neutral subsidy/incentives – subsidies/incentives that do not impact biodiversity as per CBD's goals.
- **Category 4:** Biodiversity positive subsidy/incentives subsidies/incentives –subsidies/incentives that positively impact biodiversity (through direct/indirect schemes) as per CBD's goals.



Agrifood budget

Support by Government of India

Foodgrain production in India has increased from a mere 50.8 MMT in 1950-51 to 332.3 MMT in 2023-24 with per capita net foodgrain availability increasing from 144.1 kg per year in 1951 to 207.6 kg per year in 2023. The major change took place in the period of green revolution and the transformation is attributed to high yielding varieties of seeds, along with irrigation, and fertilizer usages. This was made possible by agriculture policies that provided various input and output subsidies and incentives to ensure food security. However, agriculture incentives, when they lower input costs and/or enhance output prices can result in greater levels of input such as fertilisers, pesticides, other chemicals, irrigation or more mechanization. This can have various impacts on biodiversity. This chapter inform about the general linkages between agrifood incentives provided by Government of India and their potential adverse effects on the agrobiodiversity.

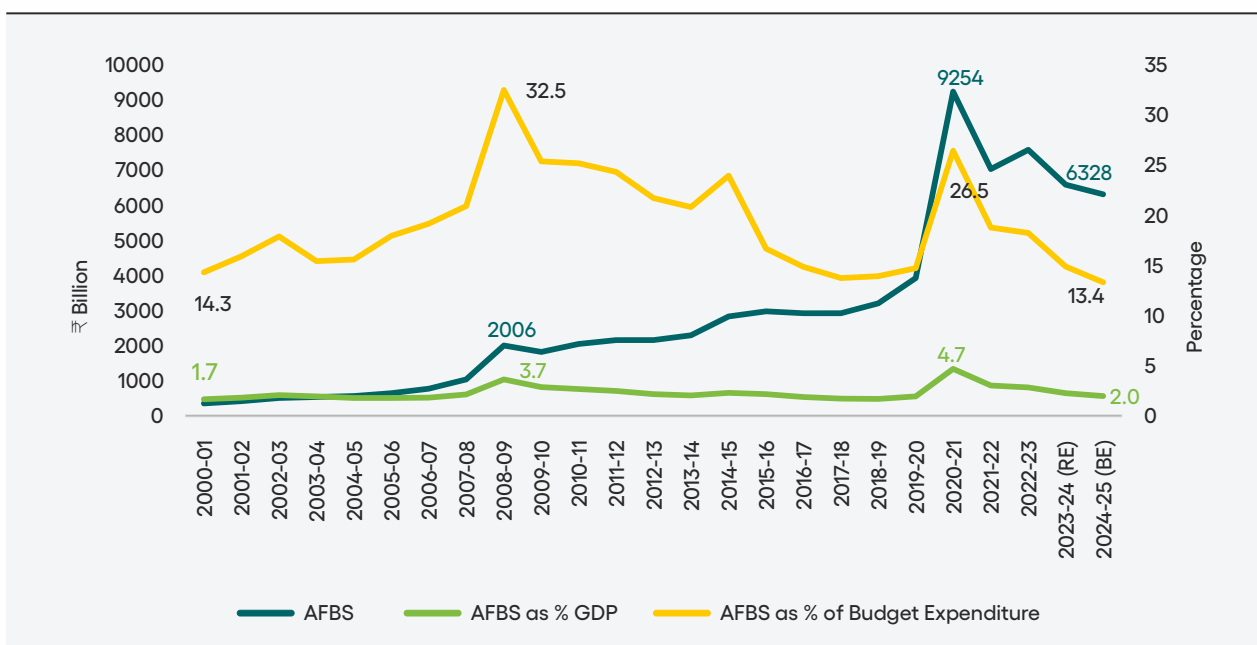


“From FY01 to FY25, AFBS increased from ₹355 bn (US\$ 8 bn) per year to ₹6,328 bn (US\$ 76 bn) per year

During FY21 (covid year), it reached its peak of ₹9,296 bn (US\$ 125 bn), which was 4.69 percent of the country's GDP. Out of the total GoI budget, the AFBS received 14.33 percent share in FY01, that peaked to 32.54 percent in FY09 and 26.48 percent

in FY21. In 2024-25 (BE), it is just 13.35 percent of the total budget expenditure and 1.99 percent of the country's GDP (2024-25, Advance Estimate, MoSPI 2024c) (Figure 2.1).

Figure 2.1: Trends of AFBS by GoI



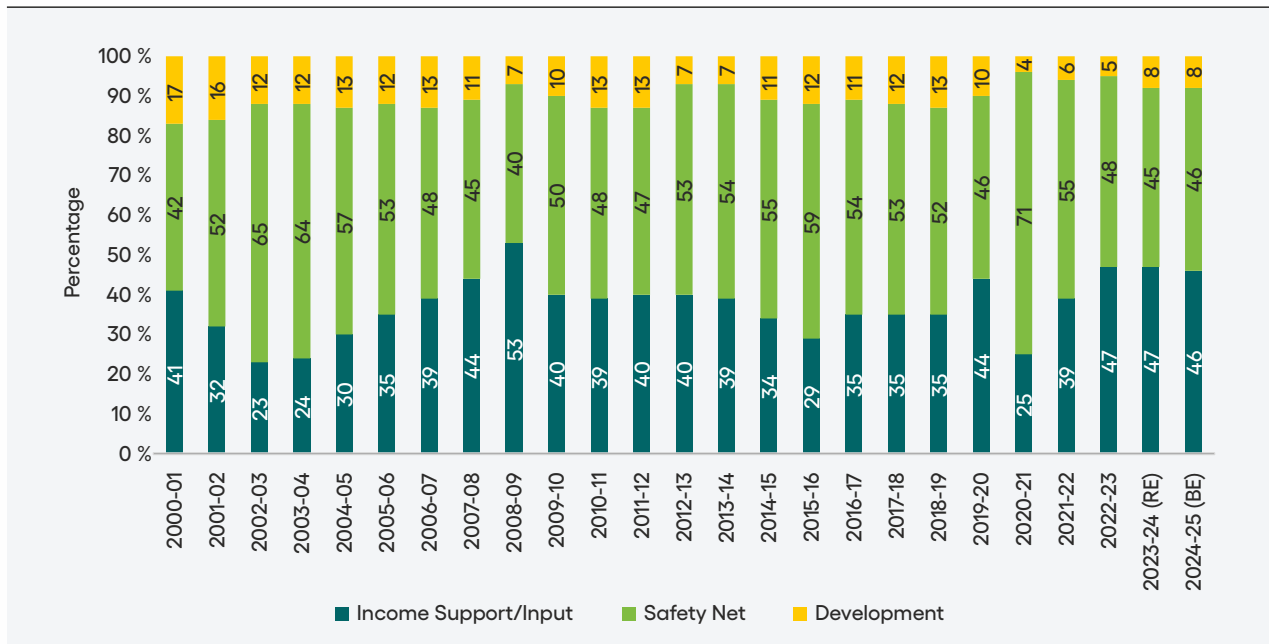
Source: Author's Calculations based on MoF, MoSPI (2024a)

Of the total AFBS, the percent share of input/income support ranged from 25-53 percent and the safety net ranged between 40-70 percent during the last 25 years. Development expenditure share was observed to be as low as 5 percent in FY21 and ranges between 4-17 percent in the last 25 years (Figure 2.2).

Figure 2.3 shows the triennial trends of AFBS. In TE 2024, the average AFBS was ₹7,076 bn (US\$ 90

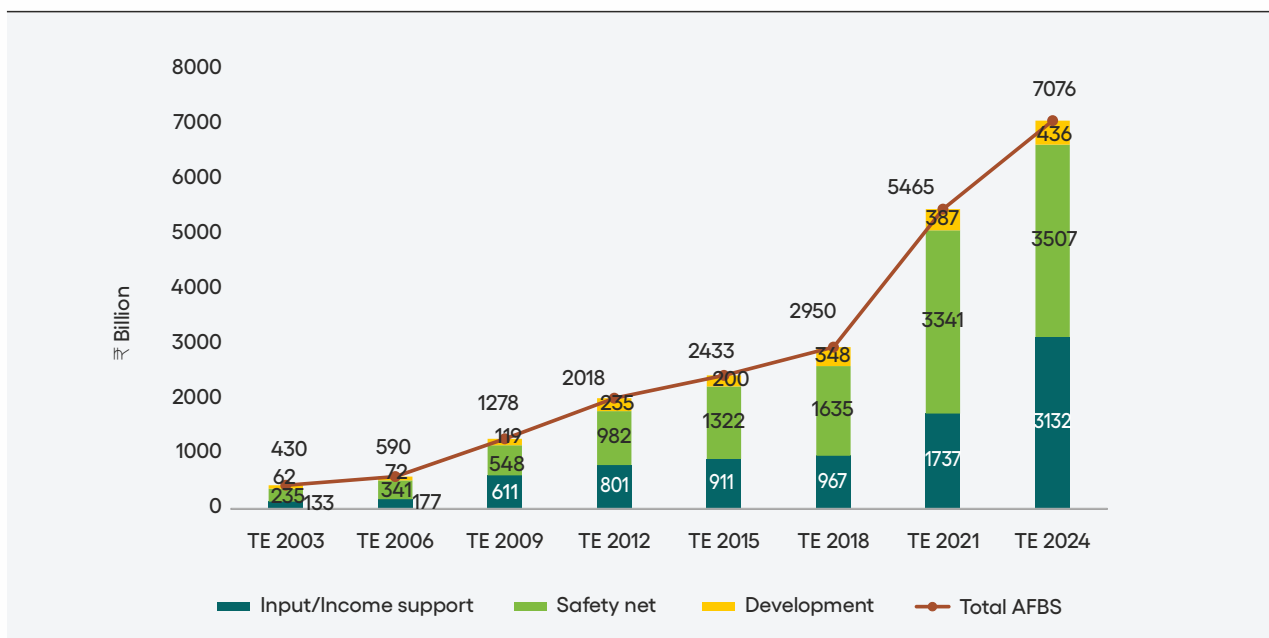
bn). Of this, approximately half this amount, about ₹3,507 bn (US\$ 45 bn) is provided as safety nets, i.e., food subsidy and rural employment (MGNREGA) that ensures food security and minimum livelihood opportunities to rural population. About ₹3,132 bn (US\$ 40 bn) was provided in the form of income support and input subsidies and only ₹436 bn (US\$ 6 bn) was used to fund transfers to the agriculture sector for development activities.

Figure 2.2: Trends of income/input support, safety net and development expenditure



Source: Author's Calculations based on MoF

Figure 2.3: Triennial average of AFBS



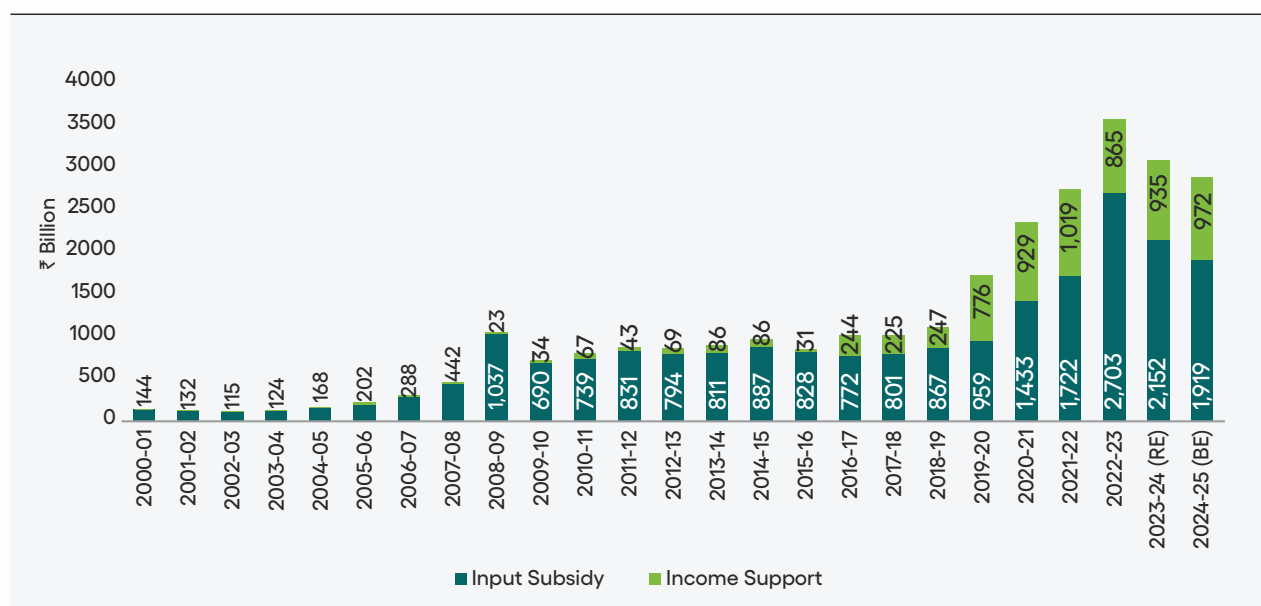
Source: Author's Calculations based on MoF

2.1 The magnitude and scale of AFBS for input and income support to farmers

In order to augment productivity and meet the ever-increasing demand for food, feed and fibre from limited resources, the government intervenes in the input market and offers critical farm inputs such as seeds, fertilisers, power, water for irrigation, pesticides, farm machinery etc., at subsidised rates. In addition, the government also provides direct income support to farmers, such as crop insurance, credit subsidies, and fixed instalments (PM-KISAN). In this section, we delve deeper into the nature and degree of subsidies/incentives the agrifood policy provides to producers for inputs

and income support. We also evaluate the implications of these incentives on biodiversity. Total support for income and input support has increased from ₹147 bn (US\$ 3 bn) in FY01 to ₹2,876 bn (US\$ 34 bn) in FY25 (BE) (Figure 2.4). In TE 2024, the input and income support was ₹3,123 bn (US\$ 40 bn). Of that total, input support accounted for about 70 percent and income support was 30 percent. The share of income support was mere 2 percent in TE 2003 and has started increasing since FY20 after PM-KISAN was introduced (Figure 2.5).

Figure 2.4: Trends of income and input support



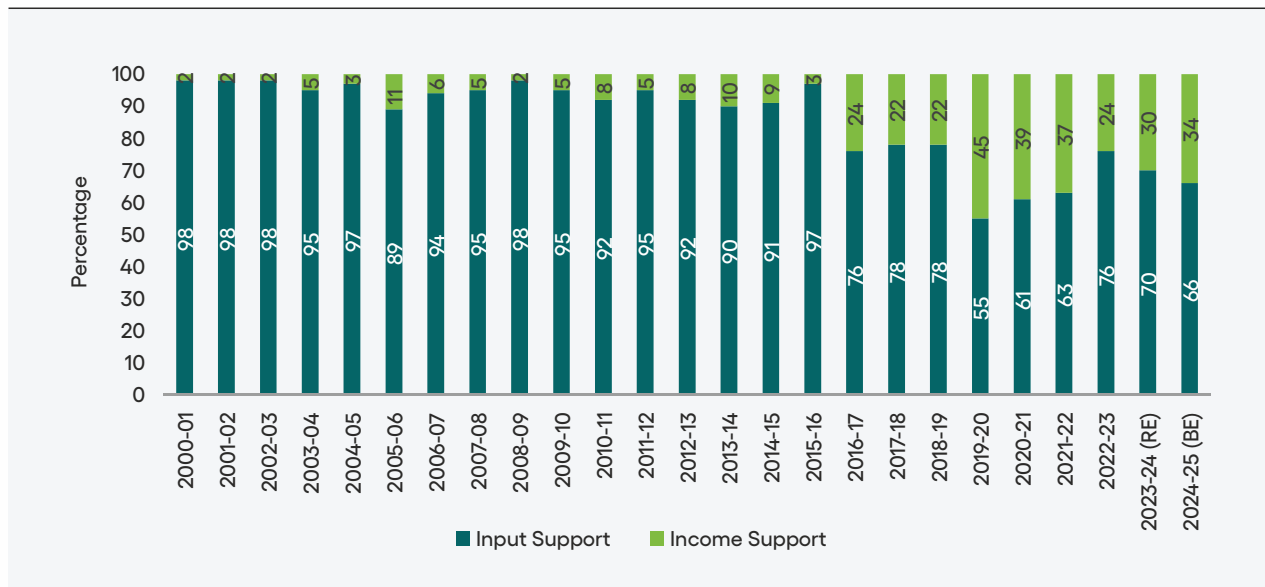
Source: Author's Calculations based on MoF

2.1.1 Input subsidies

Input subsidies have increased from ₹144 bn (US\$ 3 bn) in FY01 to ₹1,919 bn (US\$ 23 bn) in FY25 (BE) (Figure 2.6). Of that total, fertiliser subsidies

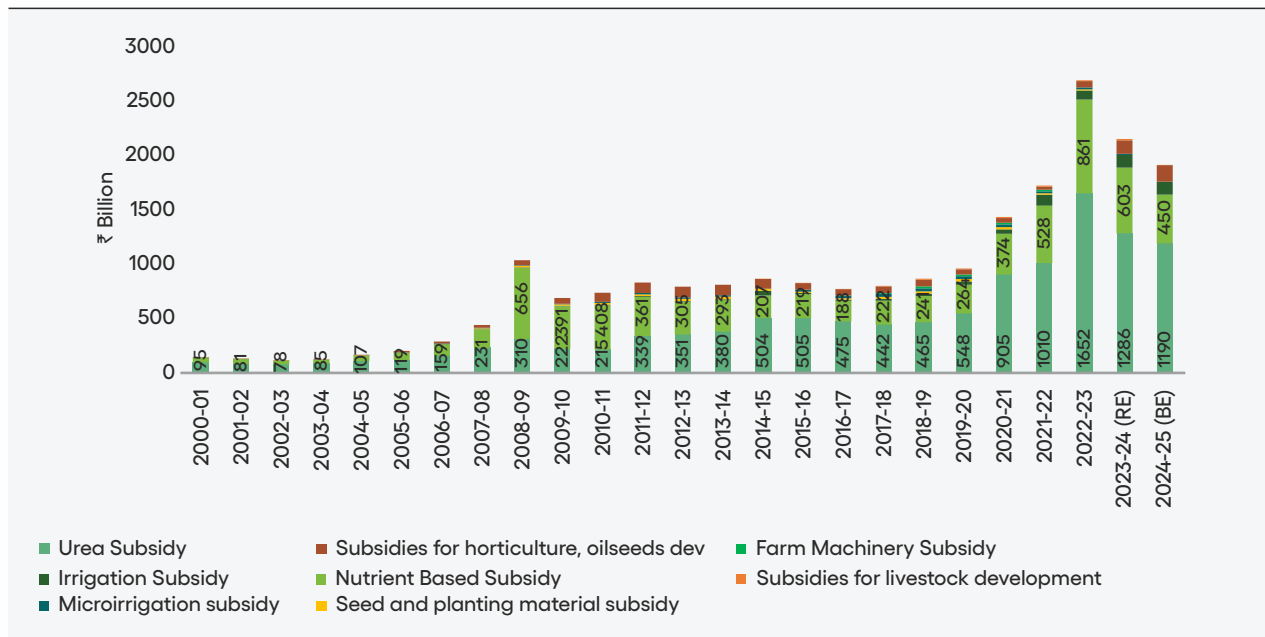
accounted for about 80-90 percent and barring few years, urea subsidies alone accounted for 60-70 percent of the total input subsidies (Figure 2.7).

Figure 2.5: Percentage share of income and input support



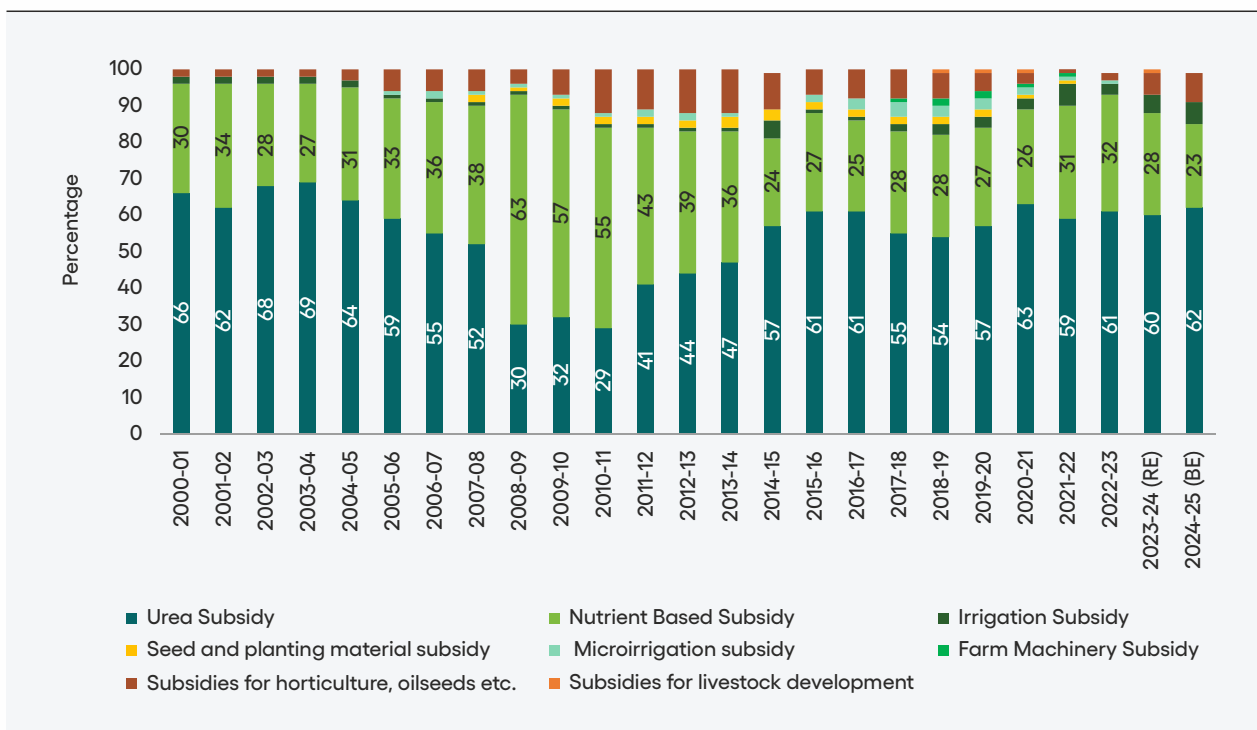
Source: Author's Calculations based on MoF

Figure 2.6: Trends of input subsidies



Source: Author's Calculations based on MoF

Figure 2.7: Percentage share of input subsidies



Source: Author's Calculations based on MoF

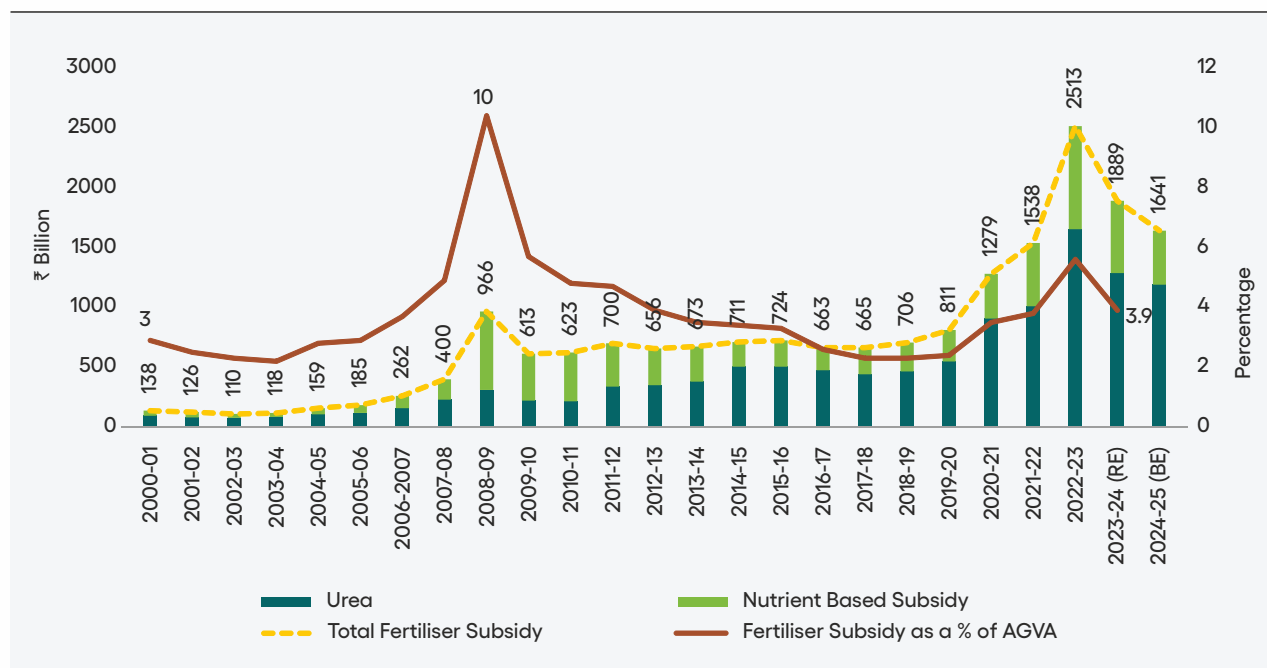
2.1.1.1 Fertiliser subsidies

Fertiliser subsidy has played an important role in Indian agriculture as it has boosted the consumption of fertiliser which positively impacted yield and output of major and minor crops. Over the years, the amount of fertiliser subsidy has increased significantly, from ₹138 bn (US\$ 3 bn) in FY01 to ₹1,641 bn (US\$ 20 bn) in FY25 (BE), reaching ₹2,513 bn (US\$ 30 bn) in FY23 (Figure 2.8). As a percentage of agri-GDP, it

has peaked in FY09 (10 percent) and is at 3.9 percent in FY24 (RE). In the same duration, subsidy on urea constituted an average of 70 percent share of the total fertiliser subsidy. Subsidy level increased from ₹744.6/ha (US\$ 17/ha) to ₹8,114/ha (US\$ 103/ha) during FY01 to FY23, per unit of gross cropped area (GCA).



Figure 2.8: Trends of fertiliser subsidy



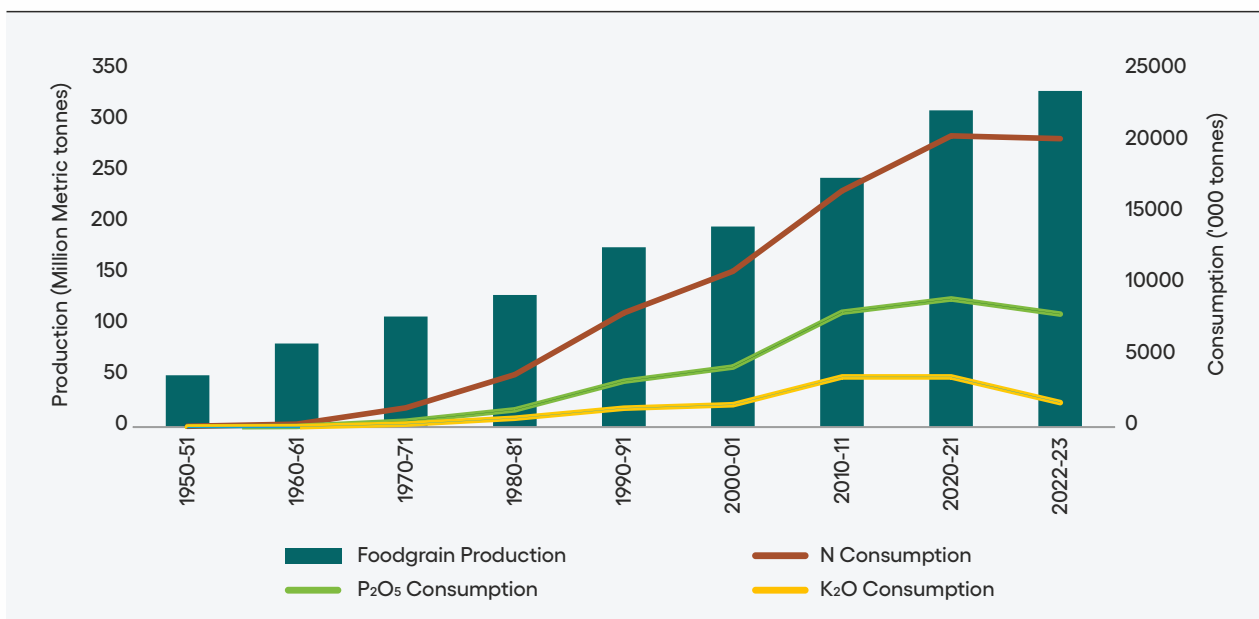
Source: MoF, MoSPI (2024a)

Fertiliser consumption and food production

India is an important player in the global fertiliser market, both as a producer and trader. Since 2000, India has been the second highest producer of nitrogenous fertilisers after China (producing 10-11 percent of world production) and the third highest producer of phosphatic fertilisers after China and the USA (producing around 8-12 percent of the total world production). India is also the second largest consumer of fertilisers in the world after China.

The share of fertiliser alone in increasing foodgrain production is estimated at 50 percent at global and all India level (FAI, 2017). India's self-sufficiency in foodgrain production parallels that of increase in fertiliser consumption (Figure 2.9). In absolute terms, consumption of total nutrients has increased from 0.069 MMT in 1950-51 to 29.8 MMT in 2022-23. In terms of per hectare of GCA, plant nutrient consumption has increased from 0.49 kg/ha in 2000-01 to 139.69 kg/ha in 2023-24 (FAI, 2024).

Figure 2.9: Foodgrain production vis-à-vis, Nitrogen (N), Phosphate fertiliser (P₂O₅) & Potassium fertiliser (K₂O)



Source: FAI, 2024

“But, fertiliser subsidy can have detrimental impacts (direct impacts are observed) on Target 4, Target 7, Target 8, Target 10, and Target 11 of KM-GBF and NBSAP

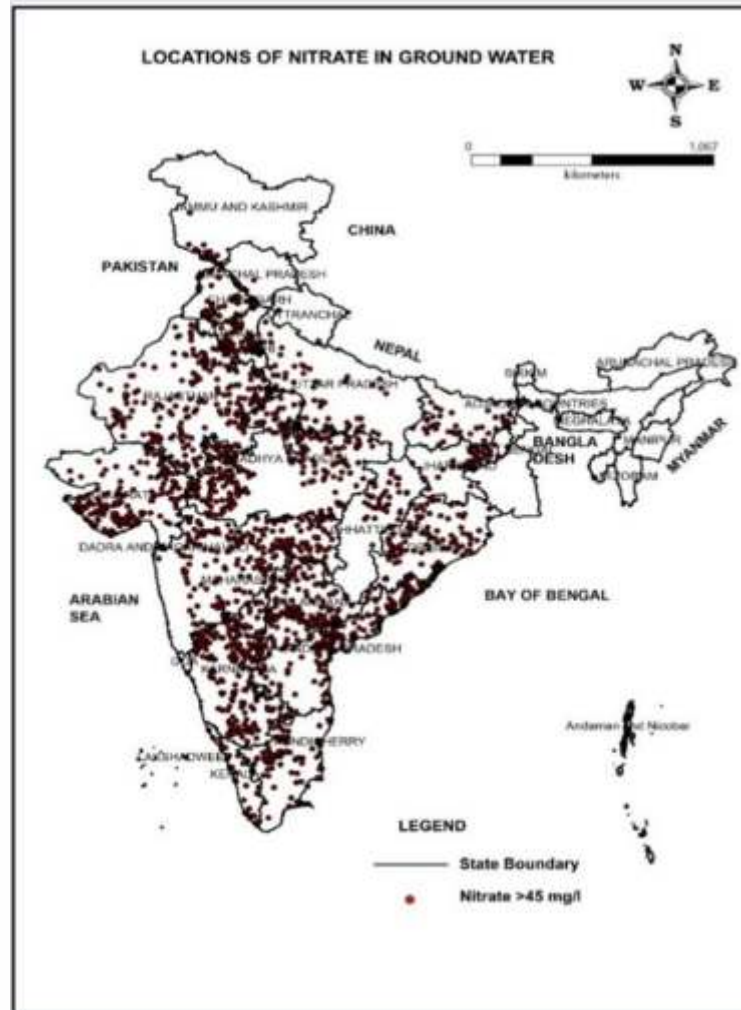
When crop plants are harvested, soil nutrient levels are reduced over time, and these are replenished either by natural decomposition or by adding fertilisers. Therefore, the basic component of agriculture is fertiliser. However, while chemical fertilisers are the main cause of adequate crop production for the world's population, their overuse, which is encouraged by subsidized fertilisers, presents serious challenges for present and future generations, such as contaminated air, water and soil, degraded land, soils and increased GHG emissions. Not only are these synthetic fertilisers being detrimental to our climate, but also to human health, livestock, and microbial forms of life.

Fertiliser use efficiency of N rarely exceeds 35 percent in lowland and 50 percent in upland ecosystems of India (FAI 2017). Un-utilized N is lost from the soil-water system through leaching (predominantly as nitrate (NO₃-) ions, volatilization (as ammonia (NH₃) gas), denitrification (as N₂O and nitrogen (N₂) gas) and surface run off and erosion. Elevated NO₃- concentrations (Figure 2.10) are observed in ground water regions with excessive, imbalanced, and unscientific application of nitrogenous fertilisers, available to farmers at subsidized rates.



Target 7: “Reduce pollution risks and the negative impact”.

Figure 2.10: Nitrate hotspots in India



Source: Central Ground Water Board, 2018

Nutrient pollution from improper and excessive fertiliser use has detrimental consequences for ecosystems. Application of fertilisers leads to water pollution and eutrophication affecting aquatic ecosystem and aquatic biodiversity. This also increases air pollution, acidification, and mineral depletion of the soil. Use of fertilisers can suppress production of certain soil enzymes involved in

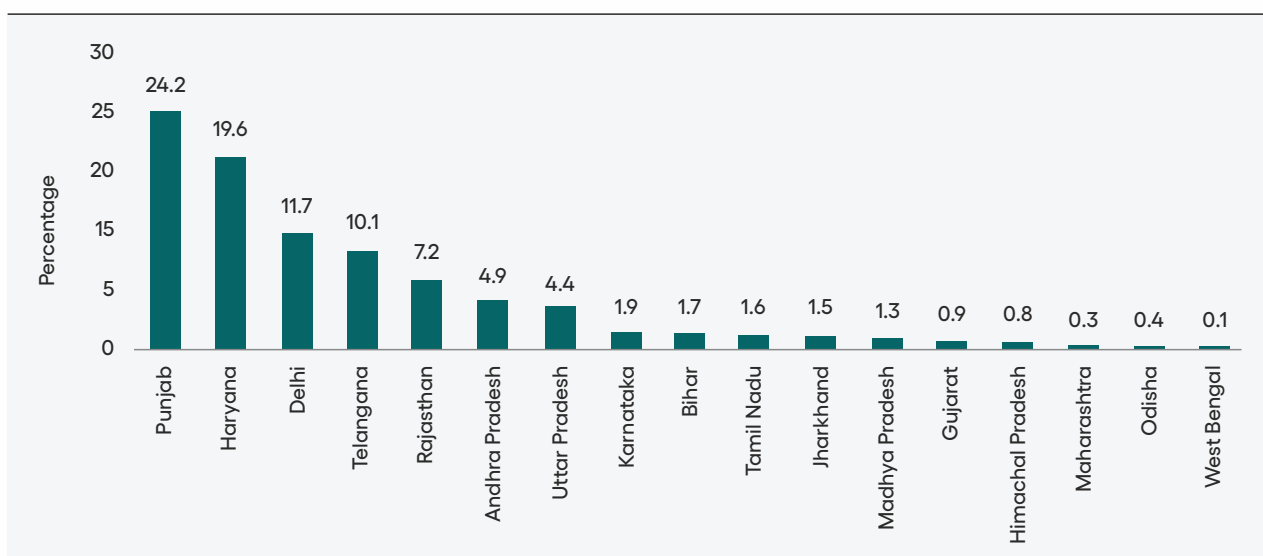
nutrient cycles. Excessive fertiliser applications can also cause soil and land degradation (NEP, 2006).

Soil is a home for soil organisms which are a mechanism for nutrient recovery, and offers many other environmental services. Chemical fertiliser overuse can contribute to soil acidification and soil

crust, thereby reducing the content of organic matter, humus content, beneficial species, stunting plant growth, altering the pH of the soil, growing pests, and even leading to the release of GHGs. The soil's loss of humus decreases its capacity to store nutrients. Repeated chemical fertiliser applications in the soil may lead to a toxic build-up of heavy metals such as arsenic, cadmium, and uranium. These toxic heavy metals pollute the ground and accumulate in foodgrains, fruits and vegetables and enter humans via food chains that can cause health

problems. Even small quantities of arsenic and uranium (10 parts per billion (ppb) for arsenic and 30 ppb for uranium) are highly hazardous to human and livestock health, leading to issues such as cancer, coronary disease, non-healing ulcers, and kidney failure, among others. Uranium concentration is connected to high N application and soil salinity, partially explaining the prevalence of cancer in pockets of Punjab's Malwa region, often referred to as the 'cancer capital' (Figure 2.11)

Figure 2.11: Percent of sampled wells with uranium concentration above 30 ppb



Source: Central Ground Water Board, 2020



Target 8: “Minimize the impact of climate change”

The rapid increase in the consumption of synthetic N fertilisers and low N use efficiency in Indian croplands have led to an increase in nitrous oxide

(N₂O) emissions¹ in Indian agriculture. N₂O is a GHG, which is 273 times more impactful than carbon-dioxide (CO₂) for temperature rise. Climate

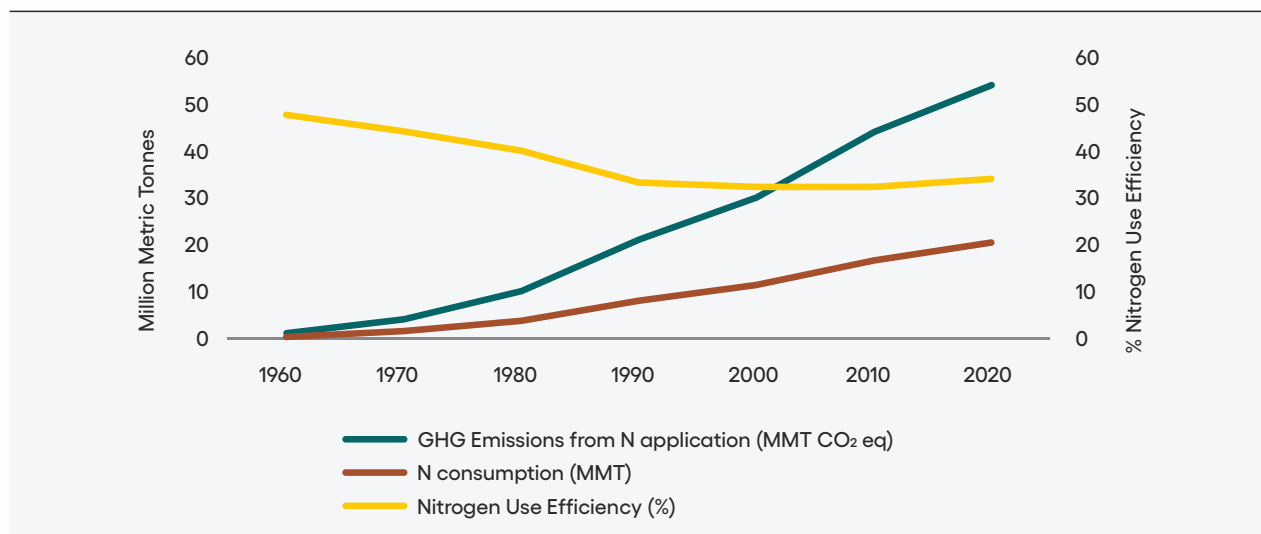
¹ Calculated using IPCC Tier 2 methodology with Country Specific Emission Factors. GWP 273 (as per IPCC Sixth Assessment Report 2022) has been used for converting nitrous oxide emissions into carbon dioxide equivalence

change has been recognized as a driver for biodiversity loss (IPBES, 2019). Total N₂O emissions due to the application of synthetic N-fertilisers from Indian croplands was estimated to be 0.56 MT CO₂ eq in 1960-61, which showed increased trend with increasing N-fertiliser application and has reached to 54 MT CO₂ eq (carbon dioxide equivalent) in 2020-21 (Figure 2.12). However, these figures don't include the emissions produced by the manufacture and hydrolysis of fertiliser products (mainly urea) during field application. The emissions related to N-fertiliser are majorly from three sources: (i) CO₂ emissions during production of N-fertiliser; (ii) CO₂ emissions from the urea hydrolysis and (iii)

Fertiliser production and application comprises 3.19 percent (Singh, 2024) of the country's anthropogenic GHG emissions of 3,132 MT CO₂ eq (MoEFCC, 2023).

N₂O emissions from the application of N-fertilisers. During 2021-22, N-fertiliser production and its consumption in India resulted in 100.83 MT CO₂ eq of GHG emissions (Singh, 2024).

Figure 2.12: Decadal trends of GHG emissions from N-use from synthetic fertilisers



Source: Singh, 2024



Target 10: Sustainable management of agriculture, animal husbandry, fisheries, aquaculture and forest areas

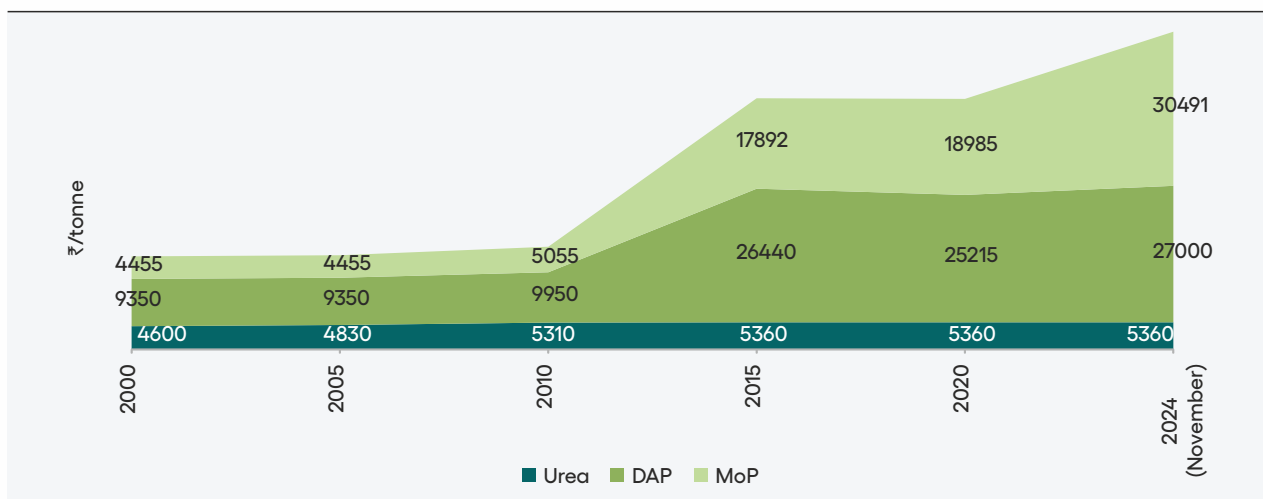
Plants need 18 vital elements (nutrients) for optimal growth. They receive them from air and/or water and soil. The crucial elements obtained from air or water (macronutrients) are Carbon (C), Hydrogen (H) and Oxygen (O). Rest of the elements are drawn

from the soil and depending on the actual amount required for adequate plant growth, they are divided into two categories, namely, macronutrients and micronutrients. Macronutrients from soil are Nitrogen (N), Phosphorus (P), Potassium (K), Sulphur (S) and Magnesium (Mg). Micronutrients that plants get from soil are Boron (B), Chlorine (Cl), Copper (Cu), Iron (Fe), Manganese (Mn), molybdenum (Mo), Nickel (Ni) and Zinc (Zn).

During 1970s and 1980s, favourable policies, namely Fertiliser Movement Control Order-1973, ECA Supply Plan-1977, RPS-1977, and Block Delivery Schemes 1980-81 played a pivotal role in expanding fertiliser production and consumption base (Tewatia, 2017). However, the fertiliser subsidy burden continued to increase due to stagnant retail price of urea against continuous increase in cost of production/imports. The

decontrol of P and K fertilisers in August 1992 led to rise in P and K prices. From April 2010, the government moved from product pricing regime towards selective implementation of Nutrient Based Subsidy (NBS) regime for P and K fertilisers. NBS is now applicable on 22 fertiliser products; however, urea was left out of the NBS policy and continues to remain so. This resulted in price increase of P and K fertilisers by 2-3 times whereas urea prices continued to be at very low levels due to heavy subsidy. There was serious distortion in urea vis-a-vis P and K prices. The price of di-ammonium phosphate (DAP) increased from ₹9,350 (US\$ 193) per ton in FY10 (pre-NBS) to ₹26,440 (US\$ 433) per ton in FY15 (post-NBS). Similarly, the price of muriate of potash (MoP) increased from ₹4,455 (US\$ 92) per ton to ₹17,892 (US\$ 293) per ton during the corresponding period. (Figure 2.13).

Figure 2.13: Maximum Retail Price of Fertiliser products



Source: MoCF

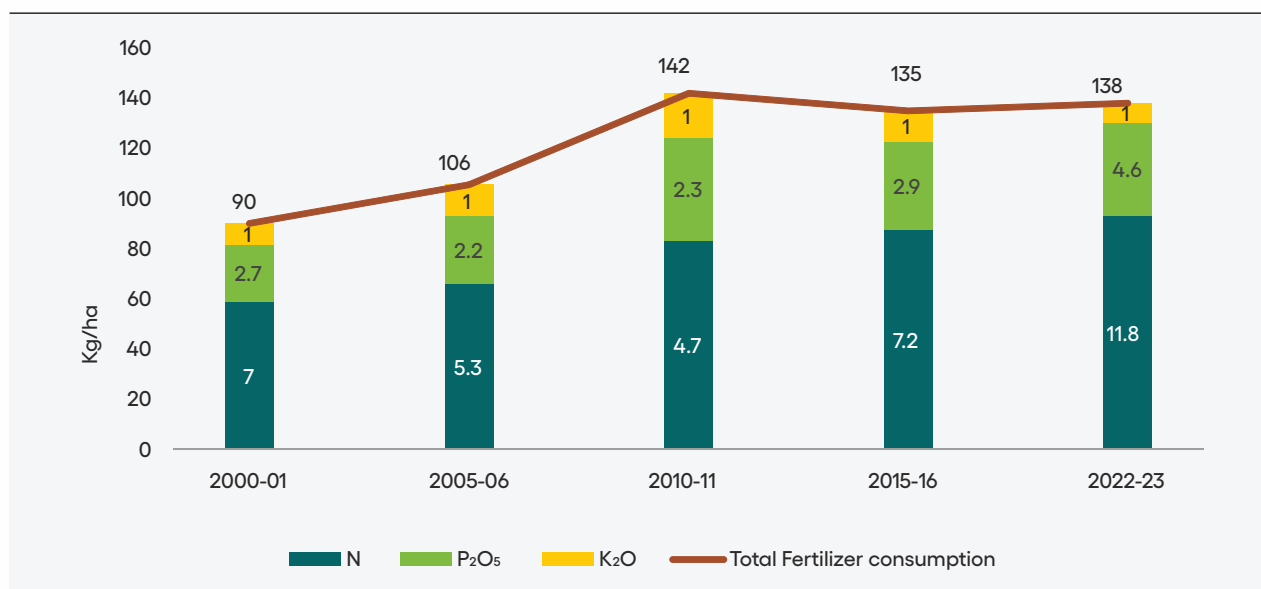
Urea is supplied to farmers at a government-mandated Maximum Retail Price (MRP). A 45 kg bag of Urea is priced at ₹ 242 (US\$ 2.9), and a 50 kg bag at ₹268 (US\$ 3.2), excluding neem-coating

charges and applicable taxes. The difference between the delivered cost of fertilisers at the farm gate and the net market realization by urea units is given as subsidy to the urea manufacture/importer

by the GoI. Consequently, all farmers receive urea at an affordable, subsidized price. Under the NBS policy, a fixed subsidy amount, determined annually, is provided for P and K fertilisers based on their nutrient content. Fertiliser companies set the MRP according to market conditions, and this is monitored by GoI to ensure reasonable pricing. However, due to lower cost of urea, skewed use of urea is witnessed, which is a highly unsustainable way of crop production. As a rule of thumb, the ideal NPK ratio for India is considered to be 4:2:1 (which may vary from state to state, soil to soil, in fact, plot to plot). Primarily due to the pricing policy, the ratio has never been close to the ideal except for a few years. At the start of the last decade

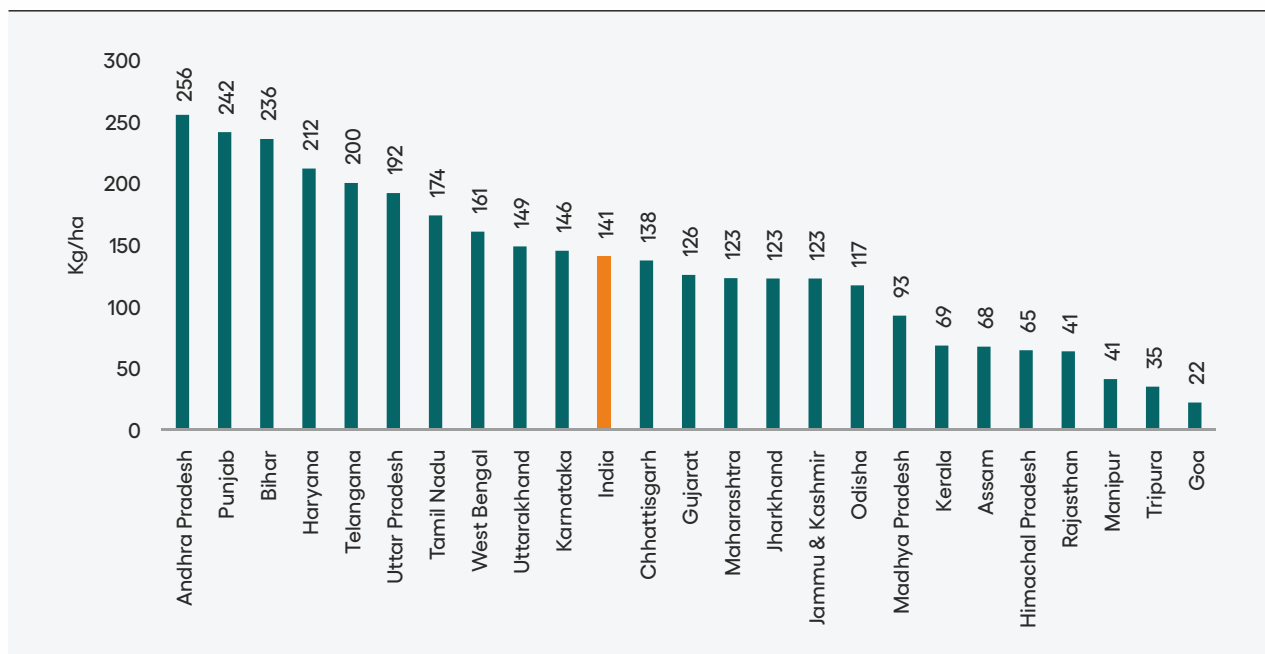
(FY01), the ratio was 7.0:2.7:1. The closest it came to the ideal ratio when it was 4.3:2.0:1 was in FY10. After the introduction of the NBS regime for P and K fertilisers in 2010, the prices of these nutrients increased rapidly while urea prices remained controlled and significantly low. This led to the unbalanced use of nutrients again. The ratio of NPK usage has increased to 9.9:3.3:1 in FY13 and 8.4:2.8:1 in FY14. However, in FY23, the ratio is still biased towards nitrogen and is now 11.8:4.6:1. (Figure 2.14), which is all-India picture and state-ratios vary widely. Fertiliser consumption also varies, state-wise (Figure 2.15), and so is the fertiliser subsidy (Figure 2.16).

Figure 2.14: Trends of all-India consumption of N, P₂O₅, K₂O (kg/ha) and NPK ratios



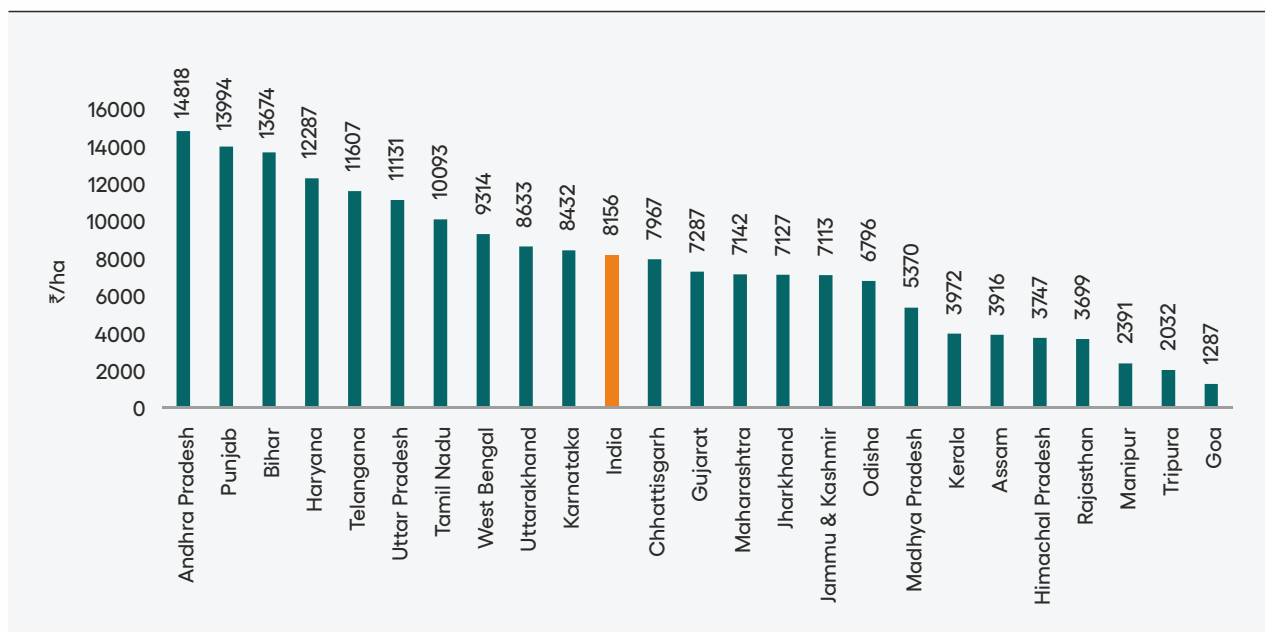
Source: FAI, 2024 | Note: Figures within the stack bars are ratios of N, P and K

Figure 2.15: State-wise fertiliser consumption (Kg/ha), TE 2023



Source: FAI, 2024

Figure 2.16: Fertiliser subsidy per unit of gross cropped area (₹/ha), TE 2023

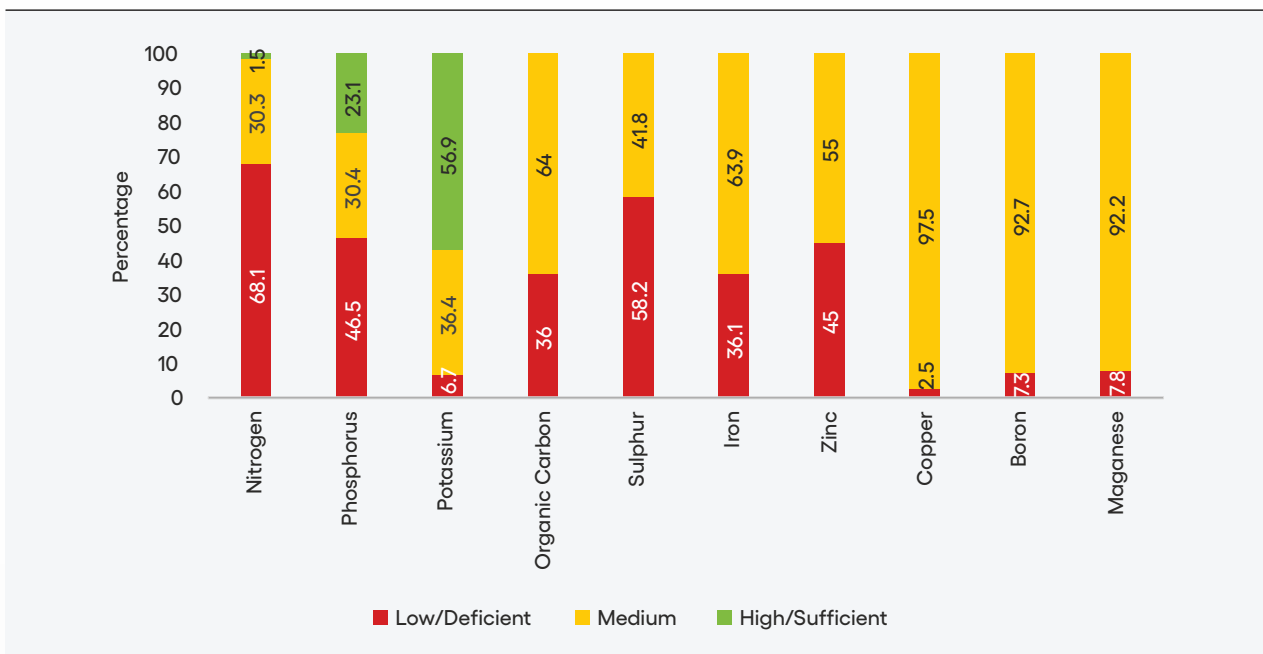


Source: MoF, MoAFWa 2024

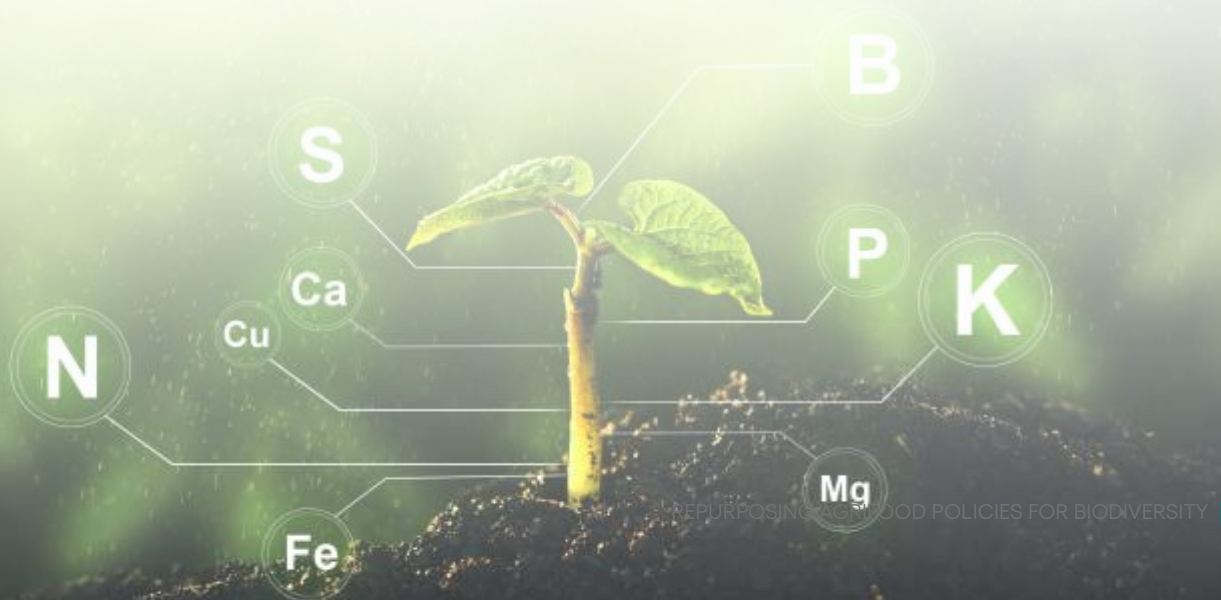
As revealed by Soil Health Cards (SHCs), imbalanced use of fertilisers (without organic manures and residues) is leading to high deficiency of organic carbon, macronutrients, and micronutrients in Indian soils. Between 2015–17 (Cycle I) and 2017–19 (Cycle II), more than 50 mn soil samples from across India were tested in government-approved laboratories to understand the state of the country's soils. Of the tested

samples, 23.4 percent were found to be saline and 6.1 percent were acidic. 36 percent of soil samples were deficient in organic carbon. 68.1 percent of soil samples were low in N, 46.5 percent soils were low in P and 58.2 percent soils were deficient in S. Among micronutrients, Zn deficiency was 45 percent, and iron deficiency was 36.1 percent (Figure 2.17)

Figure 2.17: Status of Indian Soils



Source: Soil Health Cards





Box 2.1

Soil nutrient categories of SHC

Macronutrients are categorized as "low" "medium;" and "high." The values for each macronutrient are defined as follows:

- Nitrogen: low (<280 kg/ha), medium (280-560 kg/ha), high (> 560 kg/ ha),
- Phosphorus: low (< 10 Kg/ha), medium (10-25 kg/ha), high (> 25 kg/ha),
- Potassium: low (< 120 Kg/ha), medium (120-280 kg/ha), high (> 280 kg/ha),
- Sulphur: <10.0 ppm (deficient), >10.0 ppm (sufficient)

Micronutrients are categorized as "deficient" (soils containing less than the prescribed level of a micronutrient) and "sufficient" (soils containing equal to or more than the prescribed levels of micronutrients). The prescribed values for each micronutrient are defined as follows:

- Boron: > 0.5 ppm,
- Copper: > 2.0 ppm,
- Iron: > 4.5 ppm,
- Manganese: >2.0 ppm,
- Zinc: > 0.6 ppm

Organic carbon, pH and EC are categorized as follows:

Organic carbon: low (<0.50 percent), medium (0.5-0.75 percent), high (>0.75 percent). Soils > 0.5 percent are considered under sufficient category in SHCs.

pH: Strongly acidic (<4.5), Moderately acidic (4.5-5.5), Normal > 6.5-7.3, Alkaline (>7.5)

EC: Non-saline (<4 dS/m), Saline (>4 dS/m)

Source: MoAFW

2.1.1.2 Other input subsidies

As depicted in **Figures 2.6** and **2.7**, the details of the other component/schemes through which the Government provides input subsidies to farmers are as follows:

Seeds

Since 2014-15, the Department of Agriculture and Farmers' Welfare (DA&FW) has been

implementing the Sub-Mission on Seeds & Planting Materials (SMSP) to enhance the production and multiplication of quality seeds for agricultural crops. This initiative ensures that the necessary quantities of seeds are available to farmers nationwide. To improve the quality of farmers' saved seeds, financial assistance is provided under the Seed Village Programme of

SMSP—50 percent of the seed cost for cereal crops and 60 percent for pulses, oilseeds, fodder, and green manure crops—for one acre per farmer. The aim of this scheme is to provide farmers with high-yielding varieties of seeds in a timely manner and to achieve seed self-sufficiency at the village level. The scheme is demand-driven and implemented by the respective state or implementing agencies for the benefit of all categories of farmers, thereby enhancing the productivity and profitability of various crops and boosting farmers' income in the country.

Mechanization and technology

Since FY15, the Sub Mission on Agricultural Mechanization (SMAM) has expanded farm mechanization access to small and marginal farmers and areas with low farm power availability. A Central Sector Scheme (CSS) has been launched to support the efforts of the Governments of Haryana, Punjab, Uttar Pradesh, and the National Capital Territory of Delhi in tackling air pollution caused by stubble burning. The scheme, running from FY19 to FY22, subsidized machinery for farmers to manage crop residue in situ, thereby promoting agricultural mechanization in these regions. A newly launched Namo Drone Didi is a CSS to empower women-led Self-Help Groups (SHGs) by providing them with drone technology for agricultural services. Between FY25 and FY26, 15,000 selected Women SHGs will receive drones to offer rental services to farmers for agricultural purposes, such as applying liquid fertilisers and pesticides. This initiative is expected to generate an additional income of at least ₹0.1 mn per year for each SHG, promoting economic empowerment and sustainable livelihoods.

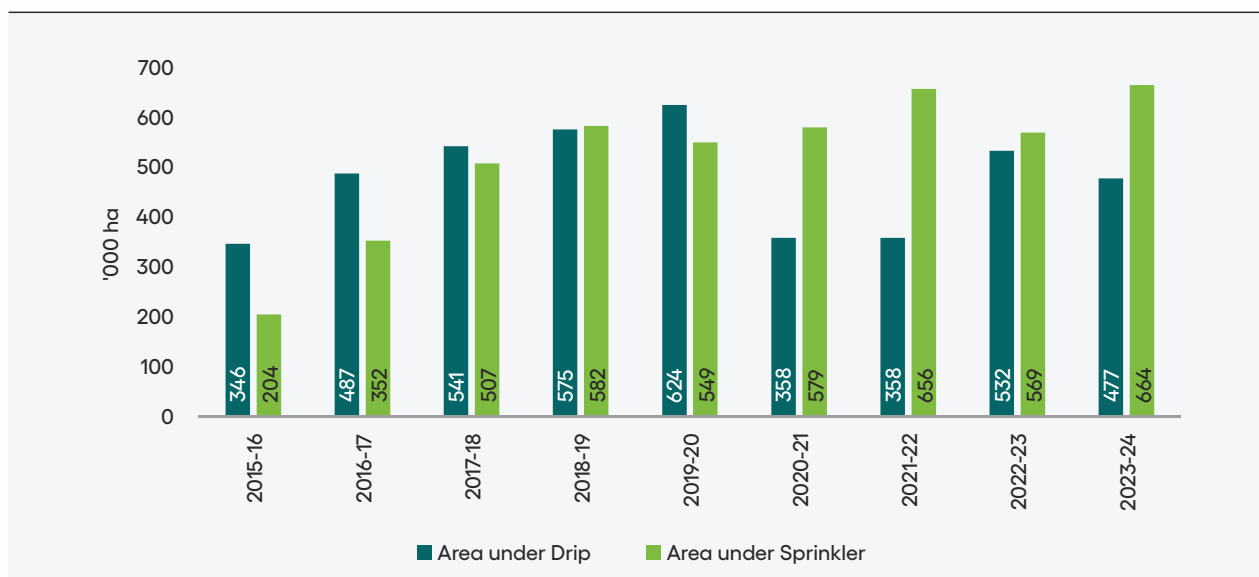
Canal irrigation

Crops are irrigated mainly by tubewells, but in areas where canal network is available (22.5 percent of net irrigated area), farmers use canal water for irrigation, particularly during power shortage. Irrigation subsidy is the difference between the expenditure and receipts of major, medium, and minor irrigation projects, obtained from MoF. During 2022-23, food crops have accounted for 81 percent of gross irrigated area under all crops. Out of the food crops, wheat and rice taken together accounted for 51 percent of gross irrigated area. Under non-food crops, oilseeds, cotton and fodder crops accounted for 11 percent, 4 percent and 2 percent respectively. Irrigation projects have majorly benefitted wheat and rice crops.

Micro-irrigation

The Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) comprises three main components: i. PMKSY (Har Khet Ko Pani) ii. PMKSY (Watershed) iii. PMKSY (Per Drop More Crop). Subsidies are available only for the PMKSY (Per Drop More Crop) component. This component, implemented by DA&FW, focuses on enhancing farm-level water use efficiency through precision and micro-irrigation techniques like drip and sprinkler irrigation. Additionally, it promotes better on-farm water management practices to optimize the use of available water resources and supports micro-level water storage or water conservation and management activities to supplement micro-irrigation. The area with drip and sprinkler is showing modest increase year-wise (**Figure 2.18**).

Figure 2.18: Area covered under sprinkler and drip irrigation



Source: PMKSY Reports

Subsidies for sustainable agriculture

Farmers receive subsidies through various other schemes, such as the National Food Security Mission (NFSM), Mission for Integrated Development of Horticulture (MIDH), RKVY, PKVY among others, all aimed at benefiting farmers. Natural farming and organic farming have recently got much attention in India. However, area under organic cultivation has increased from 0.18 mha (in 2005) to mere 2.65 mha (in 2020), which is only 1.57 percent of the GCA. Biofertiliser production has steadily increased from 9,019 tonnes (in FY02) to 90,431 tonnes (carrier based biofertilisers) and 26,442 KL (liquid based biofertilisers) (in FY21). GoI is also supporting nanofertilisers, particularly nano-urea. However, it is under pilot testing and the impact of nanofertilisers on bio-diversity needs to be studied.

Subsidies for livestock development

Rashtriya Gokul Mission was launched to develop and conserve indigenous breeds and upgrade the genetic quality of bovine population. Several key

initiatives were undertaken in 2024 to boost bovine productivity that include: (i) launch of indigenously developed sex-sorted semen production technology. This technology, available at reasonable rates, aims to produce female calves with up to 90 percent accuracy, enhancing breed improvement and farmers' income; (ii) launch of indigenous media for in-vitro fertilisation (IVF), offering a cost-effective alternative to expensive imported media for propagating elite indigenous animals; (iii) launch of the common genomic chip, Gau chip for cattle, and Mahish chip for buffalo, and (iv) initiation of the National Milk Recording programme in Bhubaneswar to identify superior animals of indigenous breeds in milk-producing regions.

2.1.2 Income support to farmers

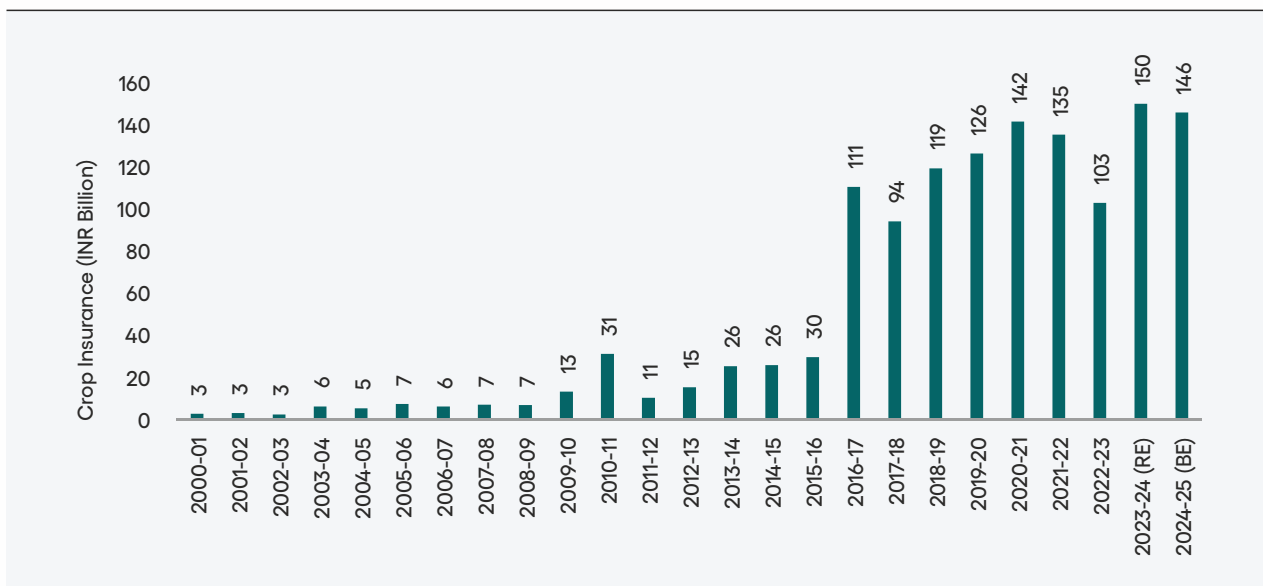
2.1.2.1 Crop Insurance

Crop losses due to various reasons, particularly because of extreme weather situations, are a common phenomenon and can prove to be catastrophic in the numerous rain-fed fields of

backward regions. It is against this backdrop that the development of sustainable adaptation strategies, one of them being crop insurance, comes into the picture. Since independence, efforts have been made both at the central- as well as state-level to introduce a crop insurance scheme for Indian farmers. The first crop insurance pilot programme was started in 1972 with little coverage. In 1978, it was replaced by the Pilot Crop Insurance Scheme (Dandekar, 1985). In 1985, the first nationwide crop insurance scheme, the Comprehensive Crop Insurance Scheme, was implemented, which was replaced by National Agriculture Insurance Scheme in 1999, and later changed to the Modified National Agriculture Insurance Scheme. Apart from these schemes, the GoI has introduced other crop insurance pilot projects and schemes, such as the Pilot Scheme on Crop Insurance (2000), the

Farm Insurance Scheme (2003), and the WBCIS (2007). Repeated modifications in insurance schemes were introduced to provide better results regarding claims, premium rates, and other factors (Gulati et al. 2018). At present, two crop insurance schemes—the PMFBY and the Restructured WBCIS—are operational. PMFBY was introduced in Kharif 2016 and is operational in 22 out of the 30 Indian states. The PMFBY consists of insurance coverage for about 40 crops, primarily food crops, and some horticultural crops. The amount of crop insurance in center's budget has increased significantly, since 2017 with the introduction of PMFBY, from ₹2.89 bn (US\$ 0.1 bn) in FY01 to ₹110.52 bn (US\$ 1.6 bn) in FY17, and is presently at ₹146 bn (US\$ 1.7 bn) in FY25 (BE) (Figure 2.19).

Figure 2.19: Trends of crop insurance schemes



Source: MoF

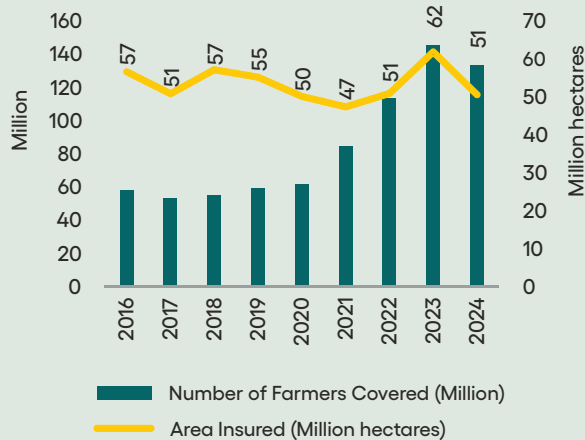


Box 2.2

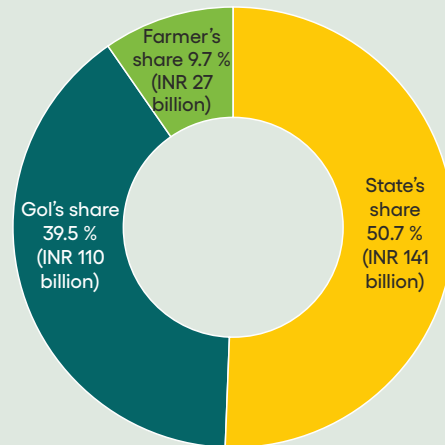
Pradhan Mantri Fasal Bima Yojana (PMFBY)

The 'Pradhan Mantri Fasal Bima Yojana' was launched by the GoI in kharif in 2016 and replaced previous schemes such as the National Agriculture Insurance Scheme (NAIS) and Modified National Agriculture Insurance Scheme (MNAIS). The insurance scheme operated on an “area approach.” The scheme was compulsory for farmers who took a loan from any financial source and voluntary for non-loanee farmers, but the scheme was made optional for loanee farmers from kharif 2020. The farmers crop insurance application started increasing since 2021. The premium under the scheme is determined through bidding however, farmers must pay maximum 2 percent for Kharif, 1.5 percent for Rabi food and oilseed crops and 5 percent for commercial/horticultural crops and the balance of actuarial/bided premium is shared by the Central and State Government on 50:50 basis and 90:10 in case of North Eastern States from Kharif 2020 season as per provisions of the scheme (PIB 2021). In 2024, of the gross premium of ₹278 bn (US\$ 3), farmers' share comprised of ₹27 bn (US\$ 0.3 bn) (10 percent), state's share of ₹141 bn (US\$ 2 bn) (51 percent) and GoI's share of ₹100 bn (US\$ 1.2 bn) (40 percent).

Farmers applications and area insured, 2016-2024



Premium share in 2024



Source: pmfby.gov.in

Weather Based Crop Insurance aims to mitigate the insured farmers against the likelihood of financial loss on account of anticipated crop loss resulting from incidence of adverse conditions of weather parameters like rainfall (deficit rainfall, excess rainfall), temperature (heat, low temperature), frost, humidity etc.

2.1.2.2 Pradhan Mantri Kisan Samman Nidhi

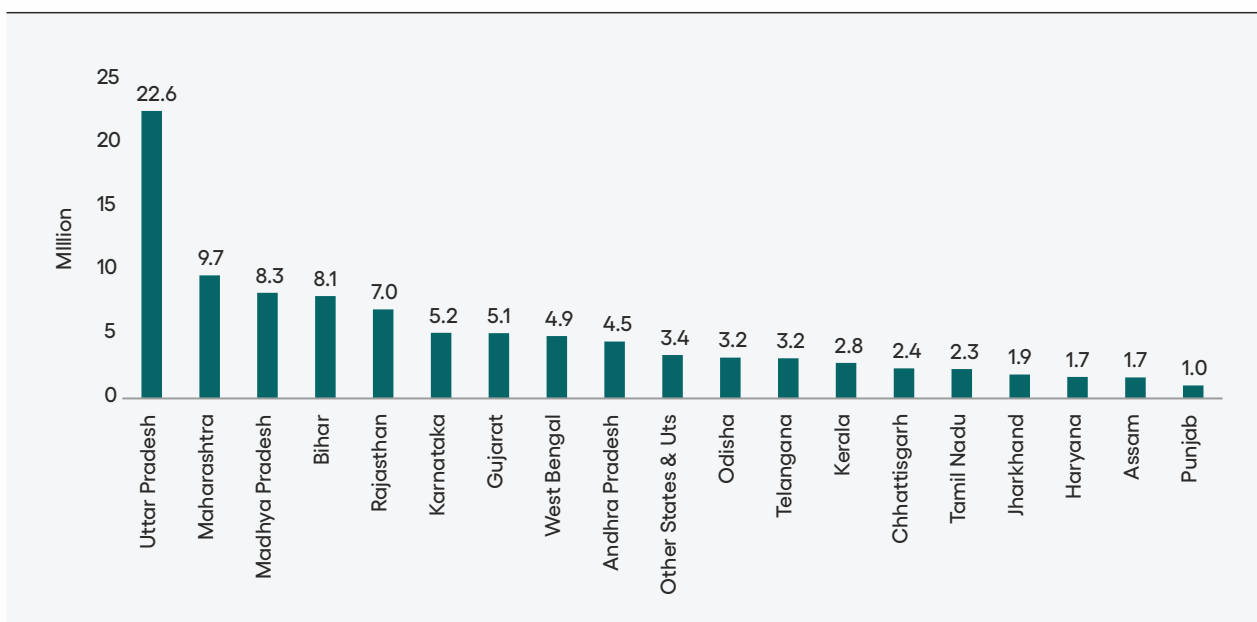
PM-KISAN, a GoI funded scheme launched in February 2019, effective from 1st December 2018. The state of West Bengal joined the Scheme from 8th installment (April-July, 2021) as initially the State desired that the funds under PM-KISAN Scheme be transferred to the State Government for onward disbursement to the farmers through the State Government.

The scheme aims to provide income support to all landholding farmers' families (with some exclusions) by supplementing their financial needs while procuring various agriculture inputs, as well

as their domestic needs. The scheme is operated through Direct Benefit Transfer (DBT) mode. Under the Scheme, irrespective of the farm size, income support of ₹6,000 per annum is provided to all eligible farmer families in the country, in three equal instalments of ₹2,000 every four months viz. December-March, April-July and August-November.

According to government data (PIB, 2024c), the scheme reached 99 mn farmers for FY24. Highest number of beneficiaries comes from Uttar Pradesh (23 percent, 22.6 mn farmers) followed by Maharashtra (10 percent), Madhya Pradesh (8.4 percent), and Bihar (8.1 percent) (Figure 2.20).

Figure 2.20: Farmer beneficiaries of PM-KISAN



Source: PIB, 2024c

As on 3rd December, 2024, funds amounting to ₹3451 bn in various instalments (18 in total) have been released to the eligible beneficiaries of this scheme across India. Out of which ₹1291 bn was released during the COVID-19 pandemic period.

2.1.2.3 Credit support

The government subsidizes short-term institutional credit for farmers in two ways – through interest subvention to lending institutions, which enables banks to advance credit to agriculture at reasonable

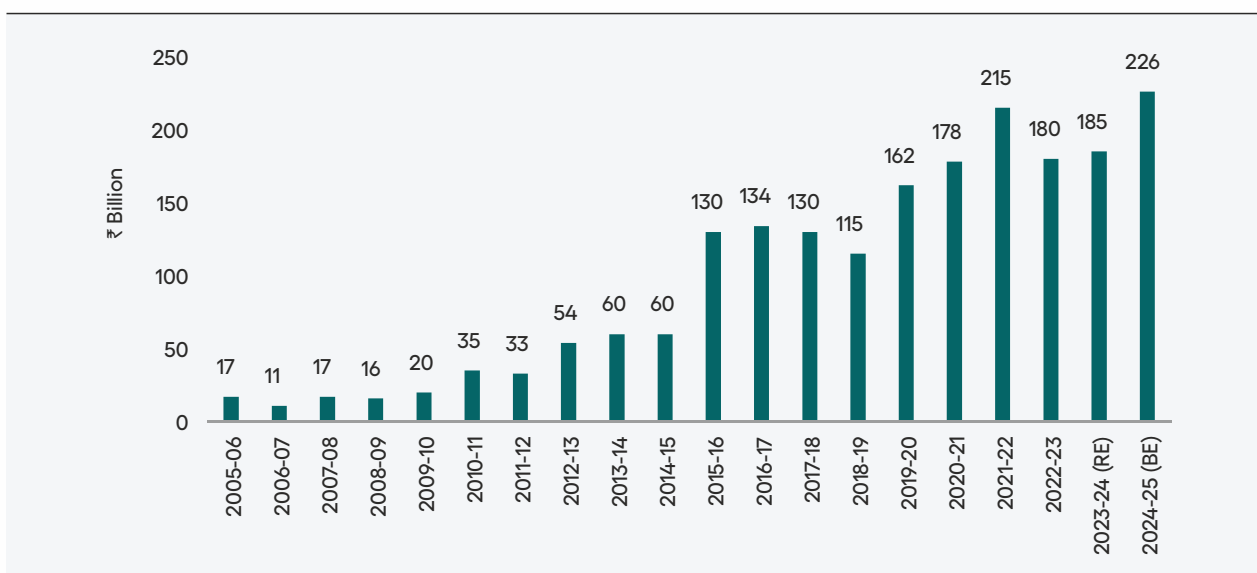
levels of interest rates and through “loan waiver” where the government reimburses the lending institutions the cost of implementing the waiver. This provides relief to farmers who are overburdened with debts (Gulati et. al., 2018).

Under the interest subvention scheme, short term crop loans and short-term loans for agriculture and allied activities including animal husbandry, dairy, fisheries, bee keeping etc. up to an overall limit of ₹0.3 mn at concessional interest of 7 percent per annum to farmers are provided with 2 percent interest subvention. Farmers are also given 3 percent additional interest subvention on prompt

repayment of crop loans on or before the due date. That is, the effective interest rate becomes 4 percent per annum. The data on interest subvention provided to National Bank for Agriculture and Rural Development (NABARD), Regional Rural Banks (RRBs), cooperative banks, and public sector banks on short-term credits to farmers is provided in the Expenditure Budget prepared by MoF (Figure 2.21)

The expenditure from the central budget has increased from ₹17 bn (US\$ 0.4 bn) in FY08 to ₹226 bn (US\$ 2.7 bn) in FY25 (BE). The subsidy increased almost 13-fold in the said time period.

Figure 2.21: Interest subvention subsidy to agriculture sector



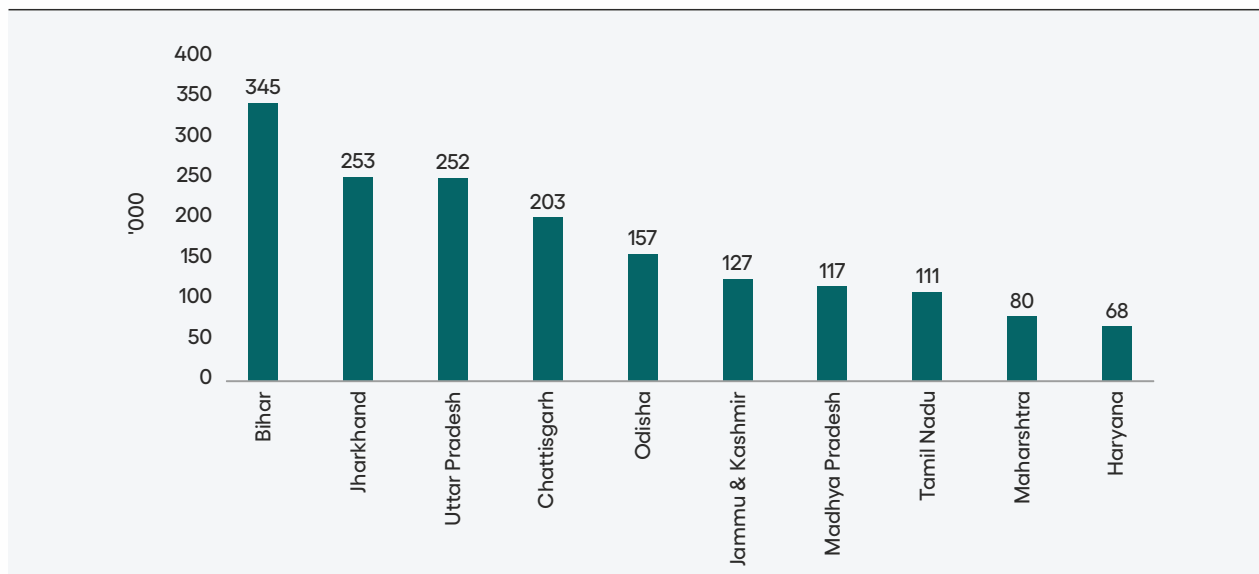
Source: MoF

2.1.2.4 Pradhan Mantri Kisan Maandhan Yojana (PM-KMY)

Launched in 2019, this old-age pension scheme is voluntary and contributory. It provides eligible small and marginal farmers with a fixed monthly pension of ₹3,000 after they reach the age of sixty. To be eligible, farmers aged between 18 and 40

years make monthly contributions between ₹55 to ₹200 per month to the pension fund until they turn 60, with GoI contributing an equal amount. As of August 6, 2024, a total of 2.3 mn farmers have joined the scheme (PIB, 2024c). Under the scheme, Bihar leads with over 0.34 mn registrations while Jharkhand ranks second with over 0.25 mn registrations (Figure 2.22).

Figure 2.22: State-wise farmers registrations for PM-KMY



Source: PIB, 2024c

Crop Insurance, PM-KISAN, Credit Subsidies and PM-KMY are efforts to boost farmers' income. These are decoupled support and are neutral with respect to their impact on biodiversity.

Decoupled support refers to fiscal subsidies that do not depend on the commodity produced or on the inputs used for producing a specific commodity (World Bank, 2020).

2.2 The magnitude and scale of AFBS for safety net to consumers

2.2.1 Food subsidy

2.2.1.1 PDS in India

The idea of food rationing goes back to the pre-independence era when the British government in 1939 introduced the system. This laid the foundation of PDS that was developed in 1942. The death of 4 mn people during the Bengal famine in 1943 gave the validity to the PDS. Till date the system is in practice and delivering food security to 813.5 mn people across India.

The primary objective of the Department of Food and Public Distribution is to guarantee food security for the majority of the population through appropriate and efficient procurement and distribution of foodgrains. The government procures different foodgrains, in order to build buffer stock and distributes among needy consumers. The dual objectives of price policy mechanism include (i) incentivizing farmers through remunerative prices for their produce by way of MSP mechanism (ii) maintaining a buffer

stock and distribution of foodgrains to below poverty line people and poor people under the AAY scheme, creating grain banks in food scarce areas and participation of Panchayati Raj Institutions in Public Distribution System. FCI, set up in 1965, is the GoI's primary agency for procuring, storing, and distributing grain in this system. In recent years, some states have taken up the role of procurement and claim subsidy directly from GoI under de-centralised procurement scheme (e.g., MP, Chhattisgarh, and Andhra Pradesh, etc.).

2.2.1.2 MSP and procurement

In 1965, the GoI institutionalized the APC to implement an integrated and balanced price policy in the country. Through MSPs for products and guaranteed procurement, the government developed a long-term perspective for price policies to eliminate uncertainties for farmers at the time when they need to make decisions about crops and to improve overall price realization for them (while, at the same time, insulating consumers against price fluctuations). In March 1985, the name of the institution was changed to the CACP² and focus was shifted towards developing a price structure that affects the production pattern in line with the overall needs of the economy (Sen and Chatterjee, 2002). At present, based on the recommendations of the CACP, DA&FW, GoI has declared MSP for 23 crops (comprising seven cereals (paddy, wheat, maize, sorghum, pearl millet, barley and ragi); five pulses (gram, arhar/tur, moong, urad, masur/lentil); eight oilseeds (groundnut, rapeseed (Toria, Mustard and Sarson), soybean, sesamum, sunflower, safflower, niger seed and toria); and three commercial crops (copra, cotton and raw jute) and fair and remunerative price

(FRP) for sugarcane, before their sowing seasons. Occasionally, the central or state governments announce a bonus over and above the MSP to incentivise the production of certain crops during specific time periods (OECD/ICRIER, 2018).

One of the key challenges with a long-established procurement-backed MSP policy is that the GoI may announce MSPs for 23 commodities and FRP for sugarcane on paper, but their implementation remains indicative in practical terms (Goklany, 2016). Only wheat and rice are procured by the FCI on a continuous basis, and that too from only a few states, while procurement mechanisms for other crops – pulses, oilseeds, sugar, and cotton – are largely inadequate.

The disproportionate procurement of wheat and rice by the government, as well as significantly rising MSPs, results in frequent overflowing of stocks over and above the buffer stocking norms.³ Against the buffer norm of 31.9 MMT of rice and wheat together, total central pool stocks on July 1, 2014 were almost double this figure, at 61.03 MMT (21.2 MMT of rice and 39.8 MMT of wheat). Moreover, in line with significantly rising MSPs, stocking norms were actually raised to 41.1 MMT in 2015-16. Even after this, as of July 1 2024, rice and wheat stocks together were higher than the revised norms (79.6 MMT against 41.1 MMT). Over the years the FCI has held much higher stocks than required (**Figure 2.23**).

This imposes huge costs, both in terms of locking in of resources as well as the economic cost of carrying stocks. Since 2013-14, the MSP of wheat has increased from ₹1,350 (US\$ 23) per quintal to ₹2,125 (US\$ 26) per quintal in RMS 2023-24. Likewise, MSP of paddy (common) has increased

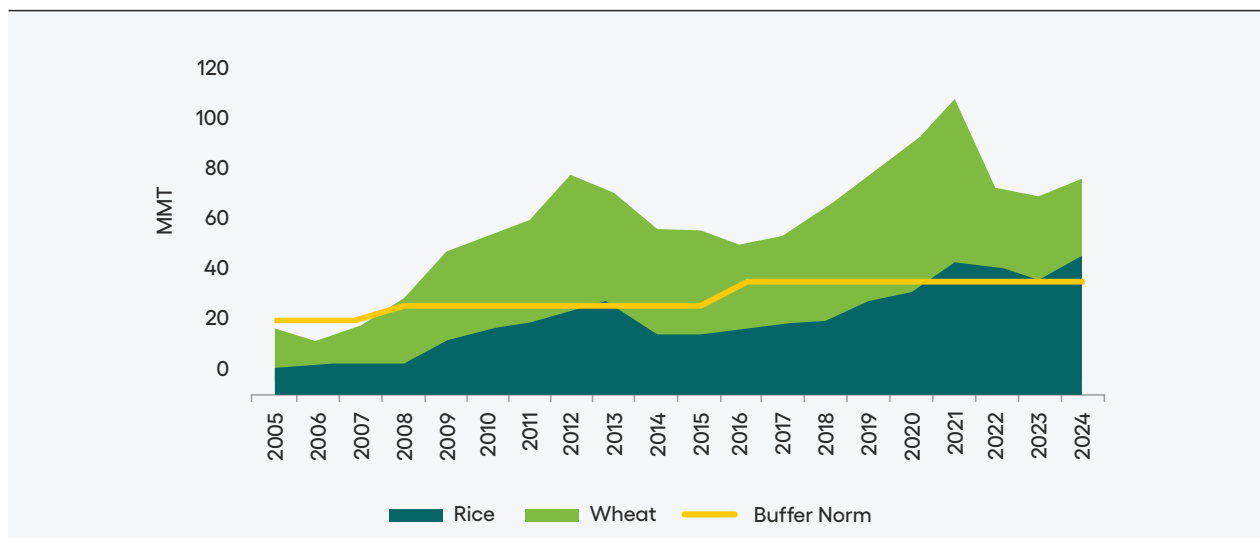
² CACP official website (<https://cacp.dacnet.nic.in/>)

³ The stocking norms are the minimum quantities of wheat and rice that must be maintained in each quarter by the central government. These comprise "food security reserves" for meeting shortfalls in procurement and "operational stocks" to meet the monthly requirements for the targeted public distribution and other welfare schemes (OECD/ICRIER, 2018).

from ₹1,310 (US\$ 22) per quintal in 2013-14 to ₹2,183 (US\$ 26) per quintal in KMS 2023-24. However, the central issue price (CIP) of wheat and rice for AAY, Below Poverty Line (BPL) and Above

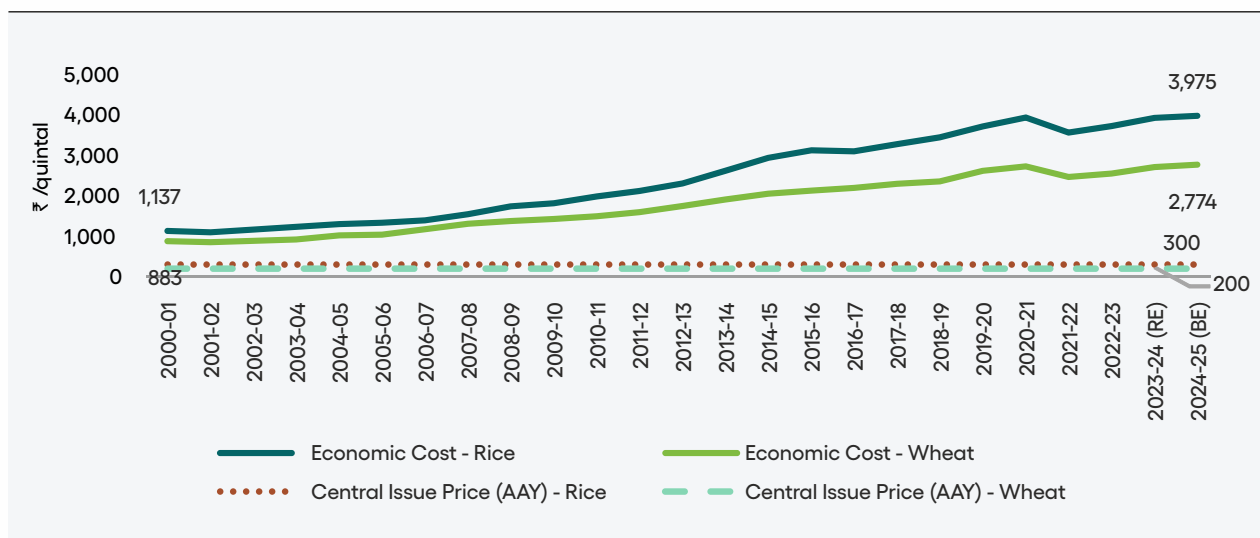
Poverty Line (APL) families has not been revised since 2013. As a result, the gap between economic cost and CIPs has been increasing (Figure 2.24).

Figure 2.23: Overflowing rice-wheat stocks compared to buffer stock norms



Source: FCI

Figure 2.24: Economic cost of rice and wheat and CIPs for the AAY



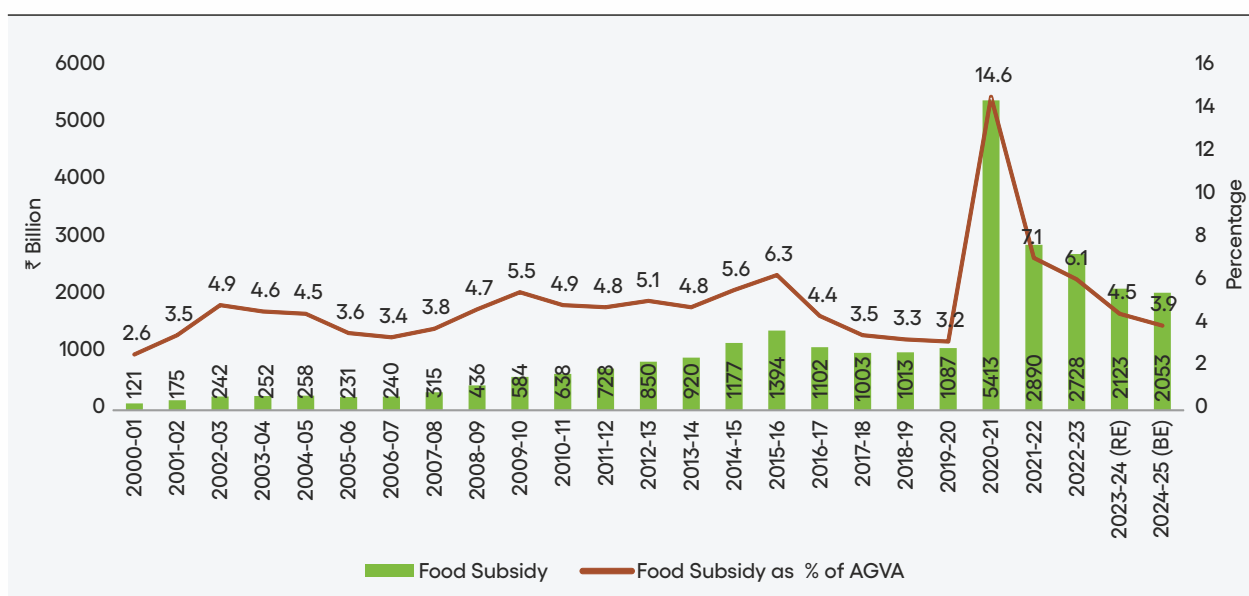
Source: FCI, DFPD

Price signalling through MSPs and government procurement is, distortionary in the economic sense as it results in an unprecedented increase in production, particularly in surplus states where farmers are effectively discouraged from diversifying into other crops. Excess production in the absence of adequate demand, lack of storage and processing facilities, and the existence of restrictive export policies lead to the piling up of stocks over and above what is necessary.

2.2.1.3 Trends of food subsidy: 2000-2025

Stagnant CIP⁴ and rising economic costs in effect create a mounting food subsidy burden on the exchequer, which, at ₹1973.4 bn (US\$ 24 bn) in FY24, is already high (Figure 2.25) As a percentage of AGVA, it hovered between 4-6 percent, except in covid year, where it touched 14.65 percent of AGVA. The subsidy burden rose in the post-COVID period as the Central government decided to provide free foodgrains to about 813.5 mn beneficiaries under the National Food Security Act (NFSA).

Figure 2.25: Trends of food subsidy



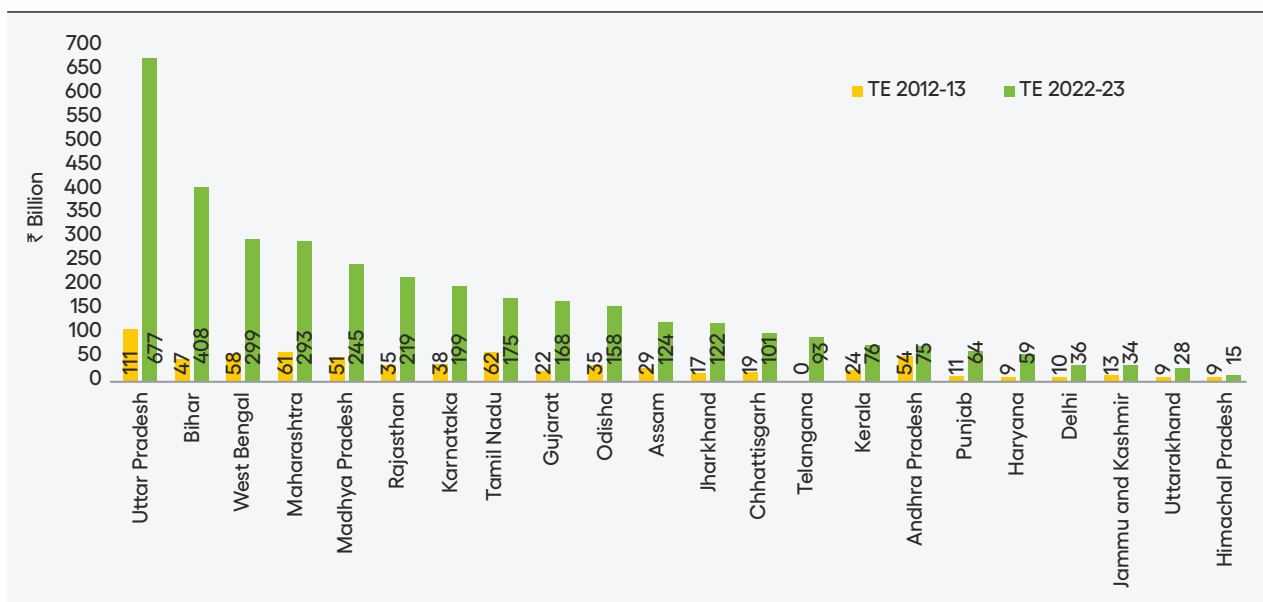
Source: MoF

The highest amount of subsidy is allocated to the most populous state of Uttar Pradesh, followed by Bihar, West Bengal, and Maharashtra. The highest

increase in subsidies is also observed for the same states (Figure 2.26).

⁴ CIP for wheat is Rs.2/kg and for rice, Rs.3/kg, under the National Food Security Act (NFSA), 2013

Figure 2.26: Food subsidy in major states of India



Source: MoF, FCI

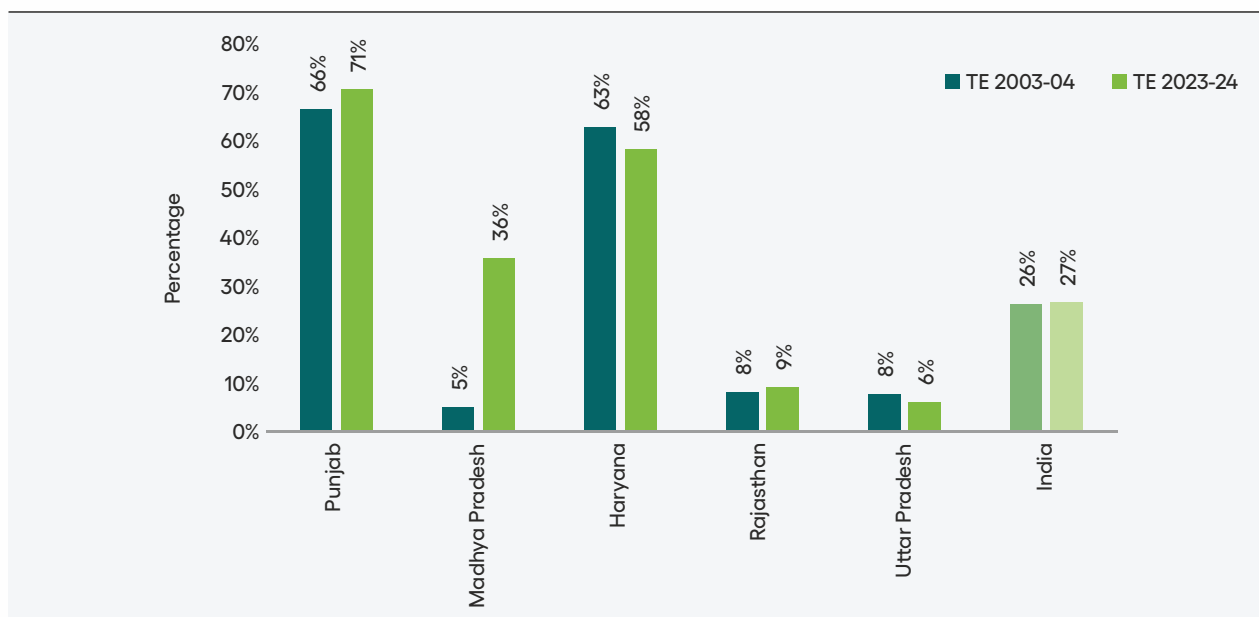
“ Assured wheat-rice procurement is discouraging farmers for crop diversification and impacting target 4 (in situ and ex situ conservation of genetic resources), target 8 (minimize the impact of climate change), and target 9 (sustainable use of wild species)

Farmers respond to the price signals provided by the MSPs and continue to grow predominantly crops which give them an assured price; for instance, water and fertiliser intensive crops such as rice and wheat are grown mainly in the water stressed northern and north-western regions of the country. In terms of percentage of production, around 75 and 69 percent of wheat produced respectively in Punjab and Haryana were procured by government agencies during TE 2021-22 (Figure 2.27). During TE 2021-22, more than 100 percent of rice produced in Punjab was procured at MSP to feed the central pool of grains (Figure 2.28).



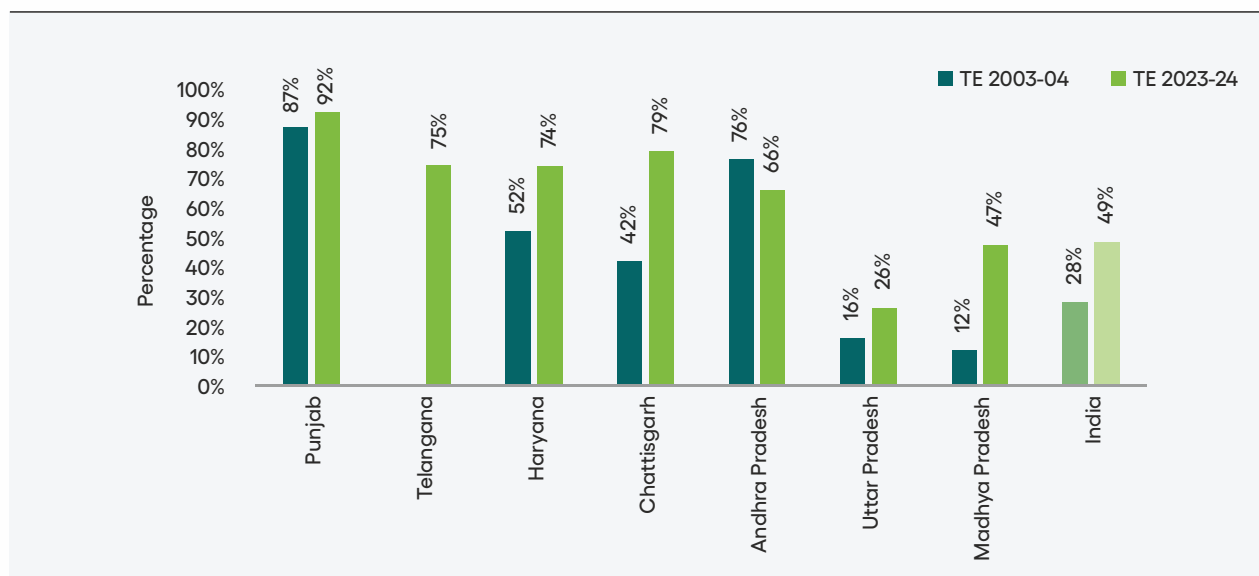
Target 4: “Ensure urgent management actions to maintain and restore the genetic diversity within and between populations of native, wild and domesticated species to maintain their adaptive potential, including through in situ and ex situ conservation and sustainable management practices, and effectively manage human-wildlife interactions to minimize human-wildlife conflict for coexistence”.

Figure 2.27: Procurement of wheat as a percentage of production in major states



Source: MoAFWb 2024, FCI

Figure 2.28: Procurement of rice as a percentage of production in major states

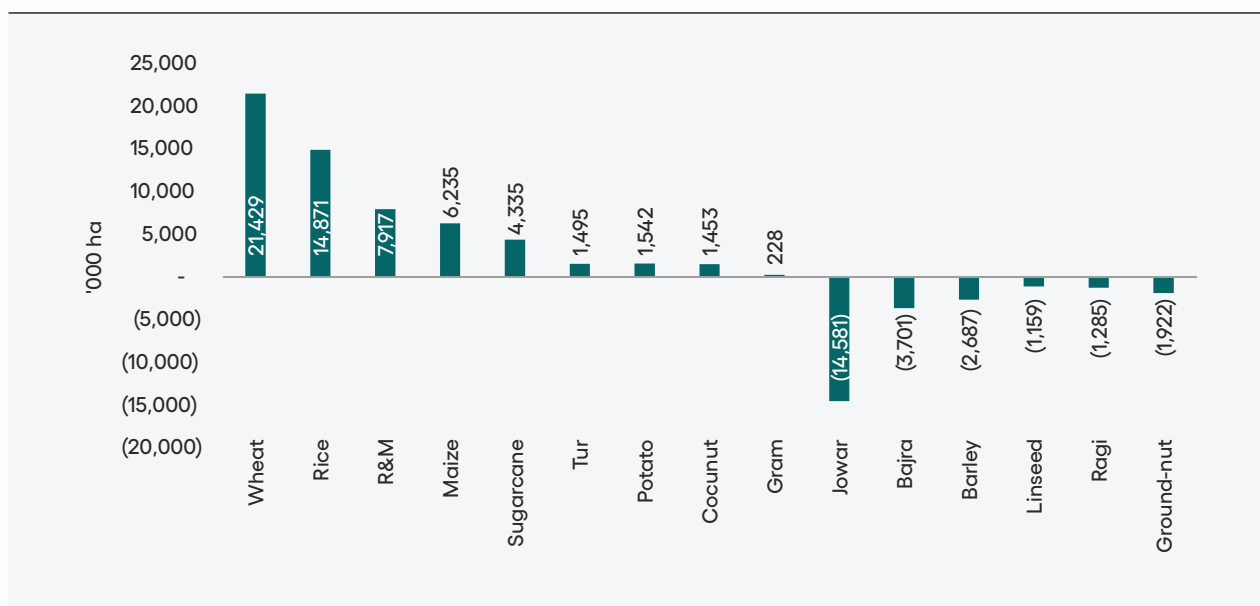


Source: MoAFWb 2024, FCI

Due to the assured income from the production of wheat and rice, the preference of farmers changed in terms of the cultivation of these two crops and their share in the total cropped area in India has increased over the years. In 1960-61, the area under paddy cultivation was only 33.8 mha which has increased to 49.5 mha in 2022-23 (Figure 2.29). Similarly, the wheat cultivation area increased from 13.4 mha to 35 mha. On contrary, the cultivation area under other coarse cereals and millets reduced significantly - jowar cultivation area reduced from 17.7 mha to 3.6 mha; bajra cultivation area reduced from 10.8 mha to 7.6 mha;

ragi cultivation area reduced from 2.4 mha to 1.2 mha and barley cultivation area reduced from 3.4 mha to 0.6 mha. The native pulses, such as moong, gram, tur, etc., and some other oilseed crops, such as mustard, sesame, etc., were not cultivated further on a larger scale than it was before. Traditionally grown and consumed crops, such as millets, grow easily in arid and semi-arid conditions because they have low water requirements. However, farmers moved to only rice and wheat, which is now covering 39 percent of the GCA and 52 percent of the food crop area.

Figure 2.29: Difference in crop production area (1961-62 to 2022-23)



Source: MoAFWa 2024



Target 8: “Minimize the impact of climate change and ocean acidification on biodiversity and increase its resilience through mitigation, adaptation, and disaster risk reduction actions, including through nature-based solutions and/or ecosystem-based approaches, while minimizing negative and fostering positive impacts of climate action on biodiversity”

As per the national inventory, rice cultivation contributes 17.4 percent of total GHG emissions from the agriculture sector (MoEFCC, 2024). These are, however, only methane emissions from rice cultivation. The after math of rice cultivation is enhanced methane (CH₄) as well as nitrous oxide (N₂O) emissions, both potent GHG that contribute to climate change. N₂O traps more heat compared with CH₄ [100-y global warming potential (GWP100) of 273 vs. 27.2 and has a longer atmospheric lifetime (121 vs. 12 y). Additionally, there are emissions from burning rice residues, emissions for application and manufacturing fertilisers, pesticides, other inputs and emissions from fuel consumption and emissions from energy used for ground water extraction. Using IPCC Tier 2 methodology (IPCC 2006, 2021), we have







estimated GHG emissions across states from all these sources to understand the overall GHG emissions from rice cultivation. During 2021-22, the total GHG emission from Indian rice cultivation for 2021-22 was estimated to be 143,756 Gg CO₂ eq at 100-yr GWP (Singh and Gulati, 2023).

Since green revolution, there was reduced cultivation of indigenous varieties of wheat, rice, millets, lentils, etc. In turn, there was increased harvest of hybrid crops, which grow faster (Taylor, 2019). Being an important crop in ensuring food security, wheat is under a continuous process of varietal improvement that quickly diffused across the farmers during the green revolution period. As a result, very little area of this crop is under the traditional varieties or land races (**Table 2.1**)



Target 9: “Ensure that the management and use of wild species are sustainable, thereby providing social, economic and environmental benefits for people, especially those in vulnerable situations and those most dependent on biodiversity, including through sustainable biodiversity-based activities, products and services that enhance biodiversity, and protecting and encouraging customary sustainable use by indigenous peoples and local communities”.

Table 2.1: Area under local and modern wheat varieties in major producing states: 2013-14

State	Percent area under different varieties		Top 5 varieties	Area coverage (ha)	Total area under top 5 varieties (%)
	Local variety	Modern variety			
Bihar 	1	99	PBW 343 HD 2733 PBW 502 PBW 373 HD 2967	66,276 48,002 31,516 26,594 5,826	80.75
Haryana 	Nil	100	WH 711 PBW 343 HD 2967 HD 2851 DBW 17	4,56,542 4,36,084 3,12,258 2,82,109 2,15,350	79.05
Madhya Pradesh 	Nil	100	Lok 1 GW 322 JW 3211 HI 1544 Sujata	8,57,242 8,02,525 5,21,033 3,87,279 3,58,704	48.14
Punjab 	Nil	100	HD 2967 PBW 550 PBW 343 PBW 621 HD 2932	20,00,084 3,73,326 3,44,878 3,26,616 68,835	88.66
Rajasthan 	2.8	97.2	RAJ 4037 RAJ 3077 RAJ 3765 PBW 550 RAJ 1482	6,04,363 5,56,900 4,75,263 1,56,312 1,33,529	60.88
Uttar Pradesh 	1	99	PBW 343 PBW 502 PBW 550 HUW 234 HD 2687	14,43,410 8,27,476 6,98,583 6,79,889 5,74,609	42.93

Source: Pavithra et al. 2017

As seen in **Table 2.1** the extent of concentration of wheat area under the top most varieties varied widely across the states. The gross wheat area covered under the major 5 varieties of a state ranged from 42.93 percent in Uttar Pradesh to 88.66 percent in Punjab. More than 80 percent of wheat area is distributed over only five varieties in

Haryana (79.05 percent), Bihar (80.75 percent) and Punjab (88.66 percent) states implying less production diversity of wheat in these states. The concentration of wheat area under top 5 varieties was least in Uttar Pradesh (42.93 percent), followed up by Madhya Pradesh (48.14 percent) and Rajasthan (60.88 percent), which suggest that these

states have higher varietal diversity in production. Wheat variety HD 2967 which is the most widely cultivated variety in Punjab, covered about 57 percent of the wheat area, indicating greater outreach and popularity of this variety among the

farmers. That means already Punjab is under monocropping of wheat-rice system and within wheat also, there is monocropping of one variety. This is an alarming trend with respect to production diversity.

2.2.2 Other procurement and market intervention schemes

The Pradhan Mantri Annadata Aay SanraksHan Abhiyan (PM-AASHA) aims to provide fair prices to farmers and manage price volatility of essential commodities for consumers. PM-AASHA now includes the Price Support Scheme (PSS), Price Stabilization Fund (PSF), Price Deficit Payment Scheme (PDPS), and Market Intervention Scheme (MIS). The key points are as follows (PIB, 2024b):

- From the 2024-25 season, the PSS will cover 25 percent of the national production of notified pulses, oilseeds, and copra, allowing states to procure more of these crops at MSP to prevent distress sales. For tur, urad, and masur, there will be 100 percent procurement in the 2024-25 season.
- The extension of the PSF scheme will protect consumers from extreme price volatility by maintaining buffer stocks of pulses and onions, discouraging hoarding and speculation, and ensuring affordable prices. The Department of Consumer Affairs will procure pulses at market prices when they exceed MSP, including from pre-registered farmers on the eSamridhi and

eSamyukti portals. The PSF scheme also covers other crops like tomatoes and subsidized retail sales of Bharat dals, Bharat atta, and Bharat rice.

- To encourage states to implement the PDPS for notified oilseeds, coverage has been increased from 25 percent to 40 percent of state production, and the implementation period extended from 3 to 4 months. The central government will cover the difference between MSP and sale/modal price, limited to 15 percent of MSP.
- The MIS has been extended with changes to provide fair prices to farmers of perishable horticultural crops. Coverage has increased from 20 to 25 percent of production, and a new option allows direct payments to farmers' accounts instead of physical procurement. For Tomato, Onion, and Potato (TOP) crops, the government will cover transportation and storage costs to bridge price gaps between producing and consuming states, ensuring fair prices for farmers and stable prices for consumers.

PM-AASHA ensures remunerative prices to farmers for their produce of oilseeds, pulses and copra of Fair Average Quality (FAQ). This is positive with respect to biodiversity and will encourage diversity in production and consumption.

2.2.3 Rural employment

With the rise of urbanization, people migrated from rural to urban areas for employment. High rate of unemployment has always been the primary concern in rural areas. Various employment generation schemes and programmes were launched by GoI. Important ones are listed as follows:

National Rural Employment Programme (NREP, 1980): The NREP was launched in 1980 to develop key assets, such as fisheries, fuel and energy plantations, and fodder and pasture development plantations by mobilizing unemployed and under-employed laborers.

Rural Landless Employment Guarantee (RLEG, 1983): RLEG provided guaranteed employment to the landless for at least 100 days. 25 percent of the funds were allocated for social forestry.

Jawahar Rozgar Yojana (JRY, 1989): JRY was launched in 1989 by consolidating the NREP and RLEGP. While keeping the general objectives same, the primary demographic target were people below the poverty line.

Jawahar Gram Samridhi Yojana (JGSY, 1999): JGSY was launched in 1999 to create demand-driven infrastructure in the village to create employment opportunities with special preference to SC/ST families living below the poverty line and for physically handicapped persons.

National Food for Work Programme (NFWP, 2004): NFWP was launched in 2004 for the 150 most backward districts of India to create supplementary wage employment for manual unskilled labour. The NFWP was subsequently subsumed under the MGNREGA.

National Rural Employment Guarantee Scheme (NREGS, 2006): NREGS which was later renamed as MGNREGA aimed to provide 100 days of guaranteed wage employment in every financial year in every household for unskilled manual work.

Mahatma Gandhi National Rural Employment Guarantee Act

MGNREGA is a flagship programme of GoI, which was launched in 2006 after the National Rural Employment Guarantee Act (NREGA) was enacted in 2005 to reinforce the commitment towards livelihood security in rural areas. The implementation of this programme was conducted in a phased manner, wherein it was initially launched in 2006 in 200 of the most backward districts of India, followed by its enactment in 113 more backward districts in 2007 and finally, its expansion to all districts of India in 2008. The primary objective of this programme was to provide guaranteed employment for at least 100 days to all those who are willing to do unskilled manual labour and come from rural households, which should ideally result in the creation of durable and quality assets. Further, its other core objectives included strengthening the rural livelihood resource base, ensuring social inclusion and deepening democracy at the grassroots level through the functioning of Panchayati Raj institutions. Another thing to consider about this programme is that it has been conceptualized as a demand-driven programme, wherein the transfer of resources under this programme from the GoI to the states is based on the demand for employment in each state. Over time there has been an overall increase in the GoI budget allocations from FY 14 to FY 21, but there has been a decrease ever since (Figure 2.30).

MGNREGA provides employment opportunities to the farmers. These are decoupled support and are neutral or potentially beneficial with respect to their impact on biodiversity as roughly 66 percent of the expenditure is going to agriculture related activities (plantation, rain water harvesting, etc.) that are potential biodiversity beneficial activities.

Figure 2.30: Trend in rural employment expenditure

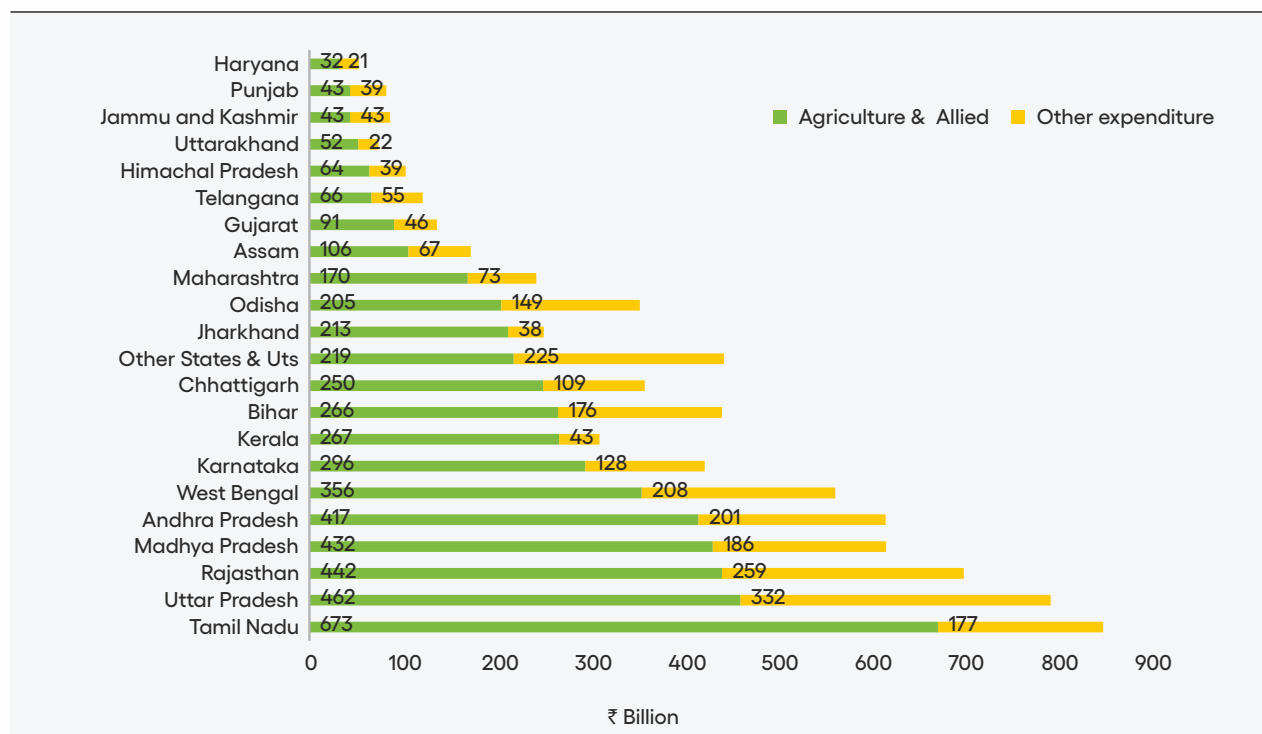


Source: MoF

GoI bears 100 percent cost of unskilled manual workers and 75 percent of the cost of material, wages of skilled and semiskilled workers. State government bears 25 percent of the cost of material, wages of skilled and semi-skilled workers. Since

inception, the central government has incurred an expenditure of ₹7801 bn. Out of this, ₹5,166 bn (66.2 percent) has been incurred on agriculture and allied works (MoRD, 2023). Highest expenditure has been observed in TN, followed by UP and WB.

Figure 2.31: Expenditure in MGNREGA since inception in agriculture and allied works



Source: MoRD, 2024

2.3 The magnitude and scale of AFBS for agriculture sector development

2.3.1 Agriculture research and extension

Agricultural growth is critical for sustainable and inclusive economic growth in India, as the vast majority of the workforce (46.1 percent in 2023-24, PLFS) depends on the agricultural sector for their livelihood. The government has made substantial investments in developing research capabilities within the Department of Agriculture Research and Education (DARE) which was established in 1973 under the MoAFW. India boasts one of the most expansive National Agricultural Research Systems globally, including 102 Indian Council of Agricultural Research (ICAR) institutes, 11 institutes for Agricultural Technology Application Research, 82 projects/networks coordinated

nationwide, 4 institutions recognized as Deemed Universities, 3 Central Agricultural Universities, and 63 State Universities dedicated to Agricultural, Veterinary, Horticultural, and Fishery disciplines across various states. In this regard, India has one of the world's largest and most well-coordinated agricultural research systems.

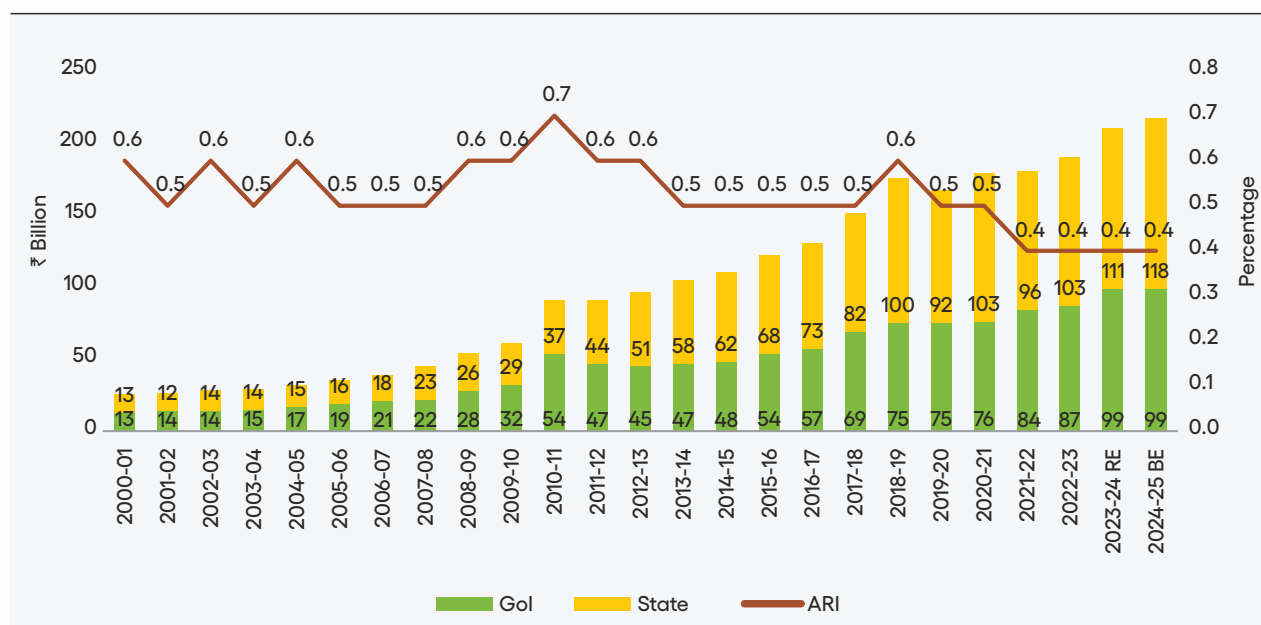
The Indian agricultural research, development, education, and extension (ARDE) system has undergone significant evolution over time, with remarkable growth in organizational capacity since India gained independence. R&D funding comes from various sources with the majority coming

from public⁵ expenditure (accounting for 89 percent in 2020-21) and the remaining 11 percent coming from private⁶ expenditure (Thangaraj and Gulati, 2024a). Public funding for agricultural R&D has increased six-fold in real terms since the early 1980s (Pal, 2017).

The expenditure of DARE has seen an increasing trend from ₹13 bn (US\$ 0.3 bn) in FY01 to ₹99 bn (US\$ 1.2 bn) in FY25 (BE) (Figure 2.32). The share of the centre and state in the expenditure has averaged 50 percent, respectively. While these numbers give an idea of the scale, it is important to

consider the percentage relative to AGVA, estimated as Agriculture Research Intensity (ARI), a crucial indicator of research commitment relative to the agricultural sector's size. The ARI has decreased from 0.6 percent to 0.4 percent between FY01 and FY25 BE, with a peak of 0.7 percent in FY11. The Committee on Agriculture (2014) has recommended a significant increase in research funding to "1 percent of the AGVA" to improve the effectiveness and efficiency of agricultural research in India. There is a need to increase the expenditures in order to meet the recommended 1 percent, from the current 0.4 percent.

Figure 2.32: Agriculture R&D and its research intensity



Source: Gulati and Thangaraj, 2023; MoF, RBI 2024

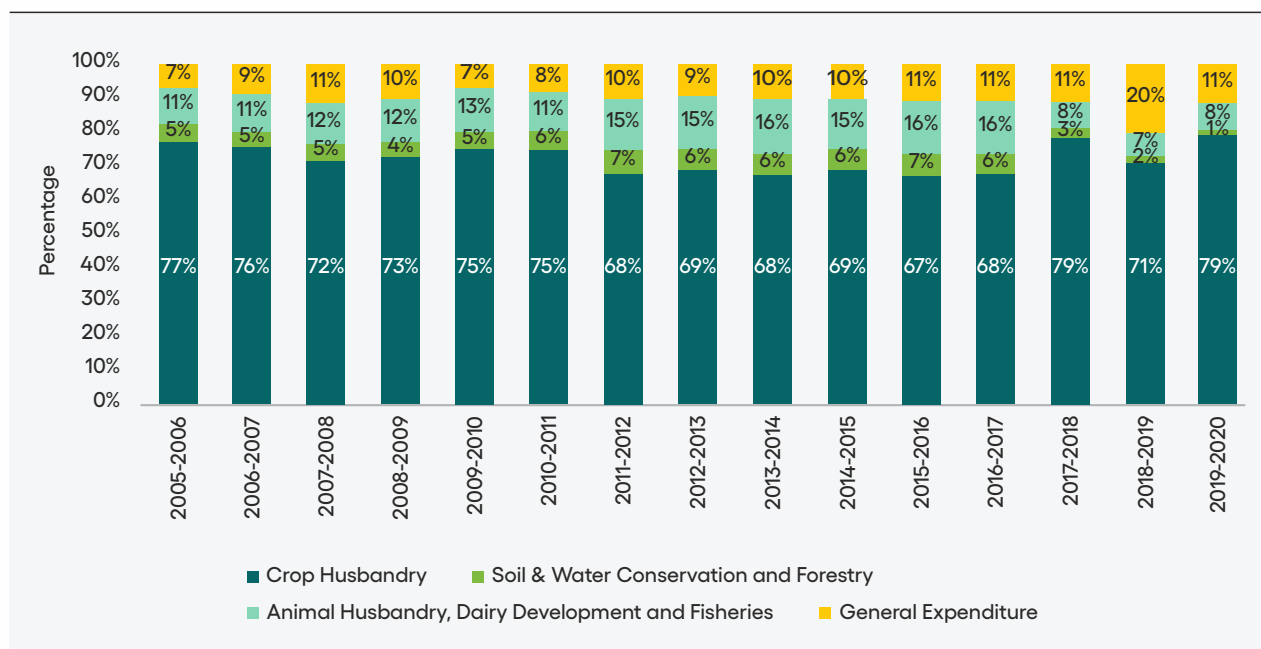
⁵ Public Sector includes Central Government Ministries/Department, Public Sector/Joint sector industries, State Government and Higher Education.

⁶ Private sector R&D reporting by DST is survey-based, which includes Private sector and Scientific & Industrial Research Organisations (SIRO).

Research is primarily structured around agencies under the ICAR umbrella at the union level and within agricultural universities at the state level. However, currently, India's gross expenditure on research and development (GERD) is the lowest among the largest economies. The government sector plays a significantly larger role in India's total GERD compared to the average of other major economies, with its contribution being three times higher (Economic Survey, 2021). This support is extended through various forms of financial assistance. The field of research is classified into the following 8 divisions namely, (i) Crop Science, (ii) Horticulture Science, (iii) Natural Resource Management, (iv) Animal Science, (v) Agricultural Engineering, (vi) Fisheries Science, (vii) Agricultural Education, and (viii) Agricultural Extension.

Upon examining the distribution of expenditure on ARDE across sectors, it becomes apparent that there is an imbalanced allocation. The majority of the funding is skewed towards the crop husbandry sector, with its relative share slightly increasing from 75 percent to 76 percent between TE 2008 and TE 2020. In contrast, the shares for soil conservation, water conservation, and forestry sectors have declined from 5 percent to 2 percent. Similarly, the shares for animal husbandry, dairy development, and fisheries sectors have decreased from 11 percent to 8 percent, despite the substantial increase in the value of livestock in the overall agricultural produce. This disparity requires immediate rectification, particularly considering that the livestock sector is responsible for a significant portion (54 percent) of GHG emissions within the agriculture sector (Gulati and Thangaraj, 2023) (Figure 2.33).

Figure 2.33: Sector-wise ARDE allocations of Gol and state governments



Source: Gulati and Thangaraj, 2023 (Data from CAG)

To facilitate our understanding, we have categorized Natural Resource Management (NRM) institutes into five distinct groups: dryland agriculture/arid zone, soil salinity/soil science/soil survey & land use planning, soil and water conservation/water management, farming system research/integrated farming research, and agroforestry. During the period from 1997-98 to FY18, expenditure in dryland agriculture/arid zone research within the total NRM expenditure escalated from 17 percent to 27 percent, marking the most substantial surge within the sub-sectors over two decades. Following closely was the

increase in ARDE expenditures for soil salinity/soil science/soil survey & land use planning research, which rose from 17 percent to 21 percent. Moreover, farming system research/integrated farming research experienced an elevation from 3 percent to 8 percent within the overall NRM ARDE expenditures between 1997-98 and 2017-18. It is worth noting that agroforestry also observed a rise in its relative portion within NRM, albeit from a modest 2 percent to 3 percent. Interestingly, soil and water conservation/water management research saw a reduction in its proportional stake, declining from 14 percent in 1997-98 to 12 percent in FY18.



Box 2.3

Climate resilient varieties

Since 1969, the National Agricultural Research System (NARS) under the aegis of the ICAR has developed over 7,200 high-yielding varieties of field and horticultural crops to address climate change-related challenges, including droughts. Between 2014 and 2023, NARS released 2,681 high-yielding and stress-tolerant varieties/hybrids, comprising 2,279 field crop varieties and 402 horticultural crop varieties, tailored for different agro-climatic conditions. Of these, 1,971 field crop varieties are climate-resilient, exhibiting tolerance to biotic and abiotic stresses. These include cereals (913), oilseeds (335), pulses (364), forage crops (106), fibre crops (189), sugarcane (54), and potential (underutilized) crops (10). Specifically, 429 field crop varieties demonstrate high tolerance to extreme abiotic stresses such as drought/moisture stress (240), waterlogging/submergence (72), salinity/alkalinity/sodic soils (58), heat stress (42), and cold/frost (17). Additionally, 487 horticultural crop varieties have been released, including 22 climate-resilient varieties tolerant to high temperatures (6 varieties: 2 each of potato and tomato, 1 each of spinach and radish), drought (12 varieties: 4 of cassava, 3 of coconut, 2 of taro, and 1 each of greater yam, white yam, and sweet potato), water use efficiency (3 potato varieties), and salinity (1 cassava variety). Furthermore, 407 varieties were specifically bred using precision phenotyping tools to withstand extreme climatic conditions, including flood/water submergence/waterlogging tolerance (73), drought/moisture stress/water stress tolerance (220), salinity/alkalinity/sodic soils tolerance (52), heat stress/high temperature tolerance (49), and cold/frost/winter chilling tolerance (13).

Since 2014 to 2024, a total of 668 varieties of rice (paddy) have been developed, out of which 199 varieties are extreme climate resilient, which can withstand extreme weather conditions, the details of which are as follows: 103 rice varieties are drought and water stress tolerant; 50 rice varieties are flood/ deep water/ submergence tolerant; 34 rice varieties are salinity/ alkalinity/ sodicity tolerant; 6 rice varieties are heat stress tolerant and 6 varieties are cold tolerant. Further, out of 668 varieties of rice developed, 579 varieties are tolerant to pests and diseases.

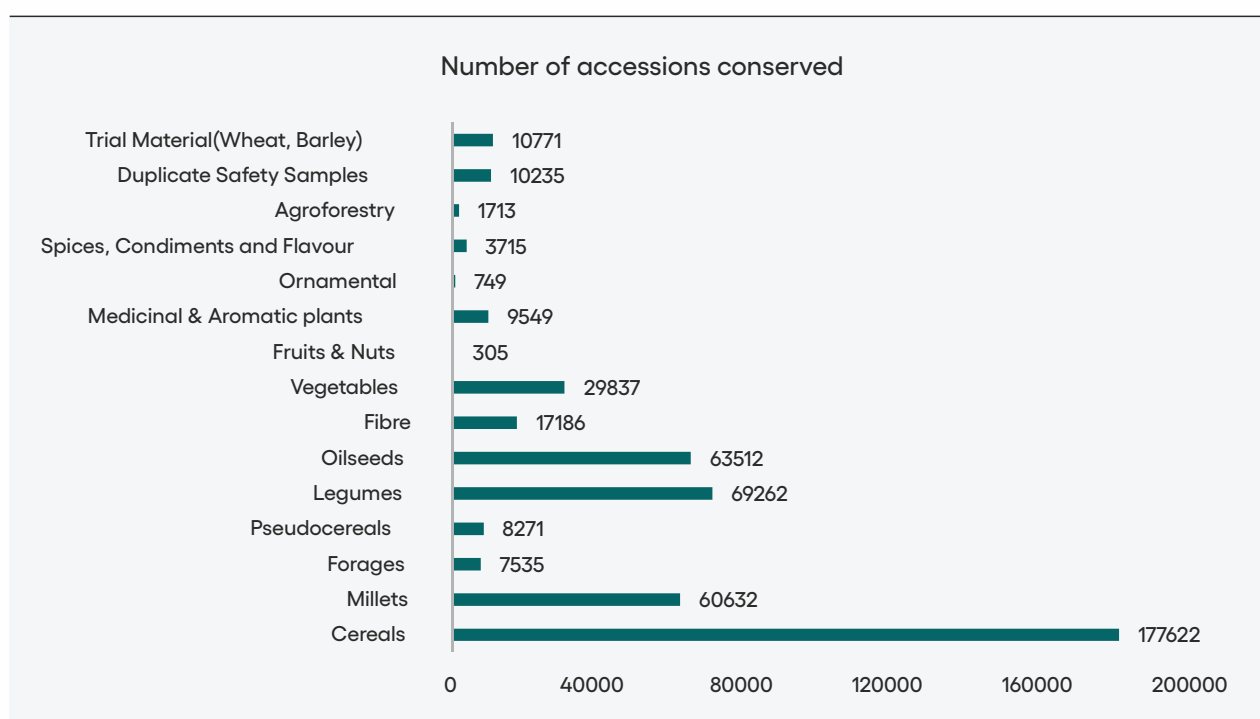
Source: MoAFW 2023, PIB 2024a

Conservation efforts

The proper conservation and use of agrobiodiversity is fundamental to food security. Realizing the importance of germplasm, systematic collection and conservation of germplasm is being carried out by National Bureaus. As on 1st January, 2025, National Bureau of Plant Genetic Resources (NBPGR) holds a total of 4,70,894 accessions (seed

genebank, -18°C) of major crops/crop groups (Figure 2.34). 25.2 percent (1,18,534 accessions) are of paddy, which indicates higher diversity of paddy germplasm (from different states) in the country. In addition, it maintains an in vitro genebank (25°C) of different fruits, tuber crops, and other crop groups totalling 2,044 numbers and a cryogenebank (-196°C) holding total collection of 15,248 (Figure 2.35).

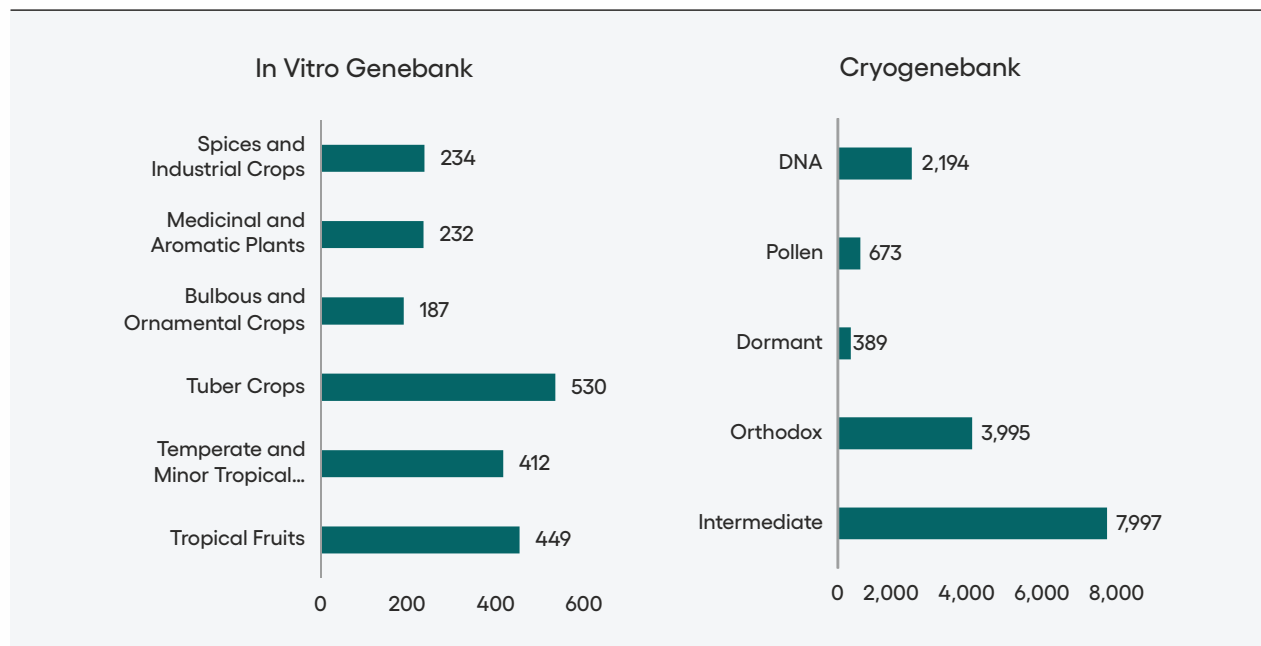
Figure 2.34: Status of base collections in national gene bank (-18°C)



Source: NBPGR (as of 1st January 2025)



Figure 2.35: Status of in vitro genebank (25°C) and cryogenebank (-196°C)

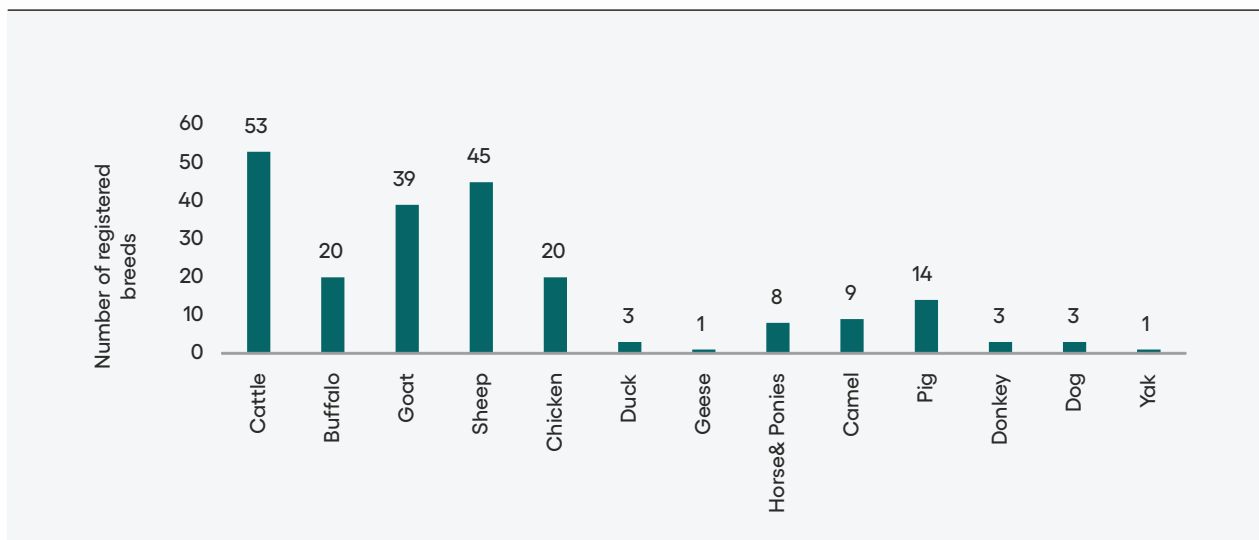


Source: NBPGR (as of 1st January 2025)

National Bureau of Animal Genetic Resources (NBAGR) has registered 212 indigenous breeds (Figure 2.36) and maintains semen of many animal breeds (Table 2.2). The National Bureau of Agricultural Insect Resources (NBAIR) maintains (ex-situ conservation) 136 live insects (107 parasitoids, 15 predators, 13 pest insects and one detritivore). These insects are being mass-multiplied and supplied to different stakeholders throughout the year. It is one of the largest live insect repositories in Asia. The Bureau is also known for rich repository of entomopathogenic

organisms such as *Bacillus thuringiensis* (304), *Pseudomonas* spp. (28), *Trichoderma* spp. (24), *Paecilomyces lilacinus* (6), *Beauveria bassiana* (64), *Metarhizium anisopliae* (33), entomopathogenic nematodes (124), baculoviruses (8) and others including culturable gut bacteria (135). NBAIR also conserves (in situ) 33 different species of bees (*Apis* and non-*Apis* groups) round the year using pollen/nectar rich plants in pollinator garden located at NBAIR farm campus, Yelahanka. Five species of Megachilid bees are being conserved by providing trap nests.

Figure 2.36: Registered indigenous breeds of animals



Source: NBAGR (as of 1st January 2025)

Table 2.2: Cryopreserved semen

Breeds For Which Semen Is Cryopreserved in National Livestock Gene Bank	
Species	Breeds
Cattle 	Amritmahal, Dangi, Gangatiri, Gir, Hallikar, Haryana, Kangayam, Kankrej, Kherigarh, Khillar, Krishna Valley, Ongole, Ponwar, Punganur, Rathi, Red Kandhari, Red Sindhi, Sahiwal, Tharparkar, Vechur, Frieswal, Gaolao, Bargur, Nagori, Badri, Nimari, Deoni, Binjarpuri, Ghumsari, Khariar, Malnaad Gidda
Buffalo 	Assamese Swamp, Banni, Bhadawari, Jaffarabadi, Murrah, Nilli-Ravi, Pandharpuri, Surti, Tarai, Mehsana, Toda, Nagpuri
Goat 	Black Bengal, Chegu, Osmanabadi, Assam Hill, Gaddi, Ganjam, Jamnapari, Berari, Beetal, Sirohi, Sangamneri, Barbari
Sheep 	Garole
Camel 	Jaiselmeri
Equine 	Marwari, Zanskari, Poitou, Manipuri, Hallari
Yak 	Arunachali

Source: NBAGR (as of 1st January 2025)

2.3.2 Other development schemes



Box 2.4

Irrigation projects and schemes

Irrigation enables farmers to maintain a regular crop-growing schedule, leading to more dependable food supplies. However, modern irrigated agricultural development impacts on the biodiversity are through changes in landscape ecology, as pre-existing natural resource areas (be they desert, grassland or forest) needs to be modified so that water is provided to crops and livestock. Both qualitative and quantitative changes such as infrastructure development (dams, reservoirs, canals, drainage ditches), human settlement, crops, livestock, agrochemicals, and mechanization are manifested in this process. This may lead to biodiversity loss/change (including wildlife and fishery resources, change in cropping pattern due to availability of water); proliferation of invertebrate and vertebrate pests and disease carriers; soil erosion; soil fertility; sedimentation; surface water hydrology (quantity, quality); ground water hydrology (level, quantity, quality); seepage; waterlogging; and eutrophication (Amerasinghe and Boelee, 2004). Irrigation support, thus has mixed impacts on biodiversity.

Schemes related to agricultural sustainability

Krishionnati Yojana is the umbrella scheme in the agriculture sector that has been implemented since FY17 by conglomerating several schemes/missions and aims to develop the agriculture and allied sector in a holistic and scientific manner to increase the income of farmers by enhancing production, productivity, and better returns on produce. The schemes focus on creating or strengthening infrastructure of production, reducing production cost and marketing of agriculture and allied produce. The subsidies component of these schemes are included under the input subsidy section and the other expenditure in these schemes are included under the developmental activities. The missions/sub-schemes covered are (PIB, 2024c):

MIDH: MIDH consists of five schemes – National Horticulture Mission, Horticulture Mission for North-East and Himalayas, National Horticulture

Board, Coconut Development Board, Central Institute of Horticulture.

NFSM: This mission was launched in 2007-08 to increase the productivity of rice, wheat, and pulses.

Sub-Mission on Agriculture Extension (SAME): This mission is being implemented with the objective of restructuring and strengthening the agriculture extension.

SMSP: With an objective to enhance the seed sector, this mission is under implementation to enhance production and multiplication of high-quality seeds of all agricultural crops and make it available to farmers at affordable prices.

SMAM: It aims to increase the reach of agricultural mechanization to small and marginal farmers and to promote 'Custom Hiring Centres' where the power availability is low.

Integrated Scheme on Agriculture Census, Economics and Statistics (ISACES): This component provides financial assistance for payment of salaries, office expenses etc. for agriculture census that is conducted after every five years.

Integrated Scheme on Agriculture Cooperation (ISAC): This provides financial assistance for improving economic conditions of the cooperatives.

Integrated Scheme of Agriculture Marketing (ISAM): This scheme aims to develop agriculture marketing infrastructure and to promote latest technologies.

National Mission on Oil Seeds and Palm (NMOOP): This scheme was launched to increase the area of oil seeds and palm.

National Mission on Sustainable Agriculture (NMSA): NMSA is one of the eight Missions outlined under National Action Plan on Climate Change (NAPCC). This mission was formulated for enhancing agricultural productivity especially in rainfed areas focusing on integrated farming, water use efficiency, soil health management and synergizing resource conservation.

Sub-Mission on Plant Protection and Plant Quarantine (SMPPQ): This mission was launched with the aim of minimizing loss to quality and yield of agricultural crops from the ravages of insect pests, diseases, weeds, nematodes, rodents etc. and to shield our bio-security from the incursion and spread of alien species.

National e-Governance plan in Agriculture (NeGP-A): NeGP-A was launched to use Information and Communication Technology (ICT) for timely access to agriculture related information to farmers.

Few objectives of the sustainability related schemes encourage mechanization and promotion of HYVs that may not favour biodiversity. In this report, we have considered this support as biodiversity neutral. As the next step, the evidences will be gathered to further screen them for their potential adverse impact on biodiversity.

Schemes related to Livestock Sector

There are few schemes of Department of Animal Husbandry and Dairying (DAHD) that were launched for the development of the animal husbandry sector:

National Programme for Dairy Development (NPDD)

DAHD is implementing the Central Sector Scheme of the National Programme for Dairy Development

(NPDD) to enhance milk and milk product quality, procurement, processing, value addition, and marketing. This scheme has resulted in the creation or revival of 19,010 dairy cooperative societies, added 1.8 mn new farmer members to these societies, and increased milk processing capacity by 2.8 mn litres per day (PIB, 2024d). So far, 35 projects have been approved with a total outlay of ₹13.4 bn. Under the Dairy Processing and

Infrastructure Development Fund (DIDF), 37 projects from 12 states have been sanctioned with a total project cost of ₹67.8 bn, resulting in a milk processing capacity of 7.4 mn litres per day.

Livestock Health and Disease Control Programme (LHDCP)

The scheme aims to combat livestock diseases and improve veterinary healthcare infrastructure, enhancing livestock productivity and farmers' incomes, especially those dependent on livestock for their livelihood.

National Animal Disease Control Programme (NADCP)

The scheme was launched in 2019, is the largest of its kind globally and aims to eradicate Foot and Mouth Disease (FMD) and Brucellosis by 2030. So far, over 997 mn vaccinations against FMD in cattle and buffaloes have benefited 71.8 mn farmers. Vaccination campaigns for other diseases, such as Peste des Petits Ruminants (PPR) and Classical Swine Fever (CSF), have also made significant progress with millions of vaccinations completed (PIB, 2024d). In 2024, FMD vaccination coverage was expanded to include pastoral sheep and goats.



Box 2.5

Animal genetic resources

Animal husbandry in India is dominated by cattle, buffalo, sheep, goat and pig. Although the livestock sector's contribution to AGVA is increasing and is growing at 12.99 percent CAGR since 2014, the sector is the largest contributor of GHG emissions from agriculture and allied sectors. The key sources of GHG emissions from livestock sector are: (i) Enteric Fermentation; resulting in emissions of methane arises out of the process of ingesting and digesting of food eaten by herbivores, primarily bovines. India has the world largest bovine population (303.76 mn), and is predominantly responsible for 54.6 percent of country's agriculture emission that comes from enteric fermentation. (ii) Manure Management; resulting in methane and nitrous oxide emissions from animal manure arise from the process of its decomposition and contribute to 6.68 percent of the country's total agriculture emissions. As per the livestock breed survey (AHS, 2023), 19 species (184 breeds) of livestock are domesticated in India with:

- 38 indigenous, 3 cross-breed and 2 exotic breeds of cattle
- 13 indigenous breeds of buffalo
- 18 indigenous breeds of fowl
- 3 cross-bred and 42 indigenous breeds of sheep
- 28 indigenous breeds of goat
- 7 indigenous & 6 exotic breeds of pigs

However, only few breeds comprise the dominant market share. In cattle, 52 percent are non-descript and two exotic breeds (Jersey and Holstein) comprise 27 percent of the population, and remaining 22 percent from indigenous breeds (majorly from Gir, Lakshmi and Sahiwal). Exotic and cross-bred cattle emit more GHG and detrimentally impact target 8. In buffalo, only Murrah comprises 43 percent of the population and 45 percent of the buffalo are non-descript.

Schemes related to Land-Use and Land-Use Change and Forestry Sector (LULUCF)

The LULUCF sector is the only sector that consistently absorbs CO₂ in the country, making it one of the most relevant for its mitigation potential. This sector removed 15 percent of the country's carbon dioxide emissions in 2016 (MoEFCC, 2021). In its Nationally Determined Contribution (NDC), India has committed to create an additional carbon sink of 2.5 to 3 billion tonne of CO₂ eq through additional forest and tree covers by 2030. The country's total forest and tree cover is 82.74 mha, which is 25.17 percent of the geographical area (ISFR, 2023). Indian Forest Act 1927, Wildlife Protection Act 1972, National Forest Policy 1988, Forest Conservation Act 1980, and various

afforestation schemes are providing enabling conditions for achieving sustained growth of forestry in the country. Afforestation is taken up under various government schemes, viz. National Afforestation Programme, Green India Mission and Compensatory Afforestation Fund Management and Planning Authority (CAMPA) (MoEFCC), National Bamboo Mission and Integrated Development of Horticulture (MoAFW), MGNREGA and Integrated Water Management Programme (MoRD), etc. With gradual increase in forest and tree cover, carbon stocks in the forests are also increasing steadily (**Table 2.3**).

Table 2.3: Trends in carbon stock in forest and tree cover

Year	Forest Cover (mha)	Forest Carbon in Forest Cover (MT)	Tree Cover (mha)	Carbon in Tree Cover (MT)	Forest Carbon from Forest & Tree Cover (MT)	Forest Carbon from Forest & Tree Cover CO ₂ eq (BT)
2004	67.71	6,663	9.17	958	7,621	27.97
2013	69.79	6,941	9.13	953	7,894	28.97
2015	70.15	7,044	9.26	967	8,011	29.40
2017	70.83	7,083	9.38	980	8,063	29.59
2019	71.22	7,125	9.50	NA	NA	NA
2021	71.37	7,204	9.57	NA	NA	NA
2023	71.53	7,285	11.82	NA	NA	30.43

Source: ISFR (Various years), FSI



Box 2.6

India's NDC target for forestry sector

India's NDC makes a commitment to create an additional carbon sink of 2.5 to 3 billion tonnes of CO₂ equivalent through additional forest and tree cover by 2030. Forest Survey of India (FSI) has been assessing the carbon stock of India's forests on a regular basis. With the latest assessment (2023), the country has achieved an additional carbon sink of 2.29 billion tonnes with respect to 2005 as 'Base Year' in forest and tree cover.

Source: ISFR 2023, FSI Technical Information Series Volume 1 No.3

2.4 Categorization of AFBS

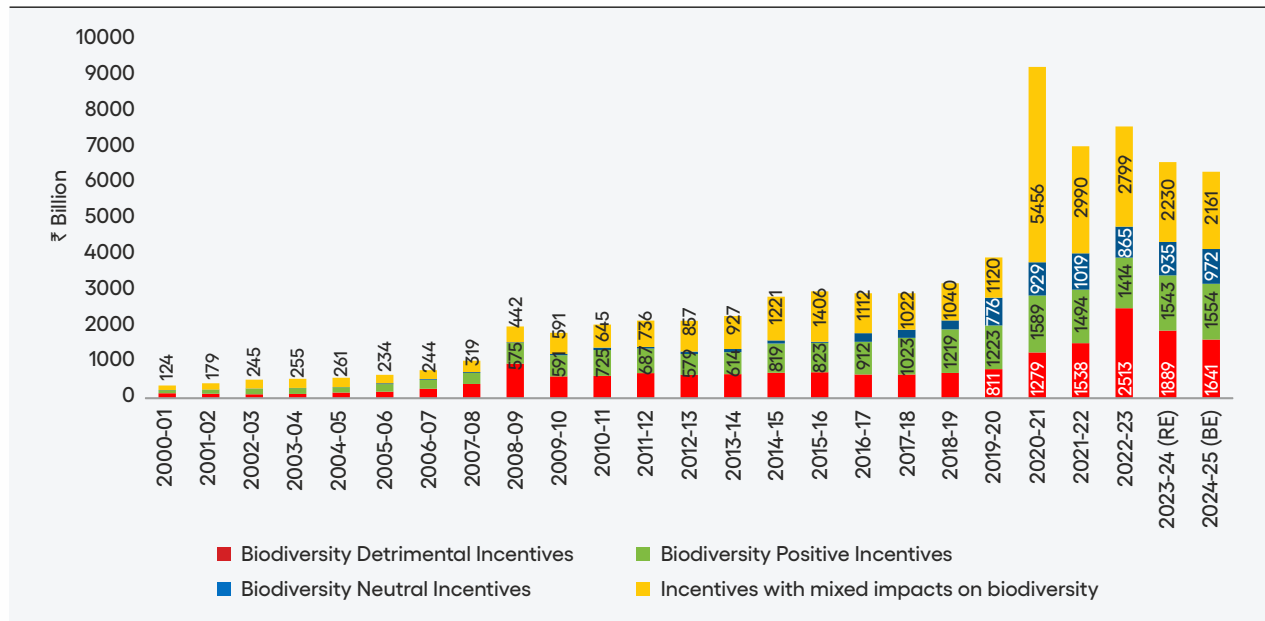
Analysis of policies and subsidies related to agrifood sector revealed that the need for evaluation of potential detrimental impacts of agriculture on biodiversity is not prioritized in strategic documents adopted for agricultural sector. Main findings of qualitative and quantitative analysis of potential adverse impacts on biodiversity resultant from implementation of ongoing and planned agricultural subsidies and incentives can be summarized as follows:

During TE 2024, total of ₹7076 bn (US\$ 90 bn) (**Figure 3.37**) was spent on agrifood support administered by various ministries and departments. Of this total support, ₹1,980 bn (US\$ 25 bn) can detrimentally impact the targets of NBSAP. This support primarily comprises of fertiliser subsidy. ₹1,483 bn (US\$ 19 bn) support is positive with respect to biodiversity. This includes

the schemes related to sustainable agriculture development of agriculture like PKVY, natural farming, KY, RKVY, agriculture research and extension, PM-KSY, Rashtriya Gokul Mission etc. The schemes related to income support such as PM-KISAN, credit subsidies, PM-KMY, crop insurance are neutral with respect to biodiversity outcomes and comprise of ₹940 bn (US\$ 12 bn). Food subsidies and irrigation expenditures comprise the highest share with allocation of ₹2,673 bn and have mixed impacts on biodiversity outcomes.

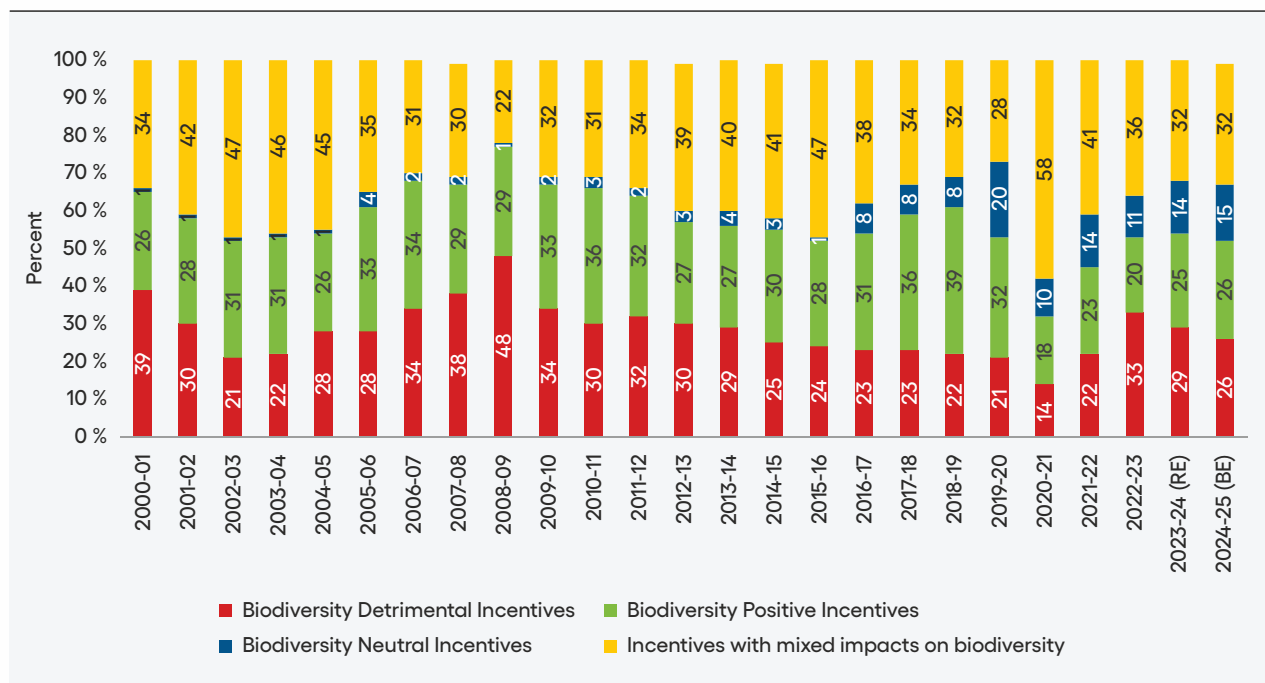
As a percentage share, biodiversity detrimental incentives comprise 28 percent share, whereas biodiversity positive incentives have a share of 21 percent during TE 2024. Biodiversity neutral incentive comprise 13 percent share and 38 percent of the AFBS is going for agri-practices and schemes that have both positive as well as detrimental impact (**Figure 3.38**).

Figure 2.37: Categorization of AFBS



Source: Author's compilation based on MoF

Figure 2.38: Categorization of AFBS (percentage share)



Source: Author's compilation based on MoF

Repurposing of fertiliser subsidy need to be considered. For example, in Union Budget FY24, PM-PRANAM was launched. Under this scheme, 50 percent of the fertiliser subsidy saved by a State/UT by way of reduction in chemical fertilisers consumption (Urea, DAP, NPK, MOP) compared to previous 3 years' average consumption, will be

provided to State/UT as Grant for the benefit of people in the state, including farmers. The scheme as of date has no takers. Additionally, the subsidies on fertilisers, which are currently skewed towards urea, should be rationalized to have parity in nutrient pricing to promote balanced fertiliser use.



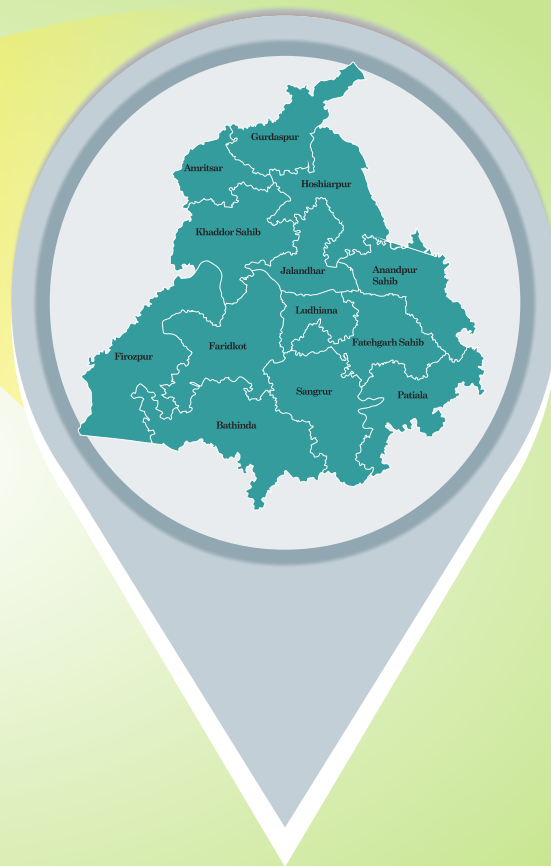
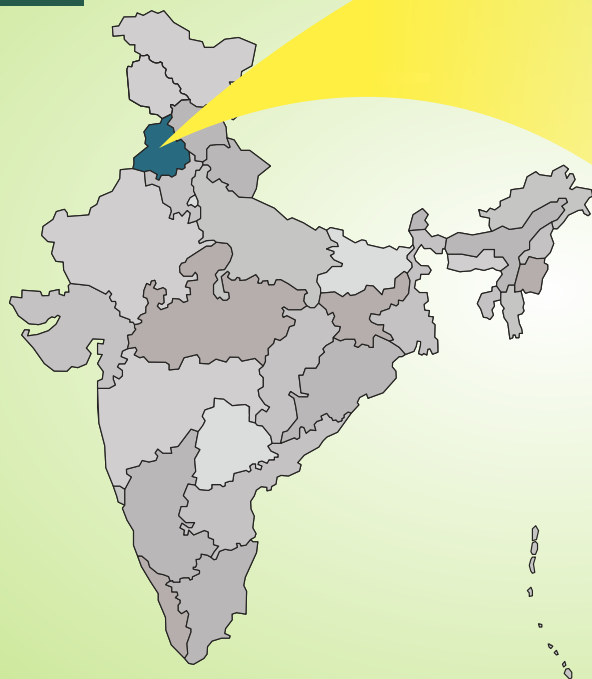
PM-PRANAM

Box 2.7

On June 28, 2023, GoI launched the PM Programme for Restoration, Awareness, Nourishment, and Amelioration of Mother Earth (PM-PRANAM). This initiative represents a significant shift towards agricultural practices that prioritize soil health to ensure the country's long-term food security. PM-PRANAM addresses concerns about the use of chemical fertilisers and pesticides, which, while boosting crop yields, have detrimentally impacted soil quality over time. The programme encourages states to adopt a balanced approach to fertiliser use and promote sustainable farming methods. A key feature of the initiative is a reward system: states that reduce their chemical fertiliser usage compared to the previous three-year average, will receive 50 percent of the saved subsidies. These funds can then be invested in sustainable land management practices, ultimately benefiting agricultural activities and overall development in those states.

The calculation of fertiliser subsidy savings will be based on data entered into the Integrated Fertiliser Management System (iFMS) portal during the financial year, along with the subsidy rates of the assessment year. The Department of Expenditure will manage the disbursement of grants through existing schemes. The proposed budget for this initiative will be drawn from existing fertiliser subsidy schemes, creating a self-sustaining cycle. Of the total grant, 95 percent will be allocated to the respective state, with 65 percent designated for capital expenditure projects. The remaining 30 percent will be untied funds for states to use on Information, Education, and Communication (IEC) activities to promote soil health and the use of alternative fertilisers. The Government of India will manage the remaining 5 percent of the grant, directing it towards monitoring, IEC initiatives, research, capacity building, and recognition programmes.

Additionally, because the responsibility for making the scheme successful predominantly lies with the State Governments, it is essential to plan strategic capacity-building initiatives. These initiatives are necessary to encourage farmers to adopt alternative fertilisers and natural farming practices, thereby facilitating the desired behavioural change.



Punjab Agrifood budget

Support by Gol and GoP

Punjab, often referred to as the "Breadbasket of India," plays a crucial role in the nation's agriculture, contributing significantly to its food security. However, the state has become very vulnerable due to high level of dependence on ground water (71 percent) for irrigation, monocropping, intensive fertilization and increasing GHG emissions. The paddy-wheat rotation, where paddy is grown in the summer (kharif) and wheat in the winter (rabi), has become the predominant cropping system in Punjab. The chapter explores the linkages between agrifood incentives and increasing monocropping in the state. The chapter also provides a way forward plan for crop diversification.



The pioneering role of Punjab in Indian agriculture is well established. With the introduction of input-intensive 'green revolution' technology, the state led the Indian agriculture scene during 1970s and 1980s with increased wheat and rice productivity, farm incomes, and poverty decline. Punjab today produces 10 percent of the country's rice and 16-20 percent of its wheat; and 90 percent of rice and wheat in Punjab are procured by GoI at MSP. The state has paid huge environmental cost for the country's food security.

The state's vulnerability emerges from a high level of dependence on ground water (71 percent) for irrigation, monocropping of wheat-rice system by most farmers of the state and is compounded by increased frequency of heat waves and variable monsoon precipitation. Further, the sustainability challenges are far-fetched to recede since the current system of agrifood incentives, primarily comprising of input (fertiliser, power and irrigation subsidies) and output (offering to procure produce at MSP) subsidies, encourages farmers to follow the

same unsustainable, resource and GHG intensive agriculture practices and crops that they have been continuing for many years (Singh et al., 2024).

Eliminating or reducing such support may be desirable for improving the financial status of GoI and government of Punjab (GoP), improving the efficiency of the electricity supply, water use, fertiliser use and improving the biodiversity. But it may render the farming sector more vulnerable and reduce food production. This poses the difficult question for the GoI and GoP, whether and how they should work towards rationalizing the subsidized-power, fertiliser, and food policies. The repurposing of fiscal support in agriculture, however beneficial it may be, is a major policy challenge and would encompass a well deliberated process where both the state and farmers gain while reducing the consumption of electricity, fertiliser, and ground water along with food and nutritional security. This chapter proposes a win-win situation by taking a broader approach to the problem.

3.1 Overview of Punjab

Punjab state is located in the north-west of India. It extends from 29.30° North to 32.32° North latitudes and 73.55° East to 76.50° East longitudes and is bordered by Jammu and Kashmir to the north, Haryana to the south and southeast, Rajasthan to the southwest and Himachal Pradesh to the northeast. It shares international border with Pakistan country; and is divided into 23 districts with a geographical area of 50,362 sq. km (GoP, 2020).

The per capita income of Punjab (at current prices) stands at ₹2,27,950 (US\$ 2760) in FY24, which is higher than ₹211,725 (US\$ 2563) at national level. Economic growth in the state has been moderating over the past few years. Since FY14, growth rate (overall as well as agriculture growth) in Punjab was slower than the national average. Average annual growth rate (AAGR) in GSDP of Punjab is 6 percent (from FY06 to FY24) as compared to 6.3 percent of all India level. The average agriculture growth in GDP at All India level is 3.7 percent against 2 percent in Punjab during the same period.

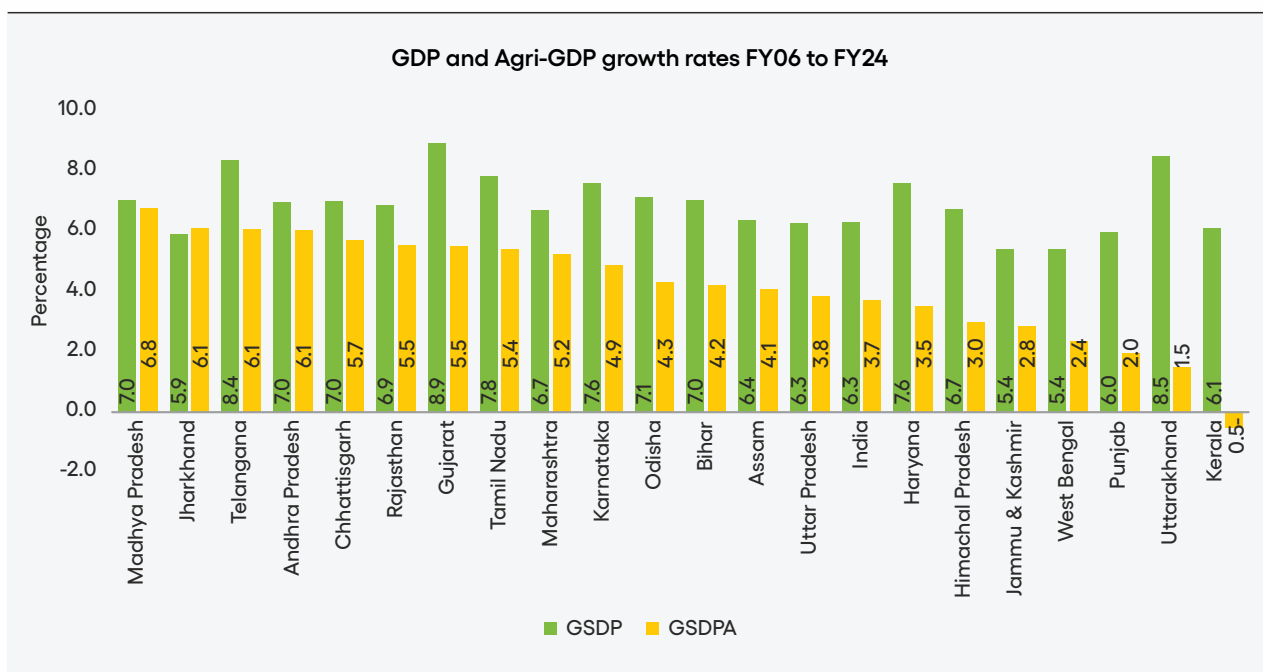
3.2 Overview of agriculture and allied sector of Punjab

Approximately 82 percent (4.13 mha) of the total geographical area of Punjab is agricultural land. Agriculture sector contributed 23 percent (at current prices) and 20 percent (at constant prices) of the state's GDP in FY24. The sector employs 27 percent of its population. Punjab accounts for 2.9 percent of India's net sown area and only 1.53 percent of the total geographical area, yet produces 13.9 percent (14.82 MMT) of the country's wheat (2021-22), 9.9 percent (12.89 MMT) of country's rice (2021-22), 2 percent cotton (0.65 million bales) (2021-22) and 6.4 percent (13.39 MMT) (2020-21) of the country's milk. Punjab contributed 51.3

percent of wheat and 25.5 percent of rice to the central pool during 2022-23. Punjab has highest rice productivity (4,340 kg/ha, All-India: 2,809 kg/ha) and second highest wheat productivity (4,206 kg/ha, All-India: 3,507 kg/ha) after Haryana (4,533 kg/ha) in the country.

Punjab agriculture witnessed AAGR of 5.7 percent during 1971-72 to 1985-86, almost 2.5 times of growth achieved at all India level. However, growth rate started declining in the state. During FY06 to FY24, it was 2 percent, less than half of all-India agriculture growth rate (3.7 percent) (Figure 3.1).

Figure 3.1: Average annual growth rate of agriculture in Punjab and All-India

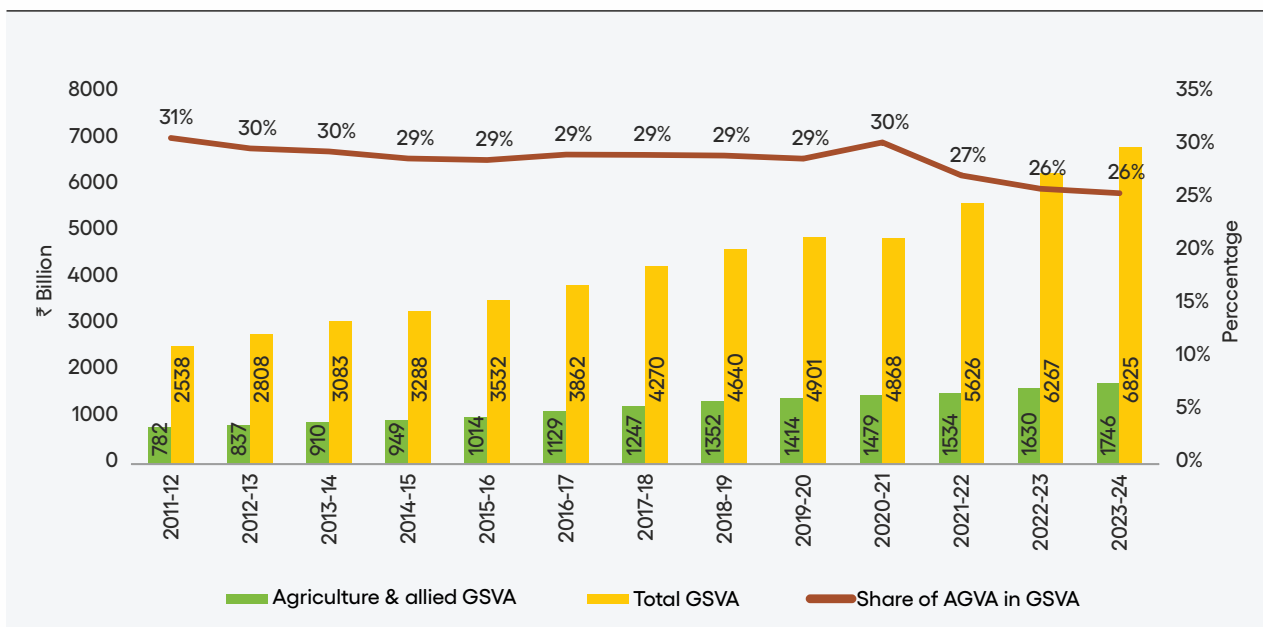


Source: MoSPI, 2024b

The Gross State Value Added (GSVA) share of agriculture and allied sector in Punjab is declining (**Figure 3.2**). The contribution of agriculture to Punjab's GDP was 31 percent in FY12, which

dropped to 26 percent in FY24 (MoSPI, 2024b). The percentage share of agriculture workforce has marginally increased from 26 percent (FY18) to 27 percent (FY24) (PLFS, 2023-24).

Figure 3.2: GSVA and percentage share of agriculture & allied sector in Punjab

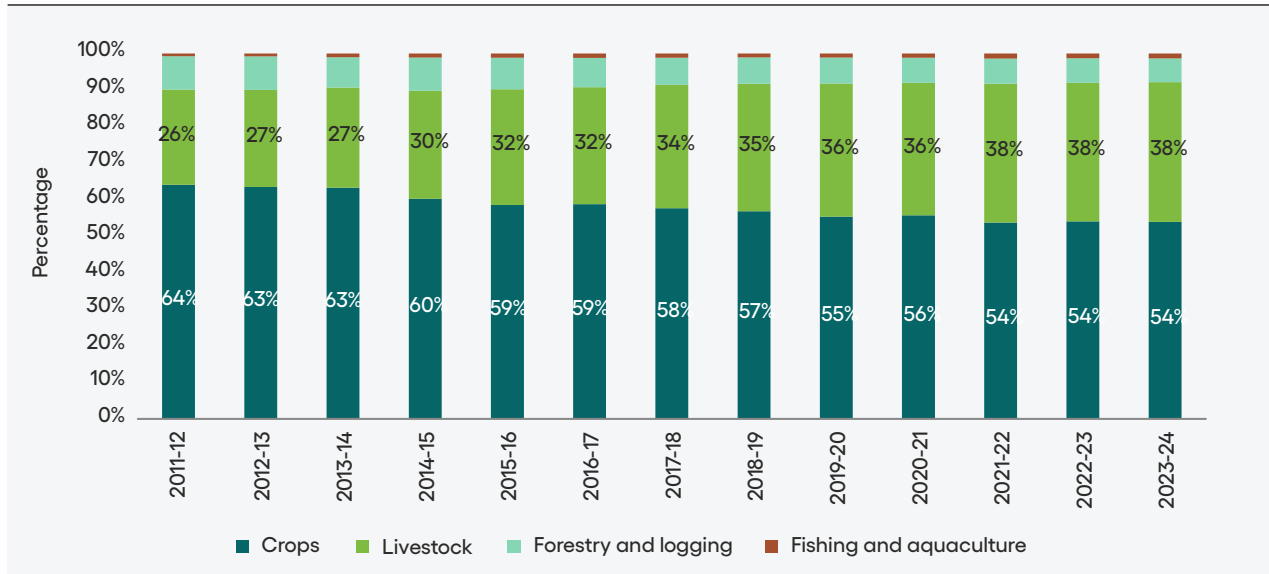


Source: MoSPI, 2024b

This slowdown was most noticeable in the crop husbandry sector, where GSVA witnessed a negative growth rate. In FY12, the crop sector at constant prices contributed 64 percent of the total agriculture GSVA but its contribution declined to 58 percent in FY24 (**Figure 3.3**). The livestock sector's percent contribution to total agriculture

GSVA at constant prices increased from 26 percent in FY12 to 38 percent in FY24. Over the last few years, growth in livestock sub-sector has been the highest amongst all sub-sectors in agriculture sector and is gradually becoming a potential source of better farm income. Agricultural households in Punjab reported the highest average monthly income (₹26,701, US\$ 390) during SAS, 2018-19.

Figure 3.3: Share of agriculture and its sub-sectors in GSDP in Punjab



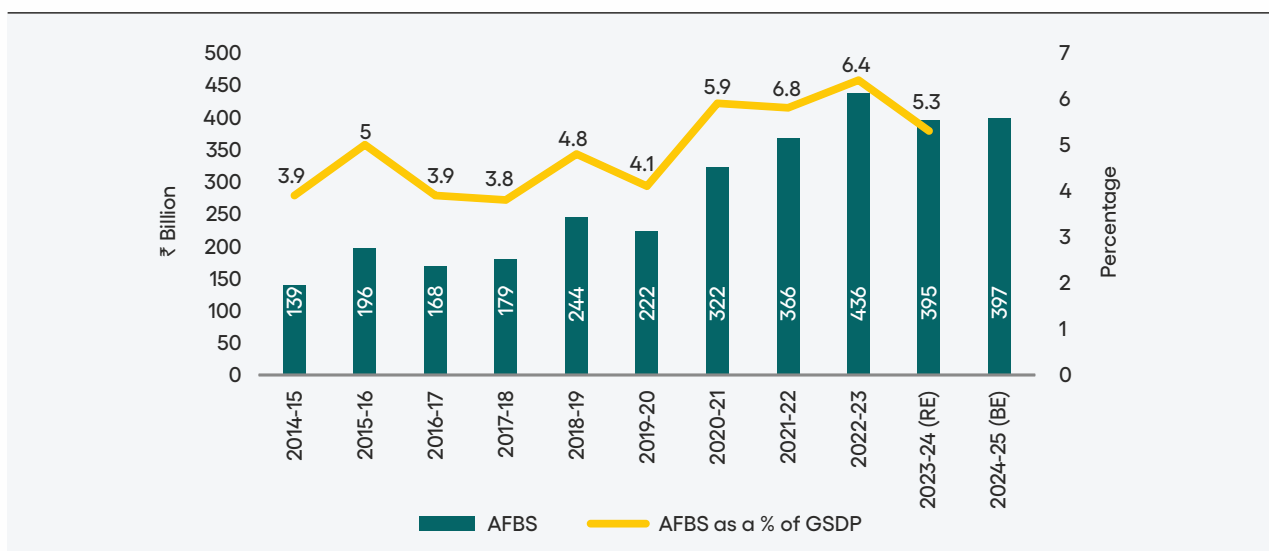
Source: MoSPI, 2024b

3.3 AFBS in Punjab

Over the period of FY15 to FY25, AFBS in Punjab increased from ₹139 bn (US\$ 2.3 bn) per year in

FY15, representing 3.9 percent of total states' GSDP value to ₹397 bn (US\$ 4.7 bn) per year in FY25 (BE), representing 5 percent of total GSDP value in FY24 (Figure 3.4).

Figure 3.4: Trends of AFBS in Punjab

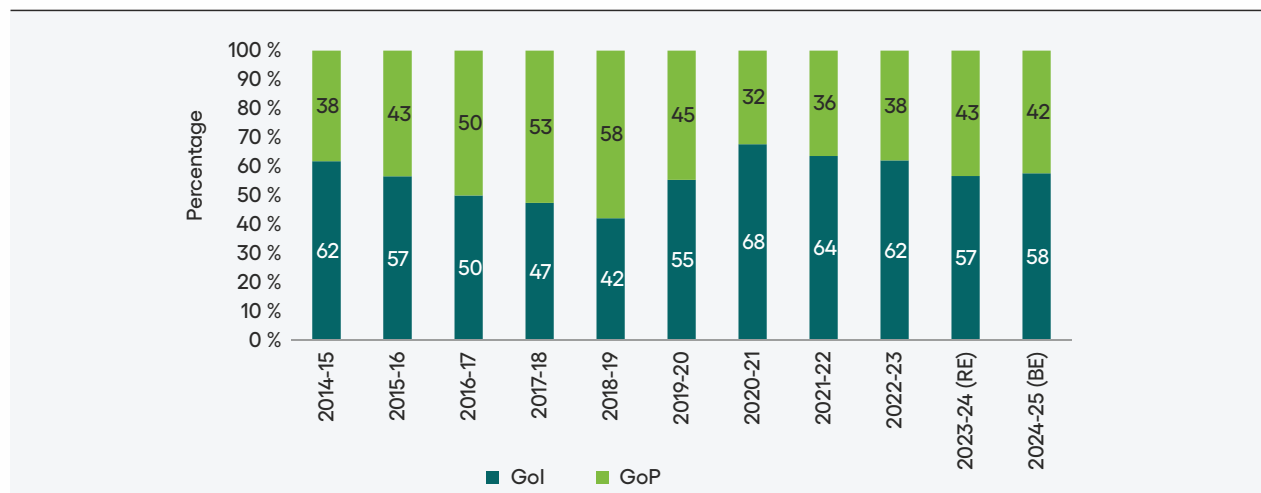


Source: Author's Calculations based on MoF, Punjab State Budget Documents, CAG, MoSPI (2024b)

This support includes the support from both GoI and GoP. AFBS share from GoI has increased

significantly during FY22 and is currently approximately at 60:40 (GoI:GoP).

Figure 3.5: GoI and GoP share of AFBS in Punjab



Source: Author's Calculations based on MoF, Punjab State Budget Documents, CAG, MoSPI (2024b)

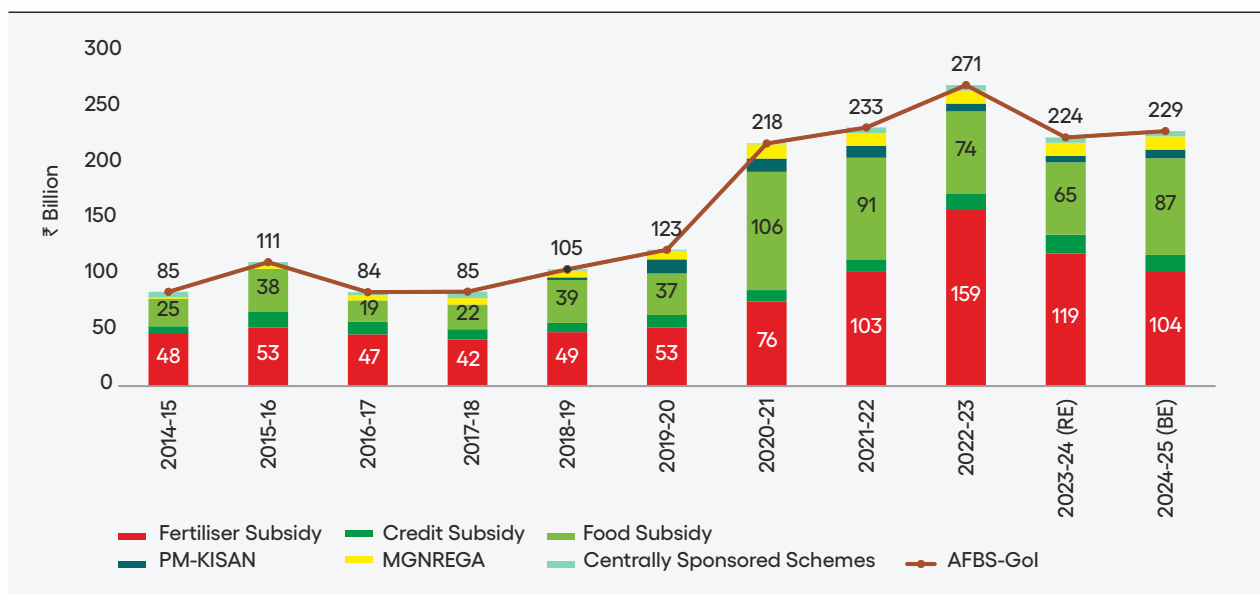
3.3.1 Budgetary support by GoI to Punjab

The AFBS to Punjab by GoI has increased from ₹85 bn (US\$ 1.4 bn) per year to ₹229 bn (US\$ 2.7 bn) per year between FY15 and FY25 (BE) (Figure 3.6).

During TE 2023-24, out of the total GoI support to Punjab's agrifood sector, the state receives approximately half of GoI's share in the form of fertiliser subsidy (Figure 3.7). Other major support from GoI to Punjab includes food subsidy for decentralized procurement of foodgrains and state's food subsidy share of FCI (based on off-take of foodgrains for Punjab consumers). This comprised

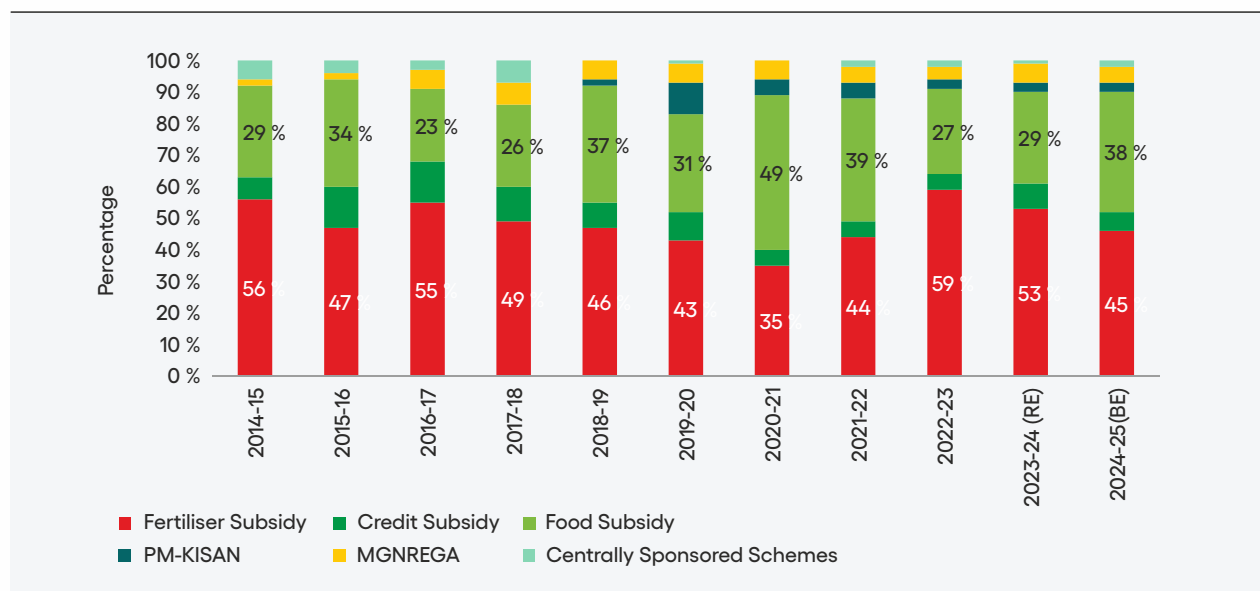
roughly 30 percent GoI share to state. GoI also provides support to state farmers in the form of credit subsidy, PM-KISAN and rural employment through MGNREGA. In addition, under CSS relevant to agrifood sector, the state has received GoI support through Green Revolution Umbrella Schemes that include RKVY, NFSM, NMH, National Project on Soil Health and Fertility, PKVY, Agriculture Mechanization, Sub-Mission on Agro-Forestry under NMSA, Livestock Health and Disease Control, National Livestock Mission, Blue Revolution, PMKSY-Per Crop More Drop, and Pradhan Mantri Gram Sadak Yojana.

Figure 3.6: Gol support to Punjab



Source: Author's Calculations using MoF and CAG

Figure 3.7: Gol support to Punjab (percentage share)



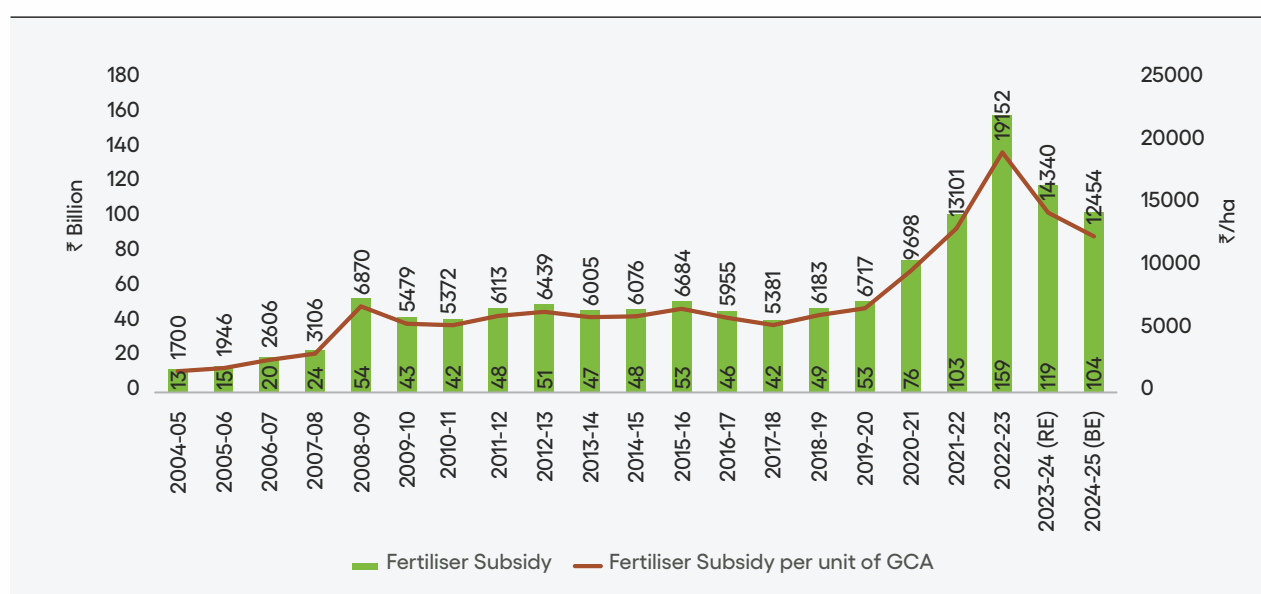
Source: Authors' Calculations using MoF and CAG

3.3.1.1 Fertiliser Subsidy

The fertiliser consumption in Punjab is quite high at 242 kg/ha in TE 2022-23, in comparison to all-India average 141 kg/ha. In FY05, 0.15 MMT NPK nutrients were consumed in Punjab agriculture that amounts to fertiliser subsidy of ₹13.5 bn (US\$ 0.3 bn) (Figure 3.8). With the increase in fertiliser consumption as well as increased allocation for

fertiliser subsidy in the GoI budget, the state's share for fertiliser subsidy has increased significantly. In 2022-23, the state's agriculture consumed 1.89 MMT of NPK nutrients (out of country's total NPK consumption of 29.84 MMT). And proportionately the GoI's support to state for fertiliser subsidy is ₹159.2 bn (US\$ 2 bn) (out of total fertiliser subsidy of ₹251.34 bn, US\$ 3.2 bn).

Figure 3.8: Fertiliser subsidy for Punjab



Source: Authors' Calculations from MoF, FAI

“But, fertiliser subsidy can have detrimental impacts (direct impacts are observed) on Target 4, Target 7, Target 8, Target 10, and Target 11 of KM-GBF

Excessive use of fertilisers and indiscriminate use of ground water are major contributors to water pollution in Punjab. Green Revolution, that aimed to increase crop yields, led to the widespread use of chemical fertilisers, pesticides, and herbicides in agriculture. Unfortunately, improper and excessive application of these substances has resulted in their

runoff into water bodies, contaminating ground water and surface water sources. About 22.4 percent of the tested water samples were found to contain nitrates at levels that are higher than the permissible limit of 45 mg/l (CGWB, 2023) (Figure 3.9)

Figure 3.9: Nitrate contamination hotspots in Punjab

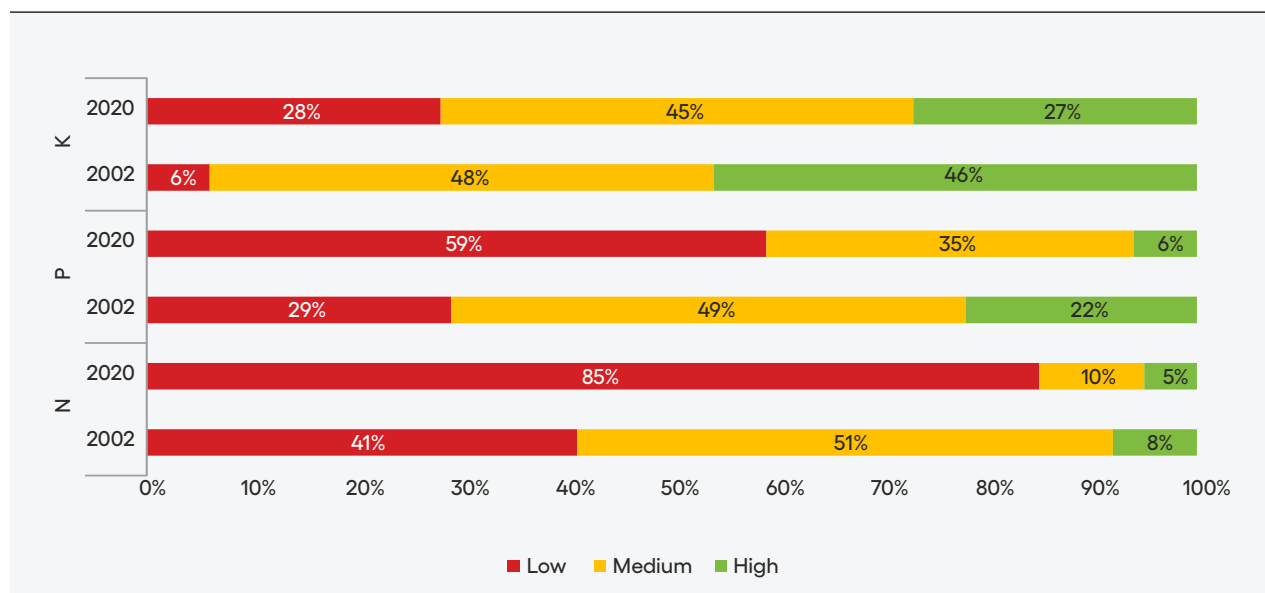


Source: CGWB, 2023

Despite higher application of fertilisers, the deficiency in Punjab soils are increasing over time (Figure 3.10). During early 2000s, 41 percent of Punjab soils were deficient in N, which has gone up to 85 percent in 2019 (SHC Cycle I & II). Similarly, percent soils samples low in P has increased from 29 to 59 percent and in K 6 percent to 28 percent during the same time. Fe and Zn deficiency in

Punjab soils have improved but approximately 73 percent of the soils are found to be low in organic carbon content. The skewed N-fertiliser application (particularly urea) is also responsible for N₂O emissions. In Punjab, highest per-hectare N₂O emissions of 476 Kg CO₂ eq/ha were estimated during 2022-23 (Singh and Gulati, 2025).

Figure 3.10: Macronutrient status of Punjab soils



Source: FAI (2000), SHC (2020)

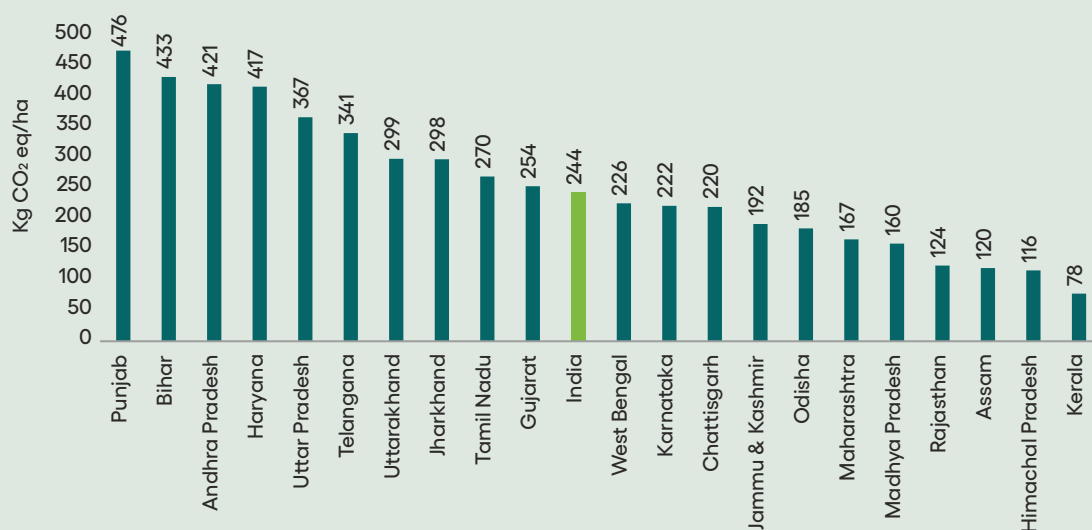


Box 3.1

Nitrous Oxide (N₂O) emissions from fertiliser application

Fertilisers, particularly N-fertilisers contribute to N₂O emissions – that causes climate changes. During 2022-23, 1.49 MMT of inorganic N nutrient was used in Punjab's GCA of 8.3 mha that contributed 14.49 Gg N₂O emissions, which is 3,955 Gg CO₂ eq. On per hectare basis, the N₂O emissions from the fertiliser application in Punjab were estimated to be 476 Kg CO₂ eq/ha, the highest amongst all states.

State-wise nitrous oxide emissions (Kg CO₂eq/ha) from N-fertiliser application, 2022-23



Source: Singh and Gulati, 2025

3.3.1.2 Foodgrain procurement and food subsidy

“ Assured wheat-rice procurement is discouraging farmers for crop diversification and impacting target 4 (in situ and ex situ conservation of genetic resources), target 8 (minimize the impact of climate change), and target 9 (sustainable use of wild species)

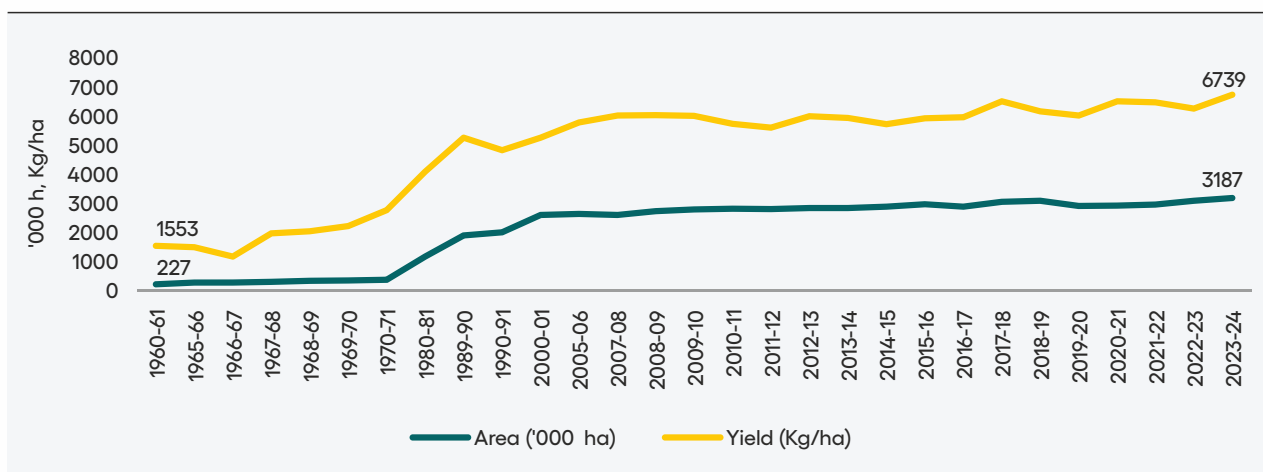
Price incentives in the form of MSP have backed the farmers from the market price crash influence but for the same reason have discouraged them for crop diversification as the procurement is skewed towards wheat and rice as opposed to other crops such as legumes and oil crops. Wheat rice crops

dominate the cropping pattern of Punjab. In 2021-22, foodgrains which include cereals and pulses were cultivated in nearly 87 percent of the total cultivated land. Cotton is cultivated merely on 3.2 percent of the total cultivated land and sugarcane and fruits each were grown on approximately 1

percent of the total cultivated area. Due to the assured income from the production of wheat and rice, their share in the total cropped area has increased over the years. In 1960-61, the area under paddy cultivation was only 0.22 mha which has increased to 3.18 mha in 2023-24 (Figure 3.11)

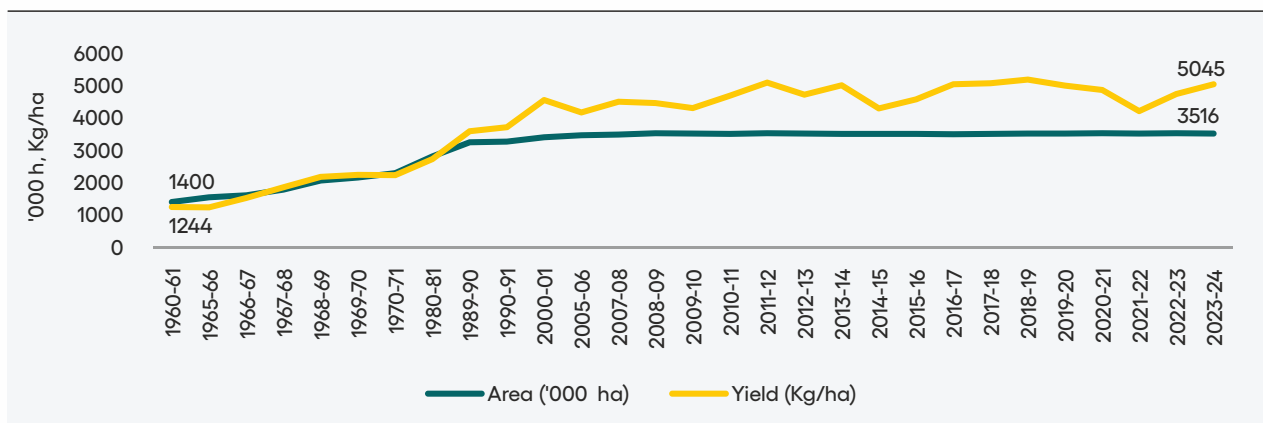
thereby increase in cropped area share from 4.8 percent to 40.4 percent (Figure 3.13). Similarly, the wheat cultivation area increased from 1.4 mha to 3.53 mha (Figure 3.12) with increase in cropped area share from 27.3 percent to 47.1 percent.

Figure 3.11: Yield and area under cultivation in paddy in Punjab



Source: GoP, MoAFWc 2024

Figure 3.12: Yield and area under cultivation in wheat in Punjab

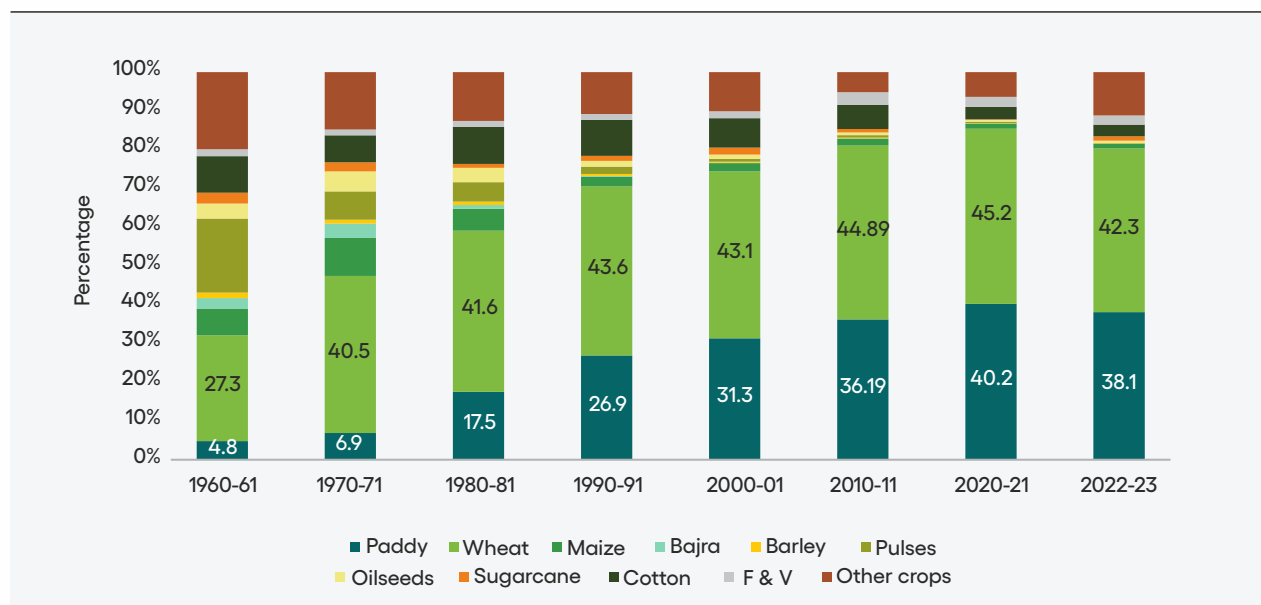


Source: GoP, MoAFWc 2024

On the other hand, the share of maize, pulses and oilseeds has declined in Punjab. The cropped area share of maize has decreased from 6.9 (in 1960-61) to 1.3 percent (in 2021-22), pulses share decreased

from 19.1 (in 1960-61) to 0.8 percent (in 2021-22) and oilseeds share declined from 3.9 (in 1960-61) to 0.6 percent (in 2021-22).

Figure 3.13: Crop-wise percentage of Punjab's cropped area

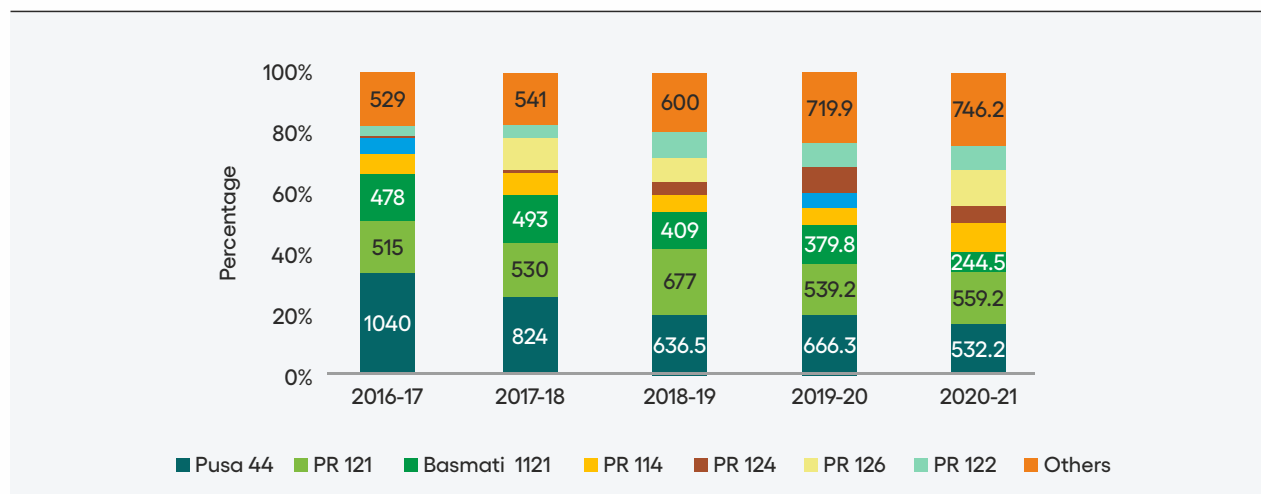


Source: Punjab Economic Survey 2021-22, MoAFWa 2024

Data in Punjab indicates that whereas area under wheat has increased by 2.42 times, area under rice has increased by 11.5 times from 1960-61 to 2020-21. At the same time, however, area under bajra has decreased by 24.6 times, under barley by about half, and under jowar it is less than 500 ha now. Further, considerable varietal changes have taken place. Prior to the green revolution, 41 varieties of wheat, 37 varieties of rice, 4 varieties of maize, 3 varieties of bajra, 16 varieties of sugarcane, 19 species/varieties of pulses, 9 species/varieties of oil seeds and 10 varieties of cotton were in use. Out of

49 post green revolution varieties of wheat released by PAU, only 3 are widely used. Out of 27 varieties of rice released, only 9 are currently in use. Although there are many varieties of wheat and rice, but in Punjab, just 2-3 varieties cover more than 50 percent area of the entire wheat and paddy cultivation area (Figure 3.14) depicting high reliability of few varieties and a very narrow diversification base. As a result, Punjab's gross value of output is skewed towards cereals, with 38 percent share, whereas all-India share of cereals is 15 percent in TE 2023 (MoSPI, 2024d).

Figure 3.14: Variety-wise percentage of Punjab's paddy cropped area

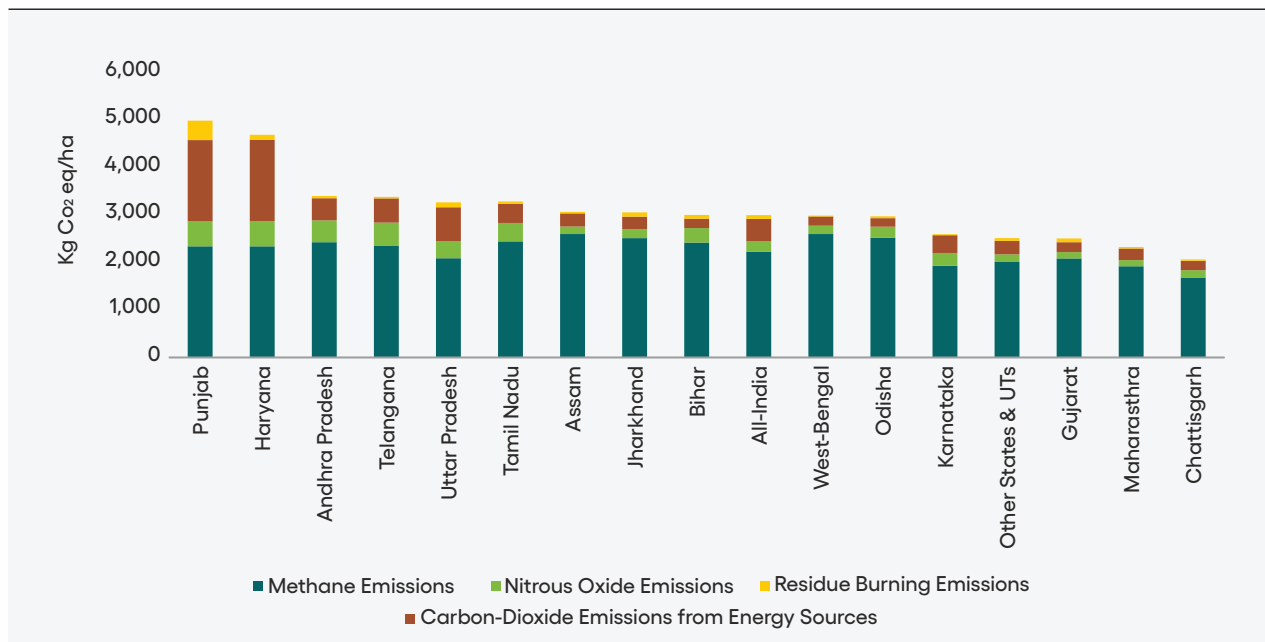


Source: MoAFW, 2021

Conventionally, farmers transplant rice seedlings after puddling the soil (intensive wet tillage) and keep the field continuously flooded for 30–40 days after transplanting. Puddling is good for initial crop establishment, weed control and reducing percolation loss of water. But anaerobic decomposition of organic material in flooded rice fields produces CH_4 , which escapes to the atmosphere by diffusive transport through the rice plants during the growing season (Takai, 1970). CH_4 is 27.2 times more powerful than CO_2 for causing temperature rise at a 100-yr time scale. Having a shorter life span of 12 years, it is 80.8 times more impactful than CO_2 at a 20-years' timescale (IPCC 2022). Second source of GHG emission from rice cultivation is N_2O , which is 273 times more impactful than CO_2 , at both 100-yr and 20-yr timescale. N_2O result from anthropogenic N inputs through (i) direct pathways (i.e. directly from the soils through synthetic fertilisers and organic manures), and (ii) indirect pathways

through volatilization of ammonia (NH_3) and nitrogen oxide (NO_x) and the subsequent re-deposition of these gases and their products to soils. Leaching and run-off of N, mainly as nitrate (NO_3^-) is another indirect pathway for N_2O emission. Field operations i.e. ploughing, cultivation, sowing, irrigation (20-25 irrigations, predominantly through ground water pumping), application of inputs like fertilisers and pesticides, and harvesting require diesel and electricity, leading to CO_2 emissions – which is the third source of emissions from rice cultivation. In India, rice residue burning is a major concern, particularly in Punjab, Haryana, and western Uttar Pradesh producing CO , CH_4 , N_2O , NO_x , NMHCs, SO_2 and many other gases. This is not only a health hazard and leads to loss of nutrients, but also the fourth source of non- CO_2 GHG emission. Punjab's emissions from rice cultivation are estimated to be highest on per hectare basis (Figure 3.15, Singh and Gulati, 2023).

Figure 3.15: State-wise GHG emissions (Kg CO₂ eq/ha) from rice cultivation, 2021-22



Source: Singh and Gulati, 2023

PM-KISAN and credit subsidies provided to Punjab by centre are efforts to boost farmers income. These are decoupled support and are neutral with respect to their impact on biodiversity. The main objective of MGNREGA is to augment livelihoods of millions of rural families. However, indirect impacts like improved vegetation, retaining of soil moisture, and arresting of soil erosion are the positive environmental impacts of MGNREGA.





Box 3.2

Swachch Badhochhi Kalan by Developing “Seechawal Model” (Case study of MGNREGA)

Badhochhi Kalan village is situated in Fatehgarh Sahib district of Punjab. The main occupation of the village is agriculture. The major sources of irrigation are tubewells, wells, and canals. A dried-up pond in the village used to get filled up with rainwater and silted with grease, oil, garbage, and mud. This site was developed as “Seechawal model,” for treating sewage water and using it for irrigation, as a pilot project. This work was taken up during the FY19 with the help of MGNREGA and RURBAN funds in convergence with 14th Finance Commission funds through the Gram Panchayat Badhochhi Kalan involving an expenditure of ₹3.6 mn.

Comparison of Before and After Scenario

	Before	After
Total Dissolved Solids (TDS) ppm	800	500
Urea used Kg per acre	150	70
Underground water usage	7 days a week	1 day in a week

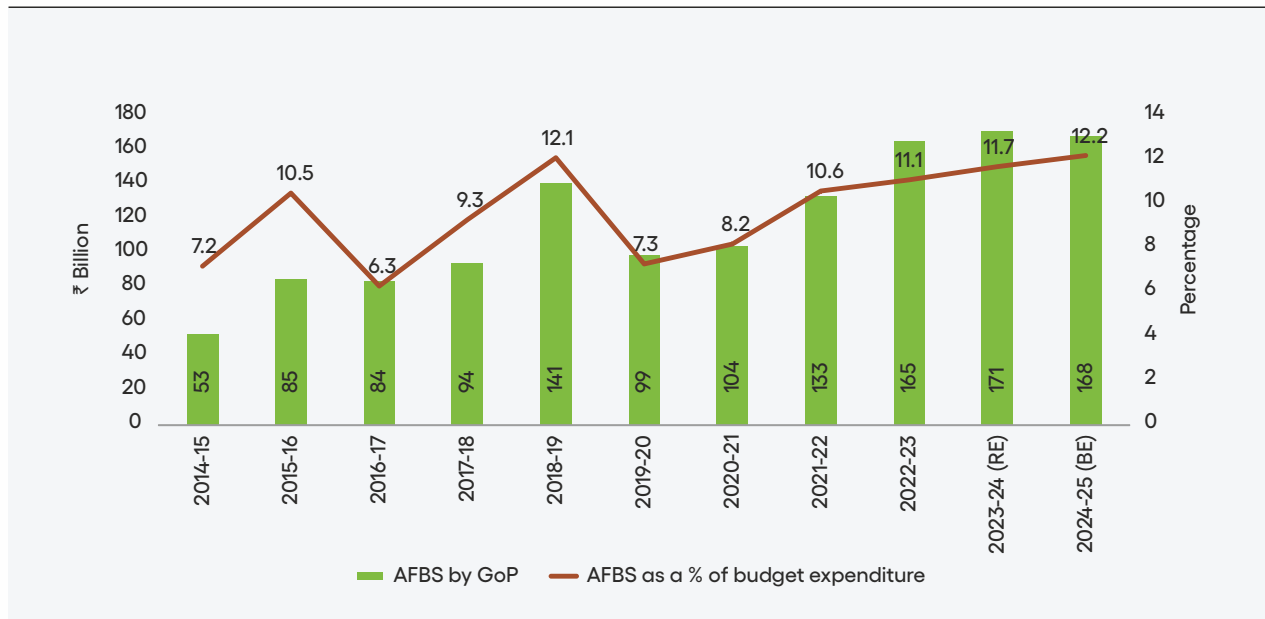
Source: MoRD

3.3.2 Budgetary Support by GoP

The importance of agriculture in Punjab's society and economy is widely recognized. The state budget puts budget in departments of agriculture, animal husbandry, dairy development and fisheries, forestry, and horticulture every year. The water department spends on major, medium, and minor irrigation projects that benefit this sector.

Over the period of FY15 to FY25, AFBS increased from ₹53 bn (US\$ 0.9 bn) per year, representing 7 percent of total state's budget in FY15 to ₹168 bn (US\$ 2 bn) per year, representing 12 percent of state's budget in FY25 (BE) (Figure 3.16). The support includes input subsidies and income support to farmers, development for agriculture sector as a whole and safety net for consumers.

Figure 3.16: AFBS by GoP

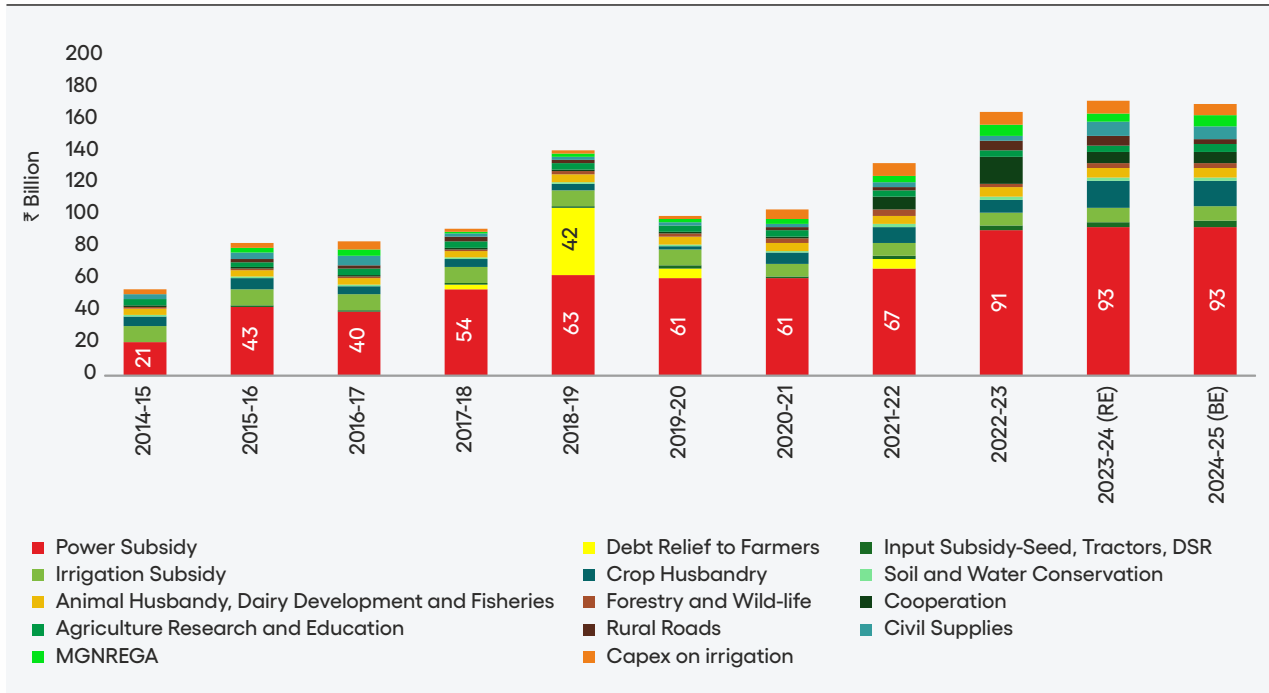


Source: Punjab State Budget Documents

GoP is providing the direct subsidy benefit to the farmers in monetary terms by reducing the price of inputs/farm machinery etc. This is being implemented through various schemes, such as farm mechanization, agriculture mechanization for management of crop residues, seed and planting material, save water save money, resource conservation and crop diversification, micro-irrigation, mushroom cultivation etc. Indirect subsidies are given for electric power use and irrigation. GoP provides free electricity to the farmers and more than 50 percent of the state's expenditure on agrifood sector is diverted to power subsidy. This is draining Punjab's economy. In TE

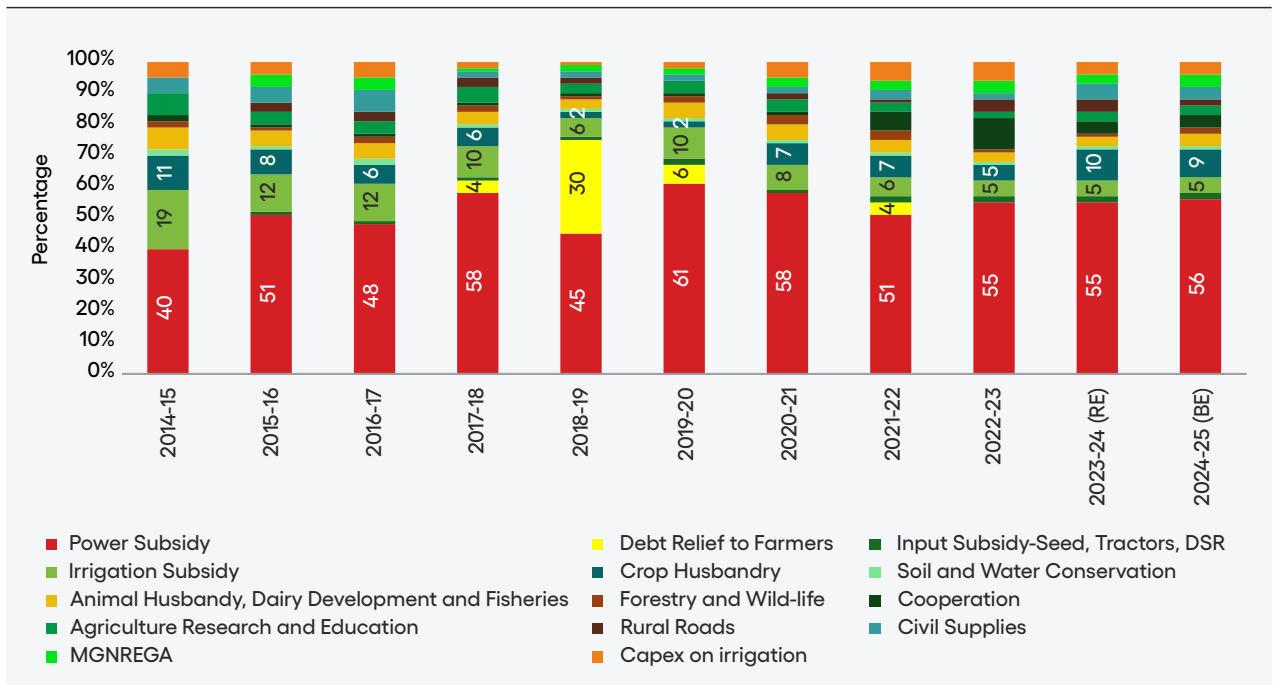
2023-24, the state has allocated ₹84 bn (US\$ 1.1 bn) per year for power subsidy (Figure 3.17), which is 54 percent of the total budget. Expenditure on other developmental activities under this sector is very less: ₹10 bn (US\$ 128 mn) for crop husbandry (6.6 percent), ₹8.7 bn (US\$ 111 mn) for irrigation (5.6 percent), ₹8.2 bn (US\$ 105 mn) co-operation (5.3 percent), ₹5.4 bn (US\$ 69 mn) for animal husbandry, dairy development, and fisheries (3.5 percent), ₹4.1 bn (US\$ 52 mn) for agriculture research and education (2.6 percent), ₹2.7 bn (US\$ 34 mn) for forestry and wildlife (2 percent), and ₹1.7 bn (US\$ 22 mn) for soil and water conservation (1 percent) (Figure 3.18)

Figure 3.17: Category-wise AFBS by GoP



Source: Punjab State Budget Documents

Figure 3.18: Category-wise AFBS by GoP (percentage share)



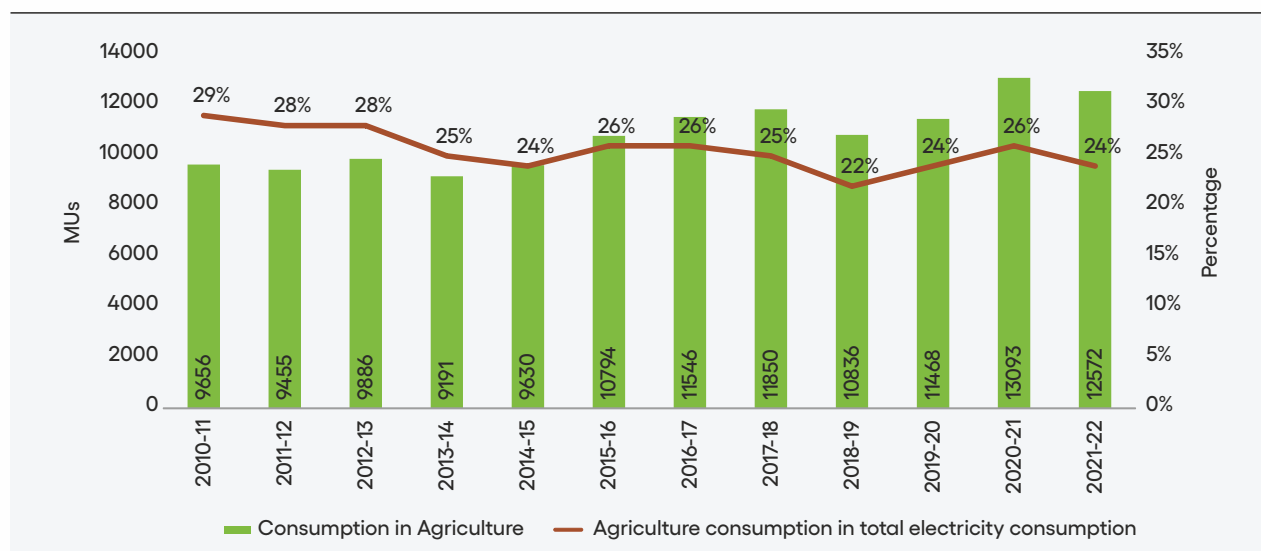
Source: Punjab State Budget Documents

3.3.2.1 Power subsidy: Easy access to power may have incentivized farmers to over-exploit ground water resources

The total annual supply of electricity for agriculture by the Punjab State Power Corporation Limited (PSPCL) was of the order of 12,533 mn units (MUs) in 2021-22, which is 24 percent of the total electricity consumption in the state (Punjab Statistics, 2021-22). Between FY11 till FY 20, there was 30 percent increase in annual agricultural electricity consumption in Punjab with a peak in FY21 and marginal decline in FY19 as has been

shown in (Figure 3.19). This electricity is predominantly used for irrigation through tubewells. 90 percent of the 1.4 mn tubewells in Punjab are electricity operated. Free power in Punjab has led to injudicious use of electricity and water by the farmers, leading to a decline of -10.89 meters below ground level (mbgl) between 2000-2022 (Thangaraj and Gulati, 2024b).

Figure 3.19: Annual electricity consumption in agricultural sector in Punjab

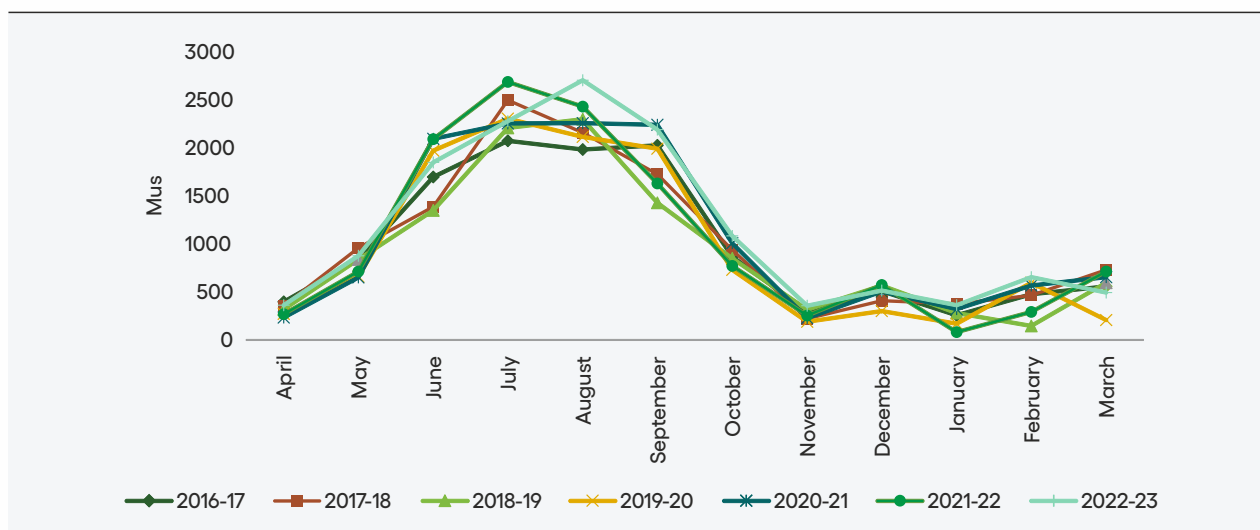


Source: GoP

However, the annual consumption of electricity for agriculture does not provide the complete picture. When we look at monthly patterns of consumption of agricultural electricity, this is the trend that emerges for the state (Figure 3.20) is that the maximum consumption of electricity takes

between June-July to August-September, when there is maximum need for irrigation of the paddy crop in Punjab. Between FY17 and FY20, the proportion of consumption of agricultural electricity during these four months ranged between 64-72 percent.

Figure 3.20: Monthly electricity consumption in agricultural sector in Punjab



Source: PSPCL

“Power subsidy can have detrimental impact (Direct Impacts are observed) on Target 10 of KM-GBF and NBSAP

Punjab is not geographically conducive for rice cultivation. However, over the year's tubewell irrigation has increased in Punjab as demand for water has been rising due to increase in rice cultivation. Due to availability of free power, there has been overexploitation of ground water in Punjab. A strong negative relationship is observed between power subsidy and ground water level (Figure 3.21).

In Punjab, the canal irrigation system efficiently utilizes the available surface water resources. However, the current surface water resources are insufficient to meet the growing demands of agriculture, resulting in an escalating reliance on ground water resources. Since Green Revolution in the mid-1960s, the number of tubewells has dramatically increased. Initially numbering only

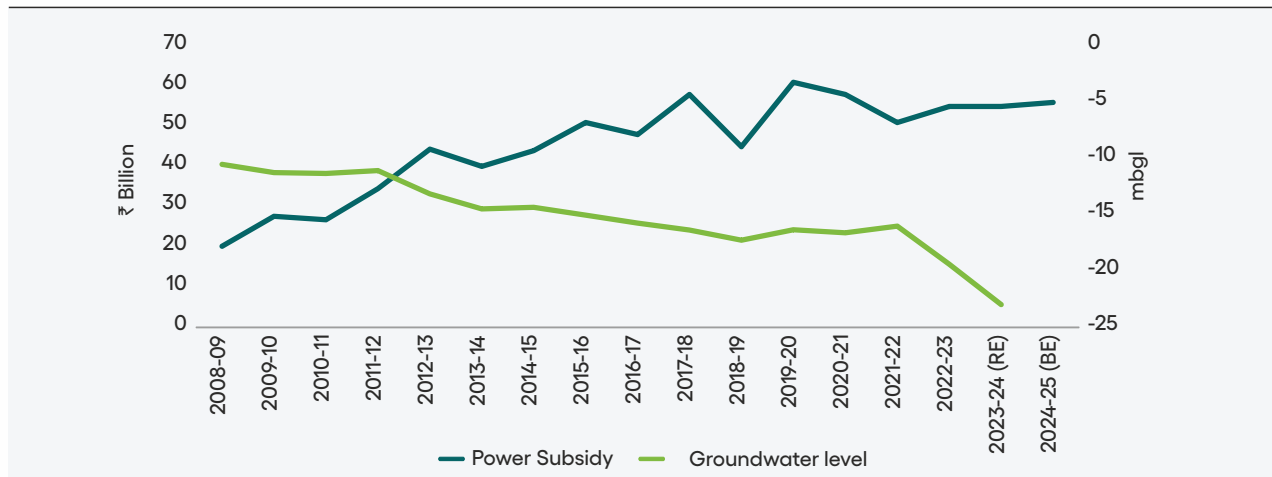
50,000 in the early sixties, the count rose to over 70,000 in the early eighties, approximately 1.07 mn in 2001, 1.18 mn in 2005-06, and approximately 1.20 mn in 2012-13, according to Punjab Statistics. Currently, the number of tubewells has reached 1.4 mn. The increase in number of tubewells also shows proportionate increase in rice cultivation area, and increased electricity consumption (Figure 3.22).

The continuous decline of ground water table has created water-stressed condition in Punjab. If the level of ground water extraction is high relative to recharge, then it is over-exploitation leading to unsustainable water use. Due to free electricity policy and increase in rice cultivation area, the ground water depth decreased, and number of over-exploited blocks increased (Figure 3.23).



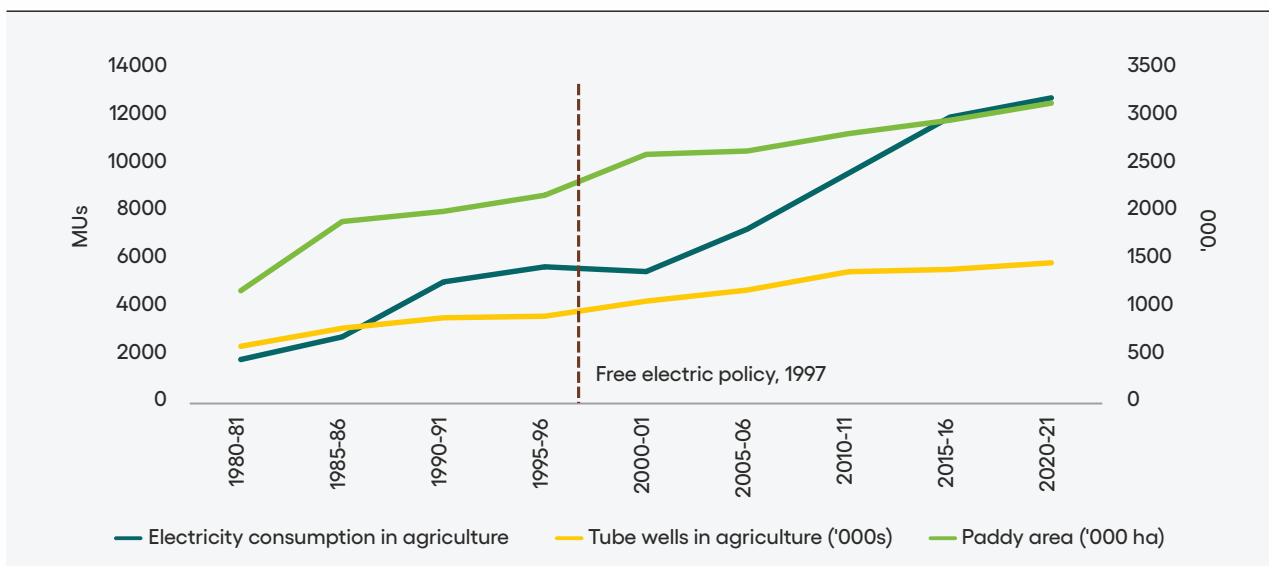
Target 10: “Ensure that areas under agriculture, aquaculture, fisheries and forestry are managed sustainably, through the sustainable use of biodiversity, including through a substantial increase of the application of biodiversity friendly practices, sustainable intensification”

Figure 3.21: Relationship between power subsidy and ground water level in Punjab



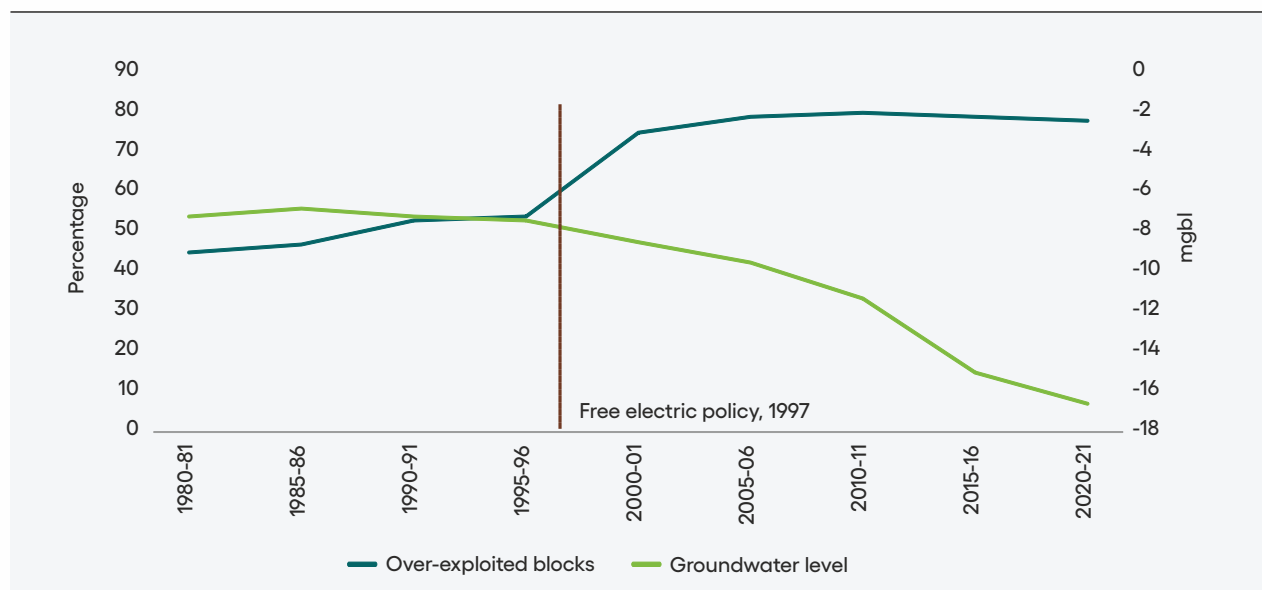
Source: GoP, Punjab State Budget Documents

Figure 3.22: Electricity consumption, paddy area and tubewells



Source: GoP

Figure 3.23: Over-exploited blocks and ground water decline in Punjab



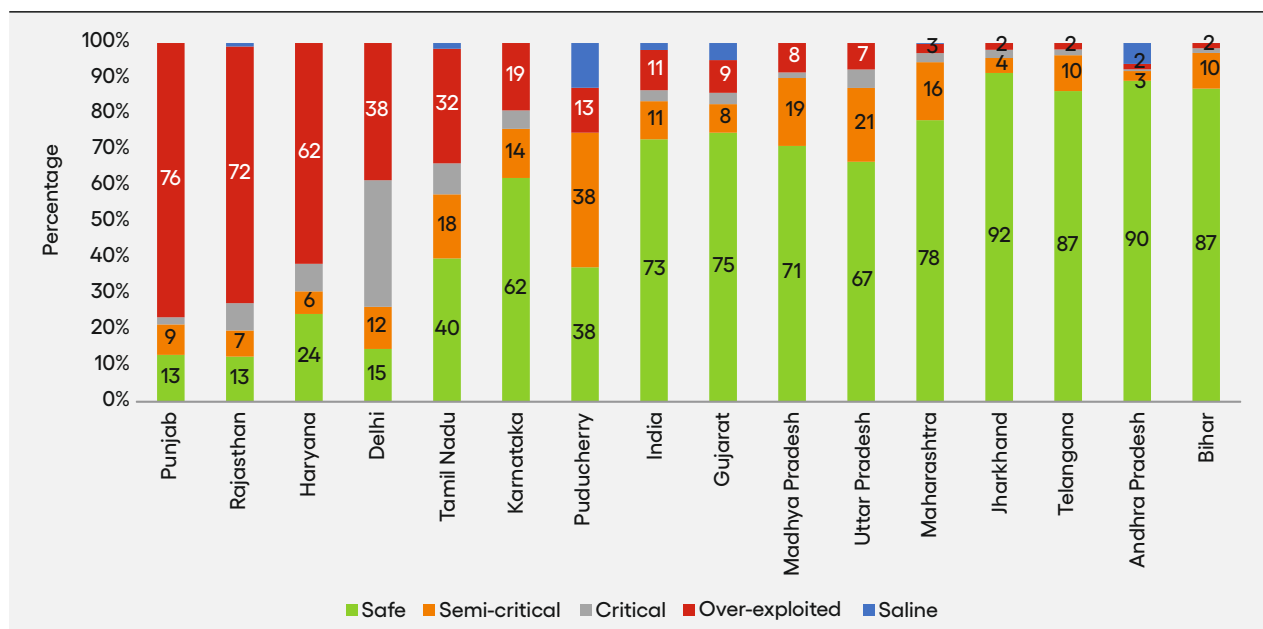
Source: GoP

Ground water resources assessment of states/UTs carried out jointly by state ground water/ nodal departments and Central Ground Water Board (CGWB) found that in 2023, the ground water resource units categorized as “safe”, are only 13 percent, “semi-critical” units are 9 percent, “critical” units are 2 percent, and “over-exploited”

units, accounted for 76 percent (Figure 3.24). In Punjab, water level has declined to – 9.2 mbgl between 2000-19. Sangrur and Barnala were affected the most where decline was -24.8 mbgl (Gulati et. al., 2022). Over a period, water stress in Punjab is becoming worse (Figure 3.24).

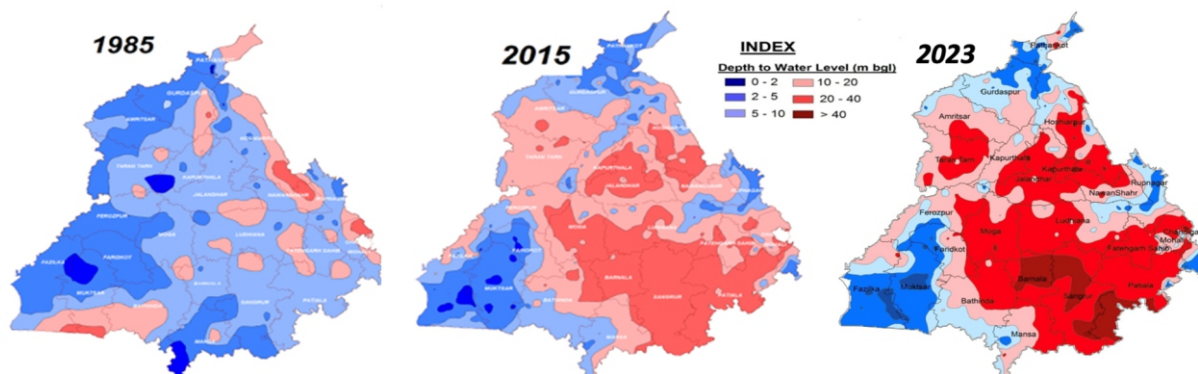


Figure 3.24: Categorization of ground water resource assessment units



Source: Thangaraj and Gulati, 2024b

Figure 3.25: Decline in ground water level in Punjab, 1985-2023



Source: CGWB

3.3.2.2 Agriculture R&D in Punjab

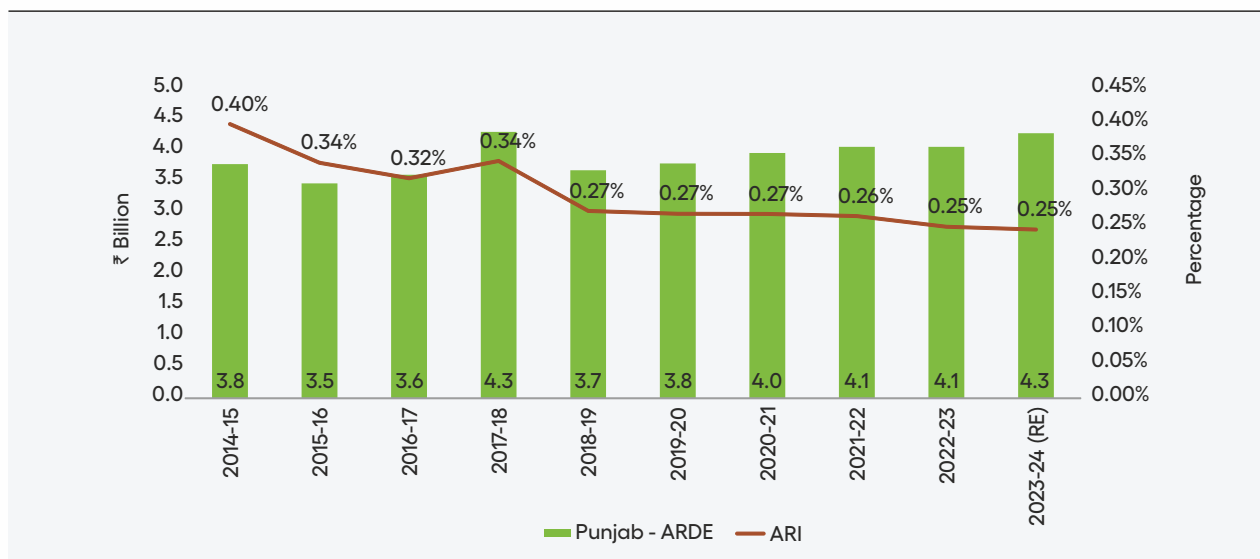
Punjab's ARDE system has contributed significantly to the state's agricultural growth. For example, the development of high-yielding crop varieties, enhanced livestock breeds, and innovation of new agricultural technology. These

improvements have aided in increasing crop yields, improving livestock productivity, and lowering production costs. As a result, Punjab has emerged as one of India's primary producers of wheat, rice, cotton, and milk. Measuring the intensity of research is seen as a good measure for understanding expenditures on research and

development. Punjab's average ARDE expenditure during TE 2024 was ₹4.1 bn (US\$ 53 mn). The ARDE expenditure has marginally increased from ₹3.8 bn (US\$ 62 mn) in FY15 to ₹4.3 bn (US\$ 52 mn) in FY24, however, ARI has fallen from 0.4 percent (FY15) to 0.25 percent (FY24) (Figure 3.26).

As seen earlier, the crop sector is the primary focus of Punjab, which is evident from their expenditures on ARDE. During TE 2020, the crop sector average ARDE expenditure was ₹3.7 bn (US\$ 54 mn) while animal husbandry expenditure was only ₹278 mn (US\$ 4 mn). As a leading example, Punjab Agriculture University has made strides in Punjab's ARDE and many efforts have the potential to favour Punjab's agricultural sustainability.

Figure 3.26: Punjab's ARDE expenditures and ARI



Source: MoSPI (2024b), Punjab State Budget Documents

Debt relief is an effort to boost farmers' income and is neutral to crop and its impact on biodiversity. Compensation for stubble management and incentivizing DSR promotes water-use efficiency and residue management and thus have potential positive impacts on biodiversity.

**Box 3.3**

Major sustainable agriculture initiatives of PAU

Crop Improvement programme: The PAU has developed/ recommended more than 100 varieties/ hybrids of different crops for diversification/sustainability of rice-wheat cropping system including varieties of wheat (10), barley (1), rice (3), speciality varieties (6), cotton (3), maize (5), sugarcane (5), oilseeds (6), pulses (5), forages (10), vegetable crops (31), fruit plants (9), flower crops (8) and agro-forestry (3).

Integrated Pest Management Strategies: Developed/recommended more than 30 pest resistant varieties of wheat (4), rice (7), cotton (3), sugarcane (4), moong (4), horticulture (7).

Use of Advanced Technologies: Genome editing of selected field and horticulture crops, genome sequencing of wheat, moong-bean and guava, transcriptomics of guava and okra, GM cotton and chick-pea, micro-propagation of sugarcane, mentha and banana, slow N release nano urea in potato, precision agriculture-use of sensors for input use efficiency in wheat, rice, and drones for pest control in cotton, rice, and wheat.

Natural Resource Management and water saving technologies: Developed many resource conserving technologies viz. wheat straw mulching in maize, paddy straw mulching in sugarcane, alternate wetting-drying in rice, stand water in rice for first two weeks only, bed planting of wheat, bed planting of cotton and first irrigation after six weeks, tensiometer, laser leveller, transplanting of rice on beds/ridges, direct seeded rice, drip irrigation in 25 crops, short duration rice varieties, sub-surface drip irrigation for cropping system.

Machineries for crop residue management: Developed machines for in situ management of crop residues – Mulcher, PAU Straw Cutter-cum-Spreader, Mould board Plough, Happy Seeder, PAU Super SMS, Super Seeder, PAU Smart Seeder, Surface seeding-cum-mulching.

Soil Health: Recommended cropping system-based fertiliser application (apply P only to wheat; not to paddy maize or cotton), developed/recommended neem coated urea, green seeker optical sensor and organic farming, developed biofertiliser for 10 crops.

Source: PAU Presentation dated 20th April 2023

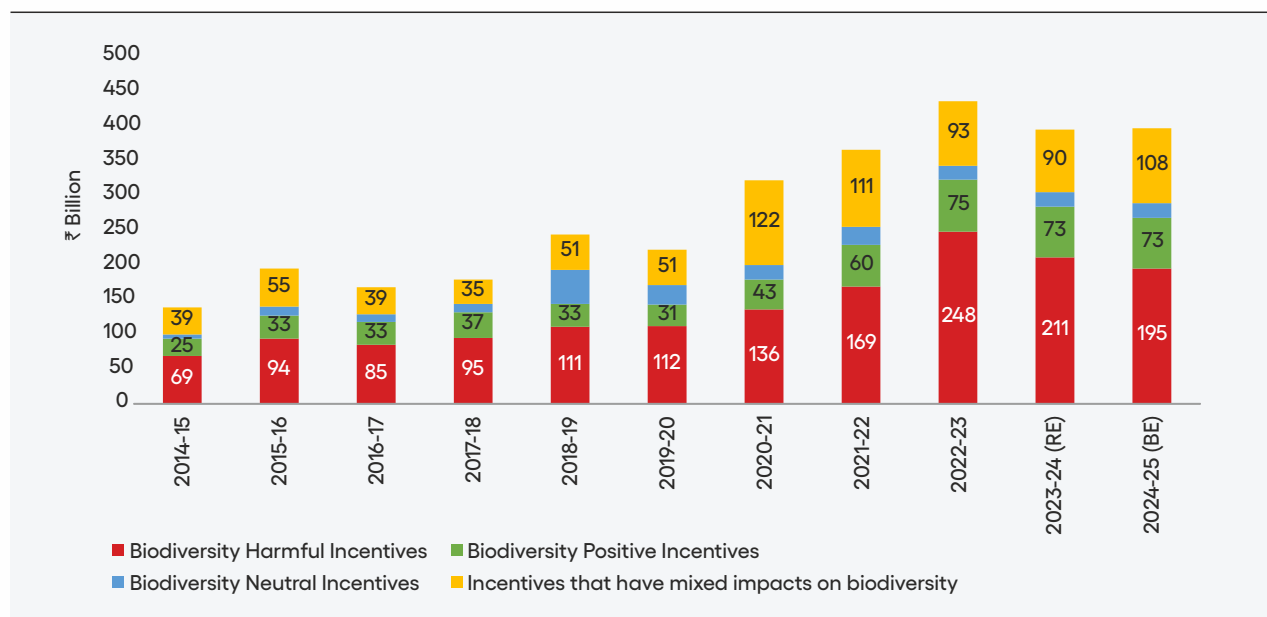
3.4 Categorization of AFBS in Punjab

Main findings of qualitative and quantitative analysis of potential adverse impacts on biodiversity resultant from implementation of on-going and planned agricultural subsidies and incentives from state government schemes, central schemes and centrally sponsored schemes are summarized below.

During TE 2024, a total of ₹399 bn (US\$ 5.1 bn) annually (Figure 3.27) was spent on agrifood support administered by various departments of GoI and GoP. Of the total support, ₹209 bn (US\$ 2.7 bn) per year was found to detrimentally impact the targets of NBSAP. This support primarily

comprises of fertiliser subsidy from GoI and power subsidy from GoP. Incentives with respect to resource conservation and overall agriculture development were to the tune of ₹69 bn (US\$ 0.9 bn) per year and was found to be positive with respect to biodiversity. The schemes related to income support such as PM-KISAN, credit subsidies, and loan waivers are neutral with respect to biodiversity outcomes and comprise of ₹22 bn (US\$ 0.3 bn) per year. Irrigation schemes and food subsidies for decentralized procurement of foodgrains comprise ₹98 bn (US\$ 1.3 bn) per year and have mixed impacts on biodiversity outcomes.

Figure 3.27: Categorization of AFBS in Punjab

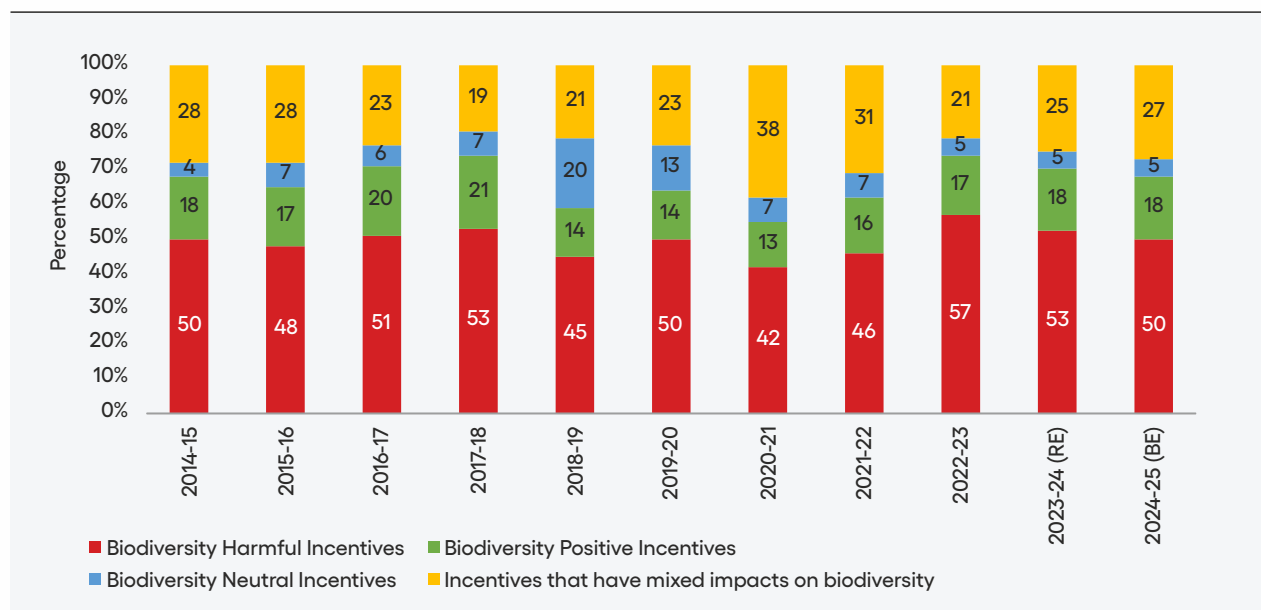


Source: Author's compilation using MoF, CAG and Punjab State Budget Documents

With respect to percentage share, half of the total AFBS provided to Punjab is detrimental to biodiversity (Figure 3.28) and 17 percent is positive with respect to biodiversity. It is high time

that the policy making in the country is geared towards sustainable, biodiversity inclusive and profitable agriculture.

Figure 3.28: Categorization of AFBS in Punjab (percentage share)

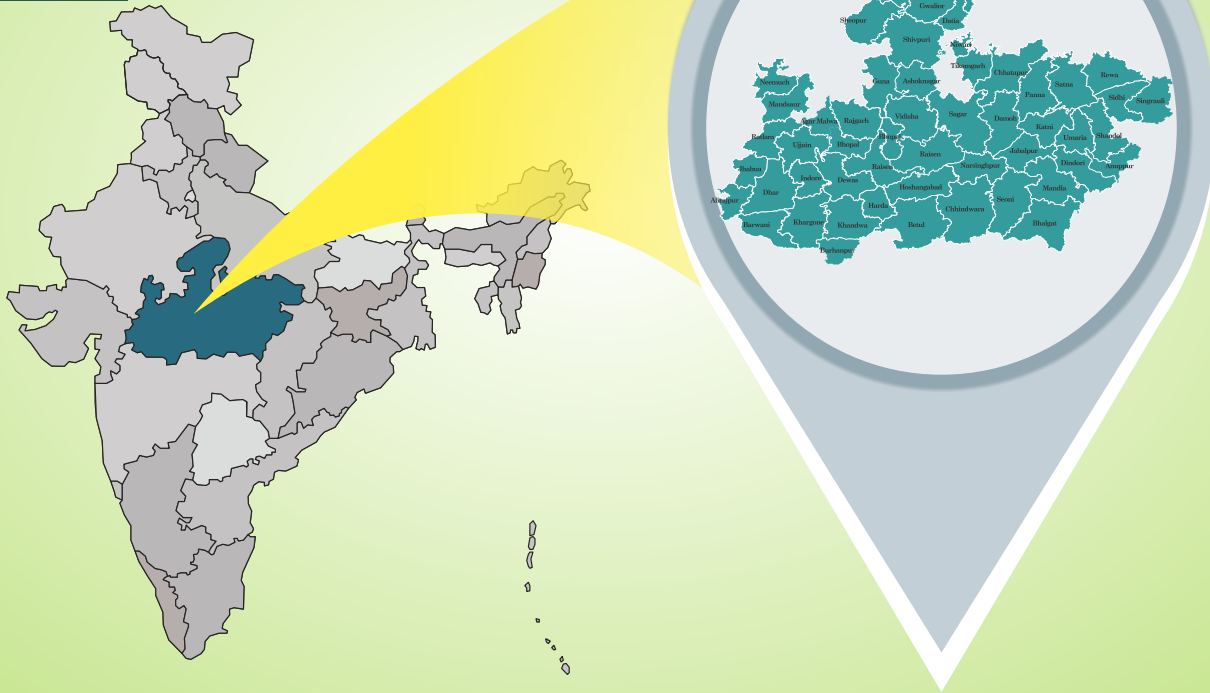


Source: Author's compilation using MoF, CAG and Punjab State Budget Documents

Peasants of Punjab have contributed significantly in feeding the country and it is obligatory on the part of the state as well as the GoI to steer them towards bio-diverse crops that are less damaging to environment and yet are more profitable than paddy. This requires innovative policy solutions. One of such policy innovation is: where farmers shifting from paddy to pulses, oilseeds, millets, and even kharif maize can be given roughly ₹35,000/ha on 50:50 basis under the joint package of GoP and GoI (Singh et al. 2024). No additional expenditure will be involved. It is the state savings on power, canal waters, and centre's savings on fertiliser subsidies that need to be given back to farmers in a different form.

The government must also ensure the purchase of alternative crops at MSP as a safety net to farmers who choose crop diversification. FCI bought 92.5 percent of the rice produced in Punjab at MSP during KMS TE 2023-24. If this support is

redirected towards other crops, it could release funds for a revolving MSP pool. This amount could then be utilized as a Stabilization Fund to ensure that agencies like NAFED, CCI, or FCI purchase pulses, oilseeds, cotton, millets, and kharif maize at MSPs, thereby mitigating market risks for non-paddy crops. Transitioning to alternative crops could potentially enable farmers to earn up to 4 carbon credits per hectare, and can open the doors of farmers for carbon market. In parallel, market-oriented cluster-based approach for high-value horticulture crops should be prioritized. FPOs, FPCs, federations, cooperatives, state agriculture and marketing boards, as well as other public sector entities can assume the responsibility of aggregating farmers for scaling up production, post-harvest management, marketing and branding of crops that is suited to different region in sync with export demand. Logistics facilities to be created to export agricultural produce to other states and internationally through air-lifting.



Madhya Pradesh: Agrifood Budget

Support by Gol and GoMP

Madhya Pradesh (MP) is one of the nation's richest reservoirs of biodiversity. Recently, rice cultivation and procurement have gained importance. It faces potential risks for a shift toward wheat-rice monocropping and associated environmental degradation. The chapter evaluates agrifood policies and the budgetary support for MP. It provides recommendations on how to safeguard MP's agrobiodiversity and long-term agricultural sustainability



4.1 Overview of Madhya Pradesh

MP is the second largest state in the country, and spans a geographical area of approximately 30.8 mha. Comprising 53 districts, 10 divisions, 428 Tehsils, and 333 blocks, the state is home to a projected population of 87 million in 2023-24, constituting around 6 percent of India's total population. In the FY24, the state's economy was ₹13.6 tn (US\$ 165 bn), with GSVA standing at ₹12.7 tn (US\$ 154 bn).

MP is a notable success story within India's economic and developmental landscape, marking a

significant departure from its historical association with the BIMARU states—Bihar, Madhya Pradesh, Rajasthan, and Uttar Pradesh. Despite its past categorization, MP, consistently outperforms the national average in terms of GDP growth, boasting an annual average GDP growth rate between FY06 to FY24 at 7.02 percent, surpassing India's AAGR of 6.32 percent. Despite these impressive figures, the GDP per capita for Madhya Pradesh in FY24 was ₹156,381 (US\$ 1893), falling below the national average of ₹211,725 (US\$ 2563). Detailed statistics of the state are given in [Appendix V](#).

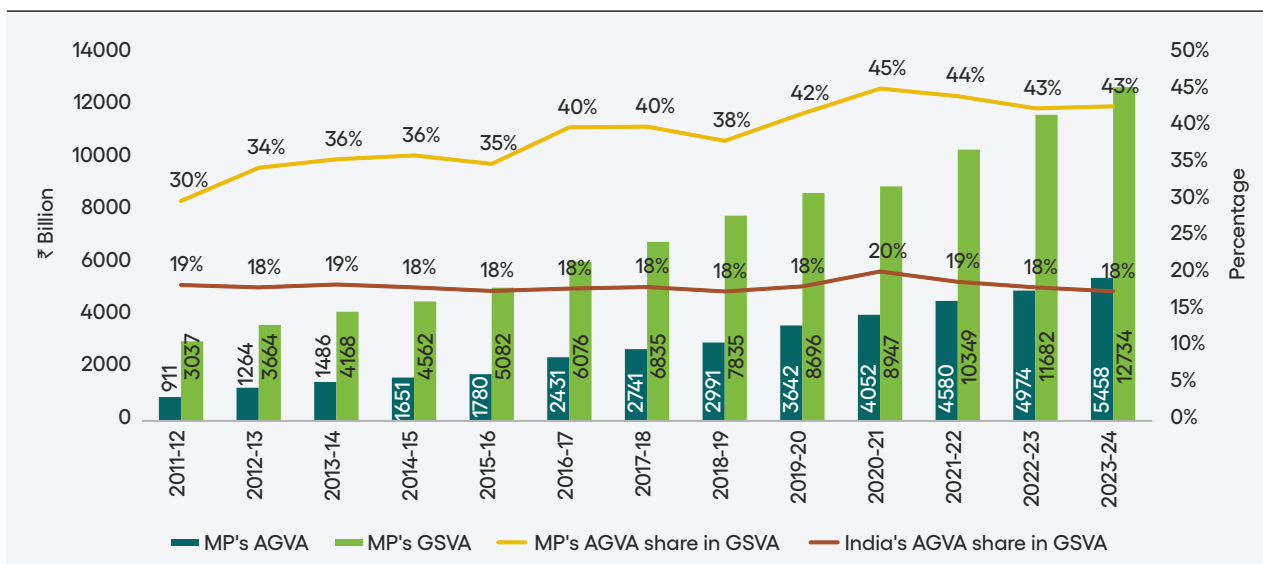
4.2 Overview of agriculture and allied sector of MP

With 53 percent (16.1 mha) of the total reporting area for land utilisation, MP's agriculture contributes 43 percent to the state GVA, more than twice of India's share of agriculture in GVA of 17.7 percent. Due to its primarily agricultural economy, MP surpasses the all-India figure with 61.56 percent of its workforce engaged in agriculture, while the national average remains at 46.07 percent (PLFS, 2023-24). However, the average monthly agricultural household income of ₹8,339 (US\$ 122) remains below the national average of ₹10,218 (US\$ 149) (SAS, 2018-19). MP's agricultural sector is predominantly characterized by small and marginal farmers. In 2015–16, 75.5 percent of these farmers, with land holdings of less than 2 ha, collectively managed 48 percent of the total

operated area. Over time, the average size of landholding has decreased, dropping from 2.28 ha in 1995–96 to 1.78 ha in 2010–11 and further to 1.57 ha in 2015–16 (Agriculture Census, 2015-16).

Much like its impressive GDP growth, the AGVA growth in MP stands out. From FY06 to FY24, the AAGR of agriculture in MP is nearly twice that of India, registering at 6.78 percent compared to India's 3.75 percent. In FY24, the GVA from agriculture in MP reached ₹5.5 tn (US\$ 67 bn) ([Figure 4.1](#)). An interesting trend emerges in the increasing contribution of agriculture to the state's GVA, climbing from 30 percent in FY12 to a peak of 45.5 percent in FY21, while India's share averaged at 18.3 percent between FY12 and FY24.

Figure 4.1: GSVA and percentage share of agriculture & allied sector in MP

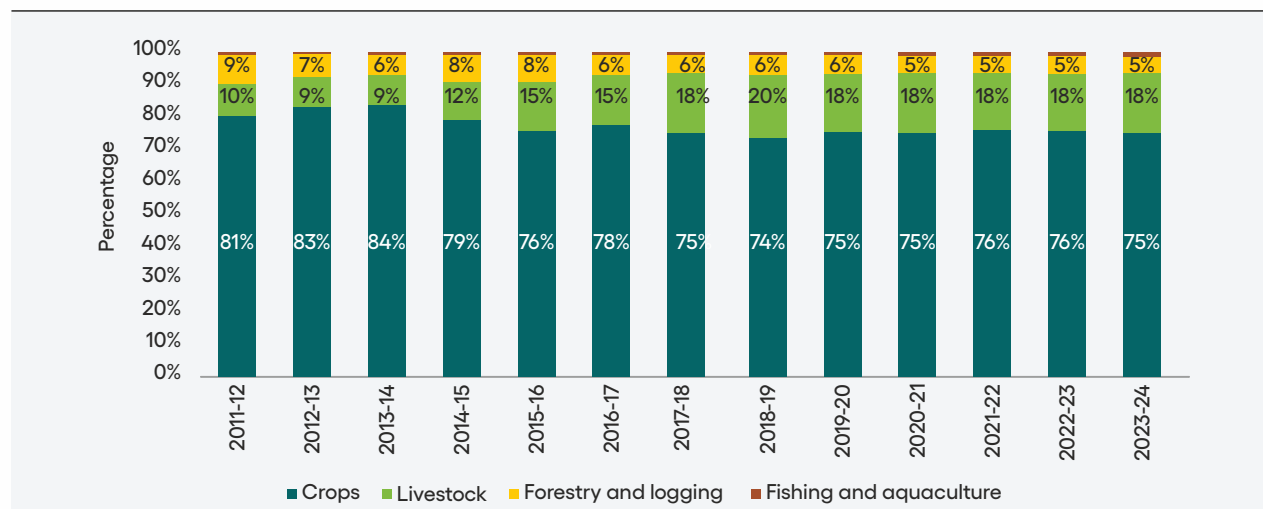


Source: MoSPI, 2024b

Within the agricultural sector, the crop husbandry sector maintains a major contribution, accounting for 75 percent in FY24, declining from 81 percent in FY12 (Figure 4.2). This decrease in the crop husbandry sector results in the high-value livestock sector's increase from 10 percent to 18 percent

during the same period. This growth in the livestock sector is expected to contribute to improved incomes for farmers. Presently, forestry and logging contribute 5 percent to the AGVA while that of the fishing and aquaculture sector remains at 1 percent.

Figure 4.2: Share of agriculture and its sub-sectors in GSVA in MP



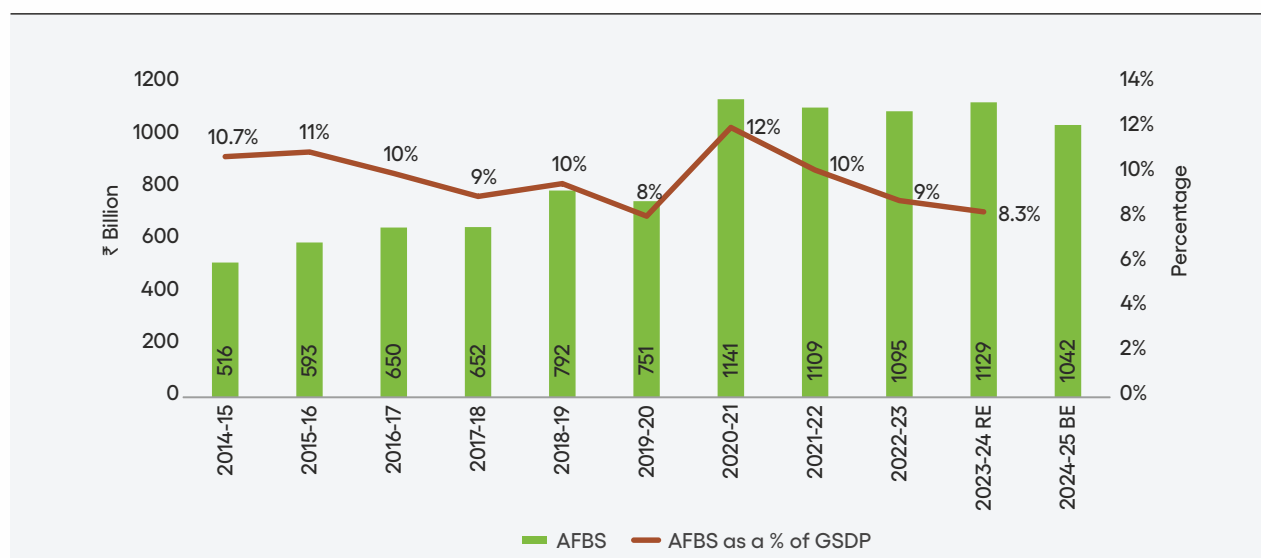
Source: MoSPI, 2024b

4.3 AFBS in MP

Together, the total AFBS (GoMP and GoI) has increased significantly from ₹516 bn (US\$ 8 bn) to ₹1024 bn (US\$ 12 bn) between FY15 and FY25 (BE), peaking at ₹1141 bn (US\$ 15 bn) in FY21 (Figure 4.3). The total AFBS averaged 9 percent of the GSDP between FY15 and FY24 RE, with a peak

of 12 percent in FY21. The total AFBS-GoI has increased substantially from ₹306 bn (US\$ 5 bn) to ₹654 bn (US\$ 8 bn) between FY15 and FY25 (BE), while that of AFBS-GoMP has increased from ₹210 bn (US\$ 3 bn) to ₹388 bn (US\$ 5 bn), during the same period.

Figure 4.3: Trends of AFBS in MP



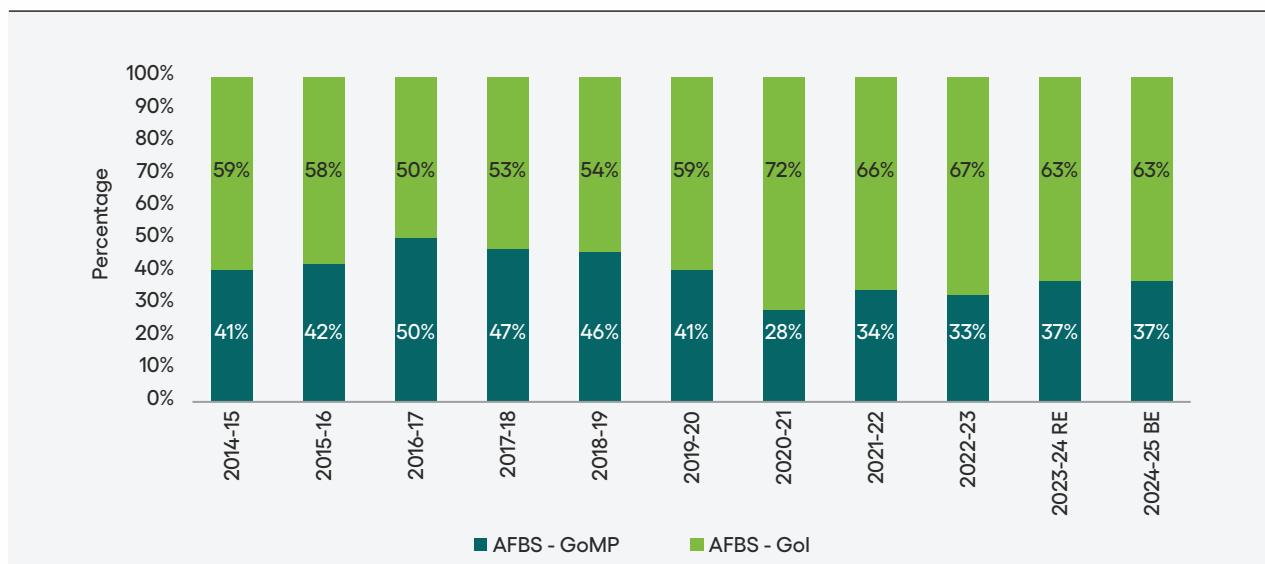
Source: MP State Budget Documents, MoF, CAG

The policies and support under the GoI include fertiliser subsidy, credit subsidy, crop insurance (GoI share), PM-KISAN, MGNREGA (GoI share), food subsidy and CSS for agriculture and allied sector. Similarly, GoMP policies and support included power subsidy, irrigation expenditure (subsidy and capital expenditures), Mukhya Mantri Kisan Kalyan Yojana, loan waiver, crop insurance (GoMP share), MGNREGA (GoMP share), and the total agriculture and allied sectors budget comprising of crop husbandry, animal husbandry, soil and water conservation, forestry and wildlife,

fisheries, agriculture research and development, co-operation and food storage and warehousing.

The share of the GoI support to the total AFBS was 59 percent in FY15, and 63 percent in FY25 (BE), fluctuating with a low of 50 percent in FY17 and a peak of 72 percent in FY21. In comparison, the GoMP share was 41 percent in FY15 and 37 percent in FY25 (BE). It peaked at 50 percent in FY17 and hit a low of 28 percent in FY21 (Figure 4.4). On average, between FY15 and FY25 (BE), the GoI share was 60 percent while the GoMP share was 40 percent.

Figure 4.4: GoI and GoMP share of AFBS in MP



Source: MP State Budget Documents, MoF, CAG

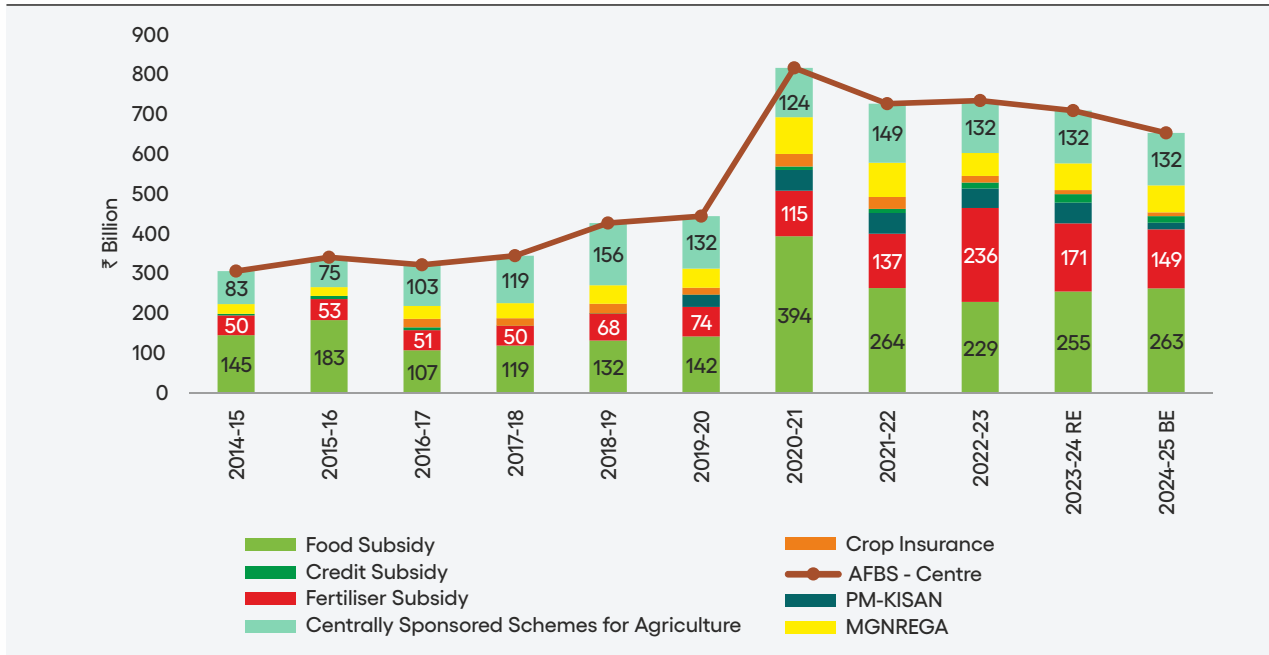
4.3.1 Budgetary support by GoI to MP

The AFBS to MP by GoI has increased from ₹306 bn (US\$ 5 bn) to ₹654 bn (US\$ 7.8 bn) (Figure 4.5) accounting for an average of 6 percent of the GSDP between FY15 and FY25 (BE). Out of the total support, in TE 2024, 60 percent of the support is towards food and fertiliser subsidies (Figure 4.6).

This was followed by CSS accounting for 19 percent, MGNREGA (10 percent), PM-KISAN (7 percent), crop insurance (3 percent) and credit subsidy (2 percent). The main CSS initiatives included are National Agriculture Development Scheme, NFSM, National Mission on Edible Oil, Soil Health and Fertility, RKVY, PKVY, PMKSY, and ATMA.

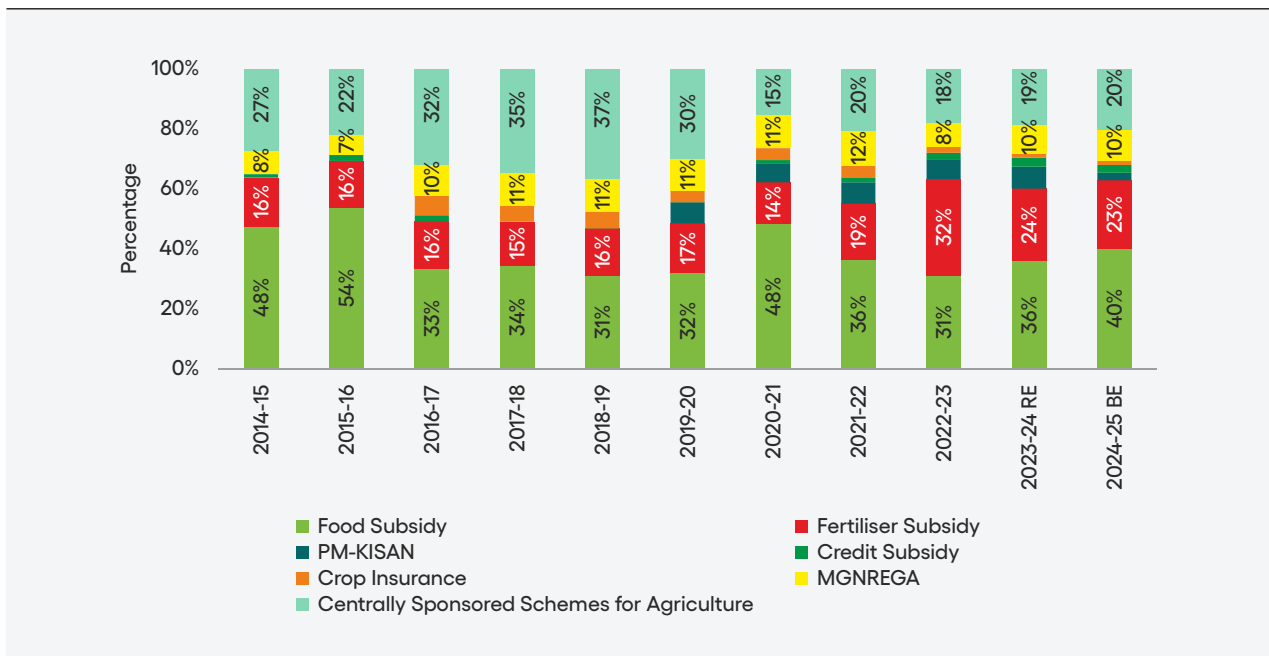


Figure 4.5: Govt support to MP



Source: Authors Calculations using MoF, CAG

Figure 4.6: Govt support to MP



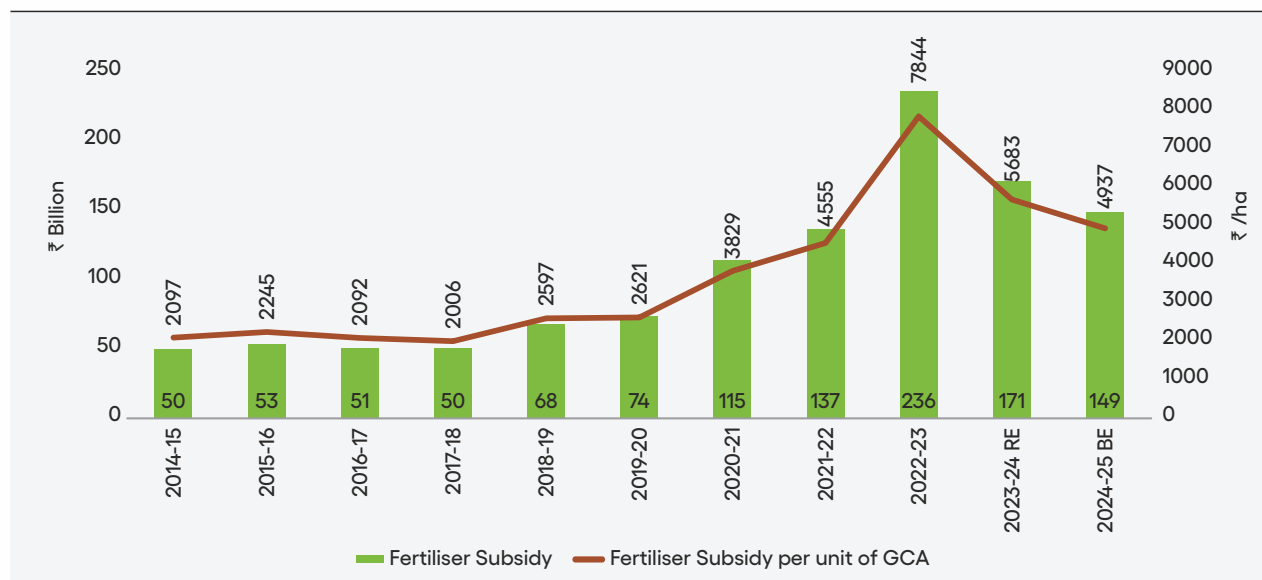
Source: Authors Calculations using MoF, CAG

4.3.1.1 Fertiliser subsidy

In MP, the fertiliser subsidy has increased from ₹50 bn (US\$ 1 bn) in FY15 to ₹149 bn (US\$ 2 bn) in FY25 (BE) (Figure 4.7). The Green Revolution led

HYV and enhanced productivity, leading to an increase in subsidy per unit of cropped area from ₹2,097/ha to ₹4,937/ha during the same period.

Figure 4.7: Fertiliser subsidy for MP

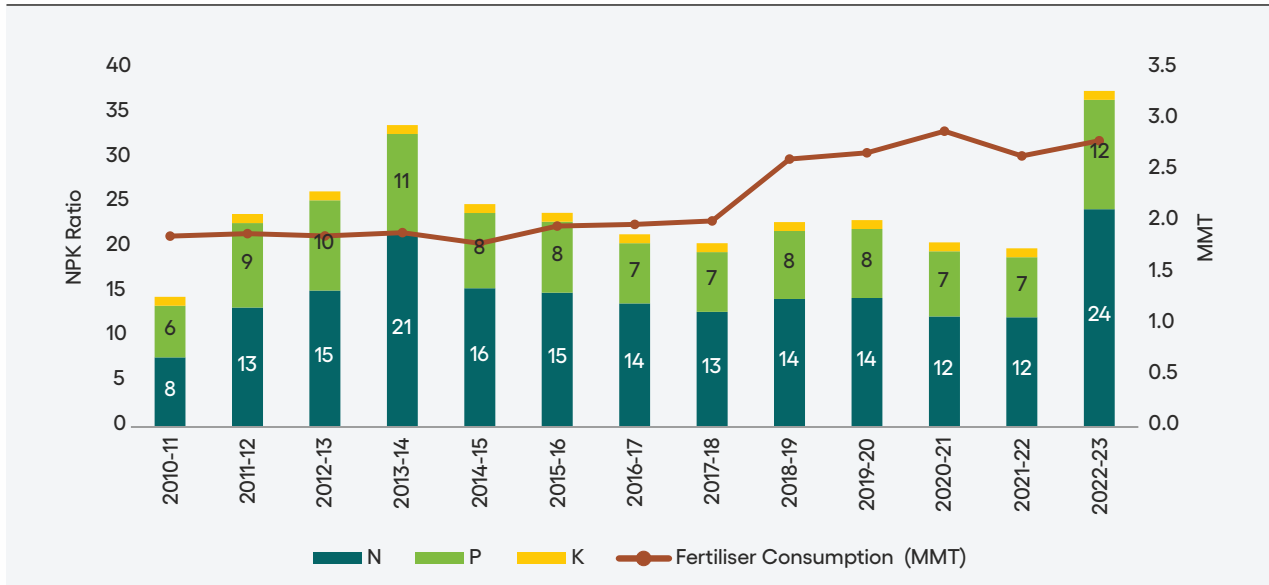


Source: MoF, MoAFWa 2024

In MP, the total consumption of NPK nutrients was 2.8 MMT in 2022-23. The consumption of N has increased from 0.5 MMT in 2000 to 1.82 MMT in 2022-23, while that of P and K have increased from 0.4 MMT to 0.91 MMT and 0.04 MMT to 0.07 MMT respectively during the same period. The share of N has increased from 56 percent of the total consumption to 65 percent between 2000 and 2023. While that of P has decreased from 39 percent and 33 percent and K has remained constant around 3

percent during 2000-2023. The per hectare consumption has increased as well from 46.3 kg/ha to 98.3 kg/ha between 2000 and 2023. This can be further observed through the NPK ratios and their significant difference from the normative ratios as estimated in the literature. The normative ratio for MP in 2009-11 was estimated to be 2.41:2.64:1 (Chand and Sankaran, 2015), which is however, 24:12:1 in 2022-23 (Figure 4.8).

Figure 4.8: NPK consumption and NPK ratios in MP

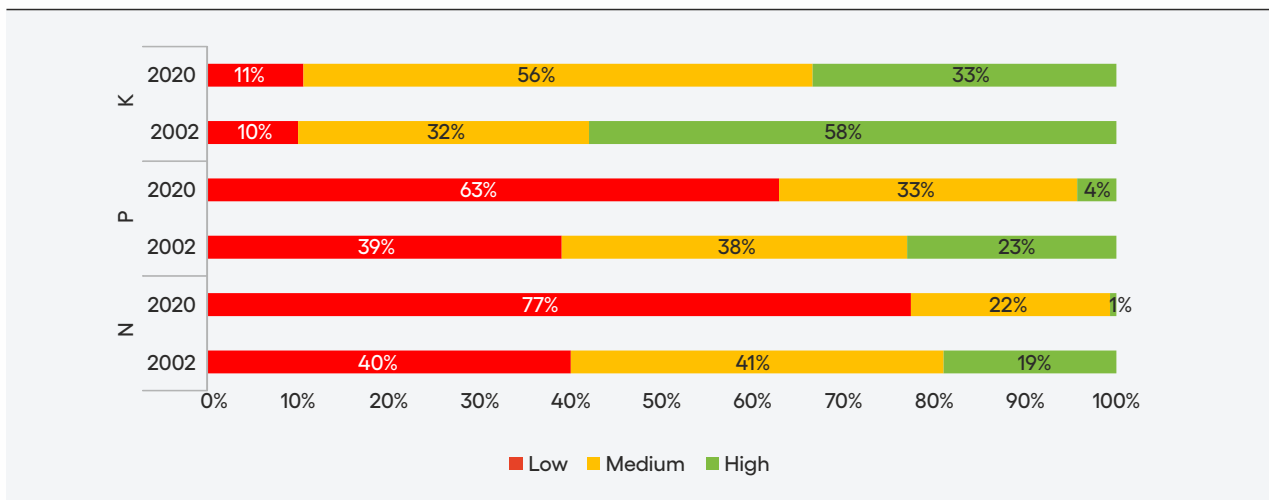


Source: MoAFWb 2024, FAI | Figures in the stack bars are ratios of N, P and K

An examination of the FAI data juxtaposed with that of SHC data indicates shifts in the status of NPK in MP soils between 2002 and 2020 (Cycle I and Cycle II) (Figure 4.9). The percentage of soil samples categorized as low in Nitrogen has surged

significantly, rising from 40 percent in 2002 to 77 percent in 2020 while that of phosphorous has increased from 39 percent to 63 percent of samples categorized as low between 2000 and 2020.

Figure 4.9: Macronutrient status of MP soils



Source: FAI (2000), SHC (2020)

Direct impacts to Target 4, 7, 8 and 11 of the KM-GBF are observed and will become more pronounced in the future. Though MP does not have very high fertiliser consumption per unit of GCA as compared to other states and all-India average, the trends observed in its cropping pattern of moving to a rice-wheat system can pose a greater threat to soil health and other related issues.

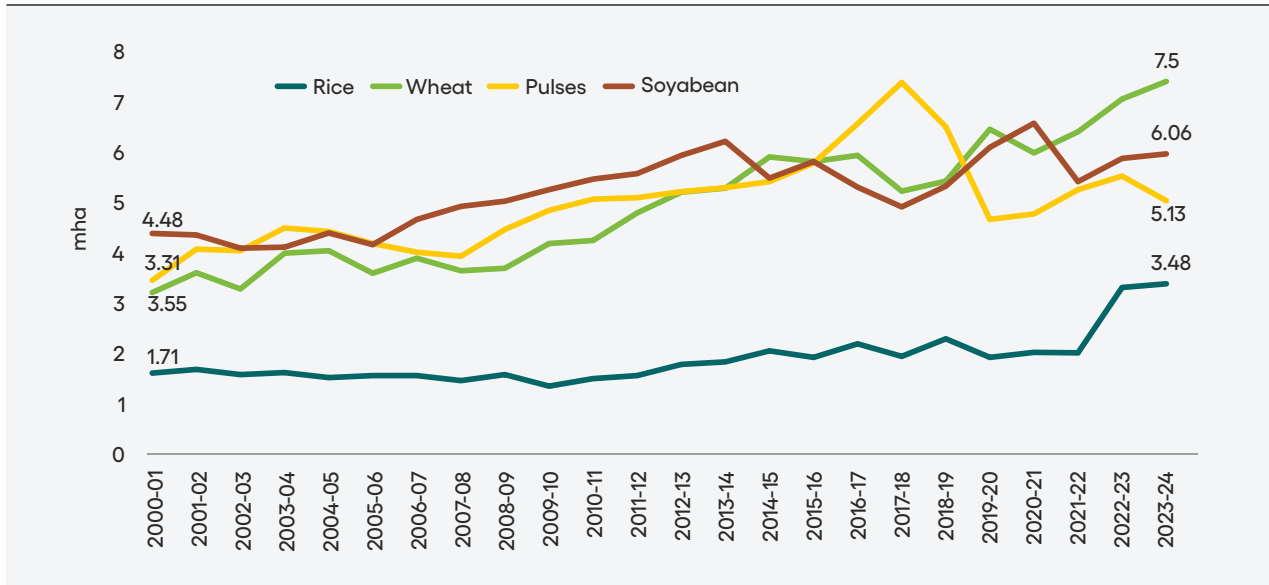
4.3.1.2 MSP for procurement and food subsidies

In MP, the PDS plays a crucial role in distributing free foodgrains to over 51.8 mn eligible beneficiaries. The state's food management policy encompasses the procurement of foodgrains from farmers at MSP, providing affordable foodgrains to consumers, especially the most vulnerable sections of society, and maintaining food buffer stocks for security and price stability. The state's food subsidy trends show that it has increased from ₹145 bn (US\$ 2 bn) in FY15 to ₹263 bn (US\$ 3 bn) in FY25 (BE). Price incentives and assured procurement have encouraged farmers to shift towards cultivating more profitable crops, moving away from traditional cropping patterns. This shift is particularly evident in the expansion of wheat and rice cultivation over the years.

In MP, the area under rice cultivation increased significantly from 1.71 mha in 2000-01 to 3.48 mha in 2023-24. Similarly, the area under wheat

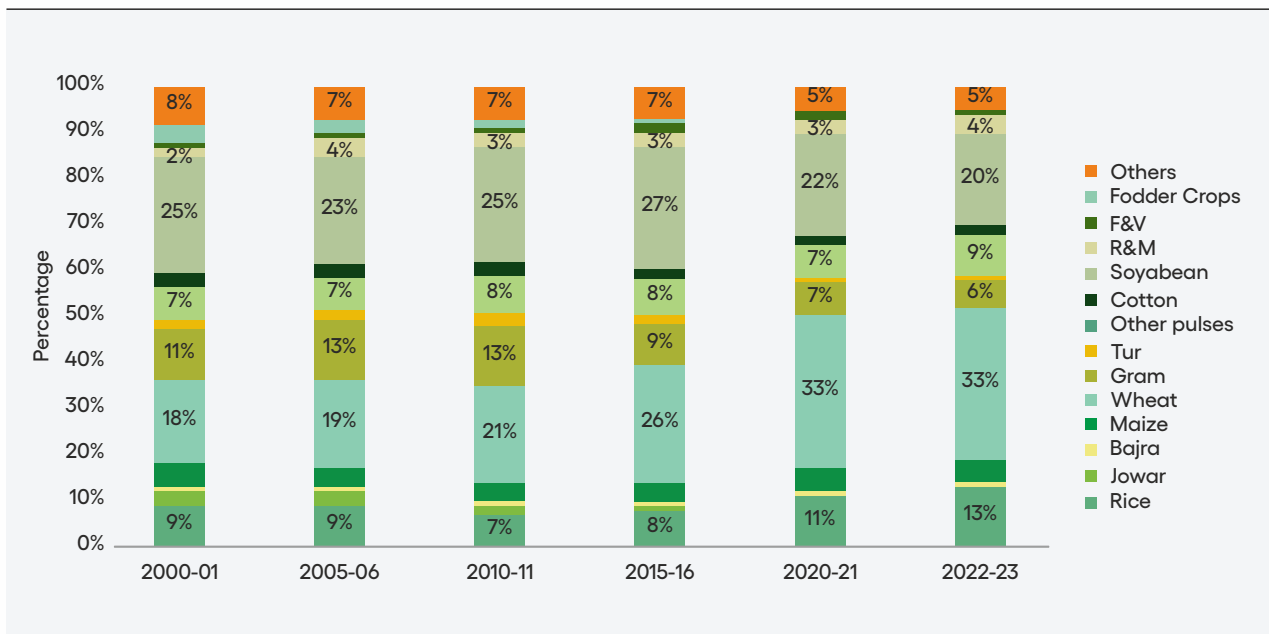
cultivation rose from 3.31 mha to 7.5 mha during the same period (**Figure 4.10**). Consequently, rice's share in the GCA grew from 9 percent in 2000-01 to 13 percent in 2022-23, while wheat's share increased from 18 percent to 33 percent during the same period (**Figure 4.11**). Although the cultivation areas of other major crops like pulses and soyabean have also expanded—from 3.55 mha to 5.13 mha for pulses and from 4.48 mha to 6.06 mha for soybean between 2000-01 and 2023-24—their shares in GCA have declined. Pulses dropped from 20 percent to 16 percent, and soybean from 25 percent to 20 percent between 2000-01 and 2022-23. Within the pulses category, the share in GCA exhibits a mixed trend. The share of gram declined from 11 percent to 6 percent, and tur decreased from 2 percent to 1 percent, whereas other pulses saw an increase from 7 percent to 9 percent. Similarly, the share of jowar dropped sharply from 3 percent to 0.3 percent, and fodder crops experienced a significant reduction from 4 percent to just 0.01 percent between 2000-01 and 2022-23.

Figure 4.10: Area under major crops in MP



Source: MoAFWc 2024

Figure 4.11: Cropping pattern in MP



Source: MoAFWa 2024

Enhanced irrigation practices, coupled with the GoMP bonus policy on the MSP for wheat, surpassed the central MSP and played a pivotal role in augmenting wheat production and procurement from 2007–08 to 2014–15. During this period, the state offered a bonus on MSP above the central MSP for wheat, starting at ₹100 per quintal from 2007–08 to 2012–13 and later increasing to ₹150 per quintal in 2013–14 and 2014–15 (Gulati et. al, 2021). Consequently, government wheat purchases from the state surged, rising from approximately 2 percent of total wheat procurement in TE 2002–03

to a noteworthy 23 percent in TE 2016–17. This notable increase positioned MP as the third-largest contributor to wheat procurement, with 58 percent in TE 2021-22 (FCI). Interestingly enough, the area, production, and procurement of rice have been increasing as well. Area under rice has increased from 9 percent to 12 percent between TE 2003 and TE 2022. The production was 4.7 MMT, with a yield of 2246 kg/ha during TE 2022. Owing to this, the procurement of rice as a percentage of production has also been steadily increasing.

“With the increase in procurement of wheat and rice in MP, it will soon discourage farmers from crop diversification and turn MP to the likes of Punjab and Haryana. This will have an impact of Targets 4, 8, 16 and 16 of the KM-GBF.

Sardana and Vijayshankar (2024), study the expansion of rice cultivation in MP and show the change in share of cropping area of rice from traditional rice zones to non-traditional zones. Out of the 11 agro-climatic zones in MP, 3 (Chhattisgarh plains, Northern Hills Region, Kymore Plateau and Satpura Hills) are classified as traditional zones, 2 (Central Narmada Valley and Vindhyaachal Plateau) are classified as non-traditional zones and all the rest as other zones. In 2004–05 the traditional rice-growing zones, accounted for 83 percent of the rice acreage and production while non-traditional zones, contributed 6 percent of the rice area and 9 percent of the production, while other zones made up 11–12 percent of the rice area and production. By 2019–20, these proportions shifted significantly. The traditional zones' share in rice acreage and production declined to around 70 percent, offset by a notable rise in the non-traditional zones, which now contributed 18 percent of the rice area and 17 percent of the

production. The share of other zones in rice area and production remained largely unchanged during this period.

A combination of factors, including advancements in research on new paddy varieties, decentralized procurement ensuring an assured market, incentives for private players to enhance milling capacity, and support for companies focusing on special rice varieties for export and urban markets, has driven rice production in the state along these pathways. Field experiences suggest that similar strategies could be extended to other crops, particularly pulses and oilseeds, to promote crop diversification and reduce reliance on monocropping systems. This approach need not compromise food security if the concept of buffer stocks is expanded to include oilseeds, pulses, and millets. However, crop diversification incentive scheme and 'One District One Product' initiative are a step in the right direction.

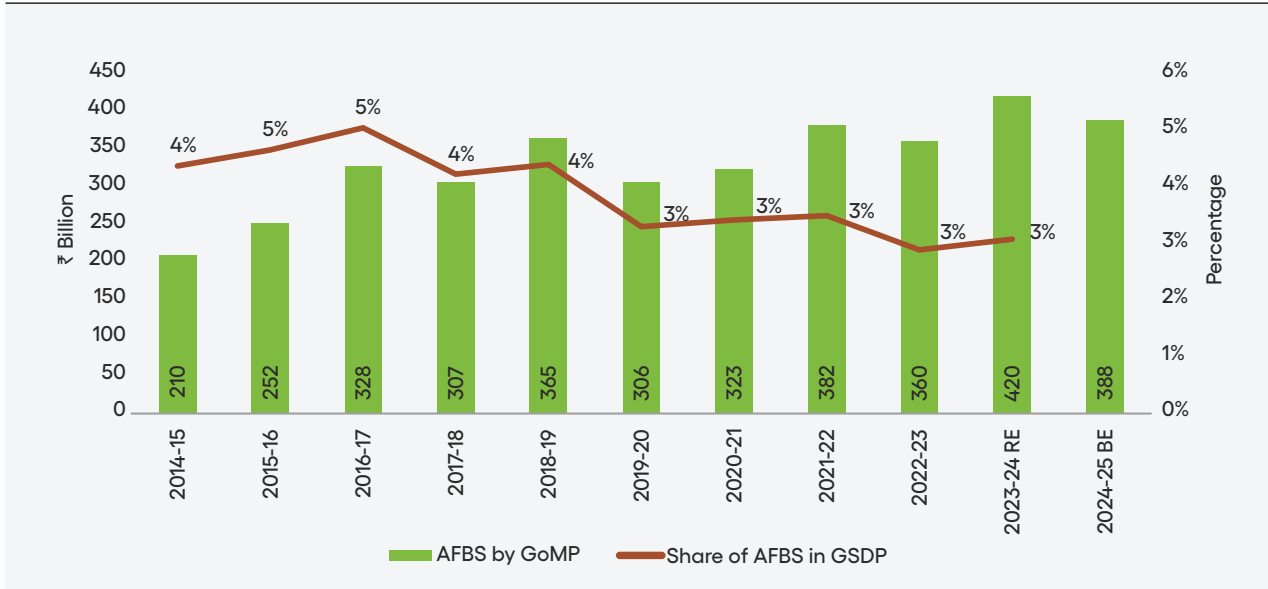
Crop insurance, PM-KISAN and credit subsidies provided to MP by GoI are efforts to boost farmers' income. These are decoupled support and are neutral with respect to their impact on biodiversity. The main objective of MGNREGA is to augment livelihoods of millions of rural families. However, indirect impacts like improved vegetation, retaining of soil moisture, and arresting of soil erosion are the positive environmental impacts of MGNREGA.

4.3.2 Budgetary support by GoMP

The total AFBS-GoMP has increased substantially from ₹210 bn (US\$ 3 bn) to ₹388 bn (US\$ 5 bn) between FY15 and FY25 (BE) which accounted for

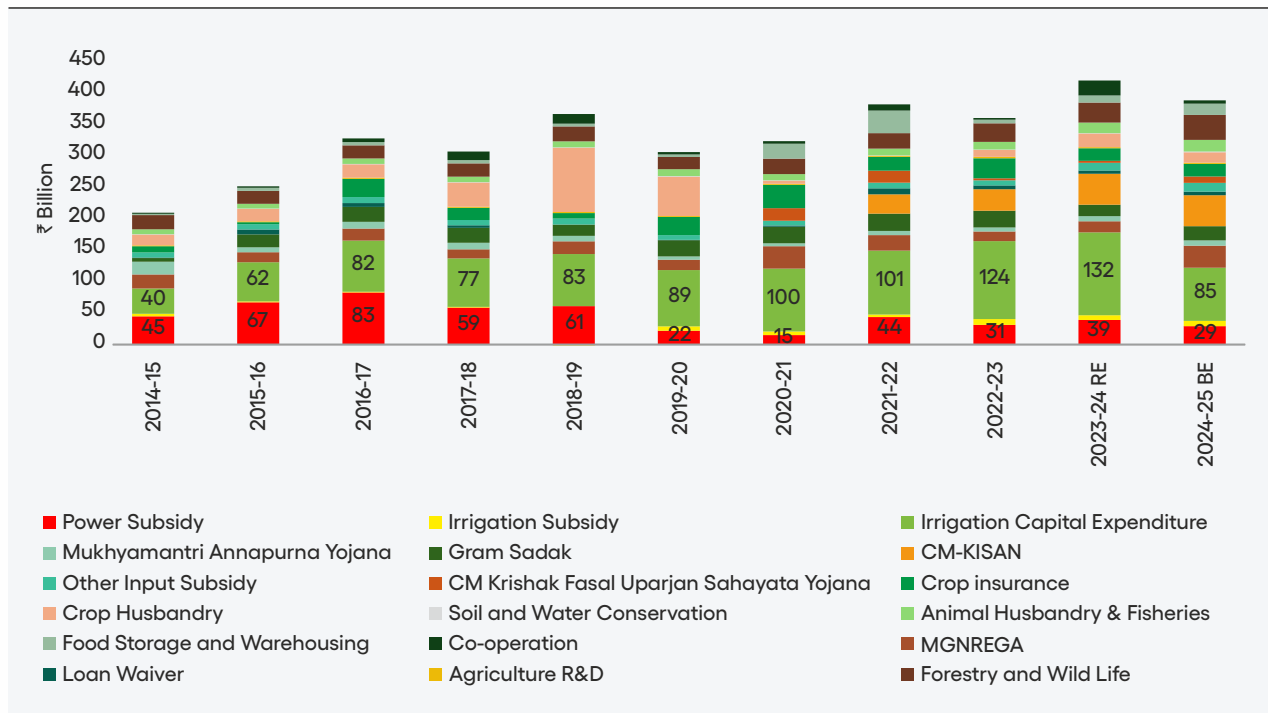
an average of 4 percent share in the GSDP in (Figure 4.12). The major support came from capital expenditure on irrigation, CM-KISAN and power subsidy (Figure 4.13) which accounted for half the support in TE 2023-24 (Figure 4.14).

Figure 4.12: AFBS by GoMP



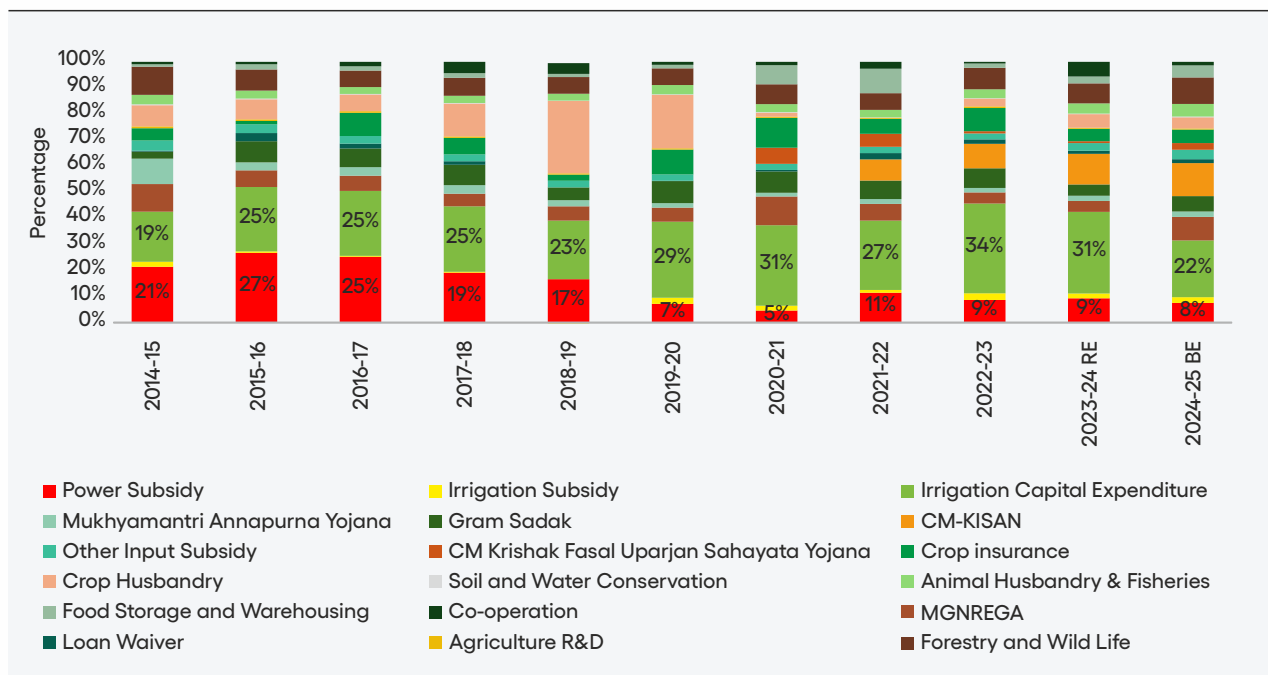
Source: MP State Budget Documents, CAG, MoSPI (2024b)

Figure 4.13: Category-wise AFBS by GoMP



Source: MP State Budget Documents, CAG

Figure 4.14: Category-wise AFBS by GoMP



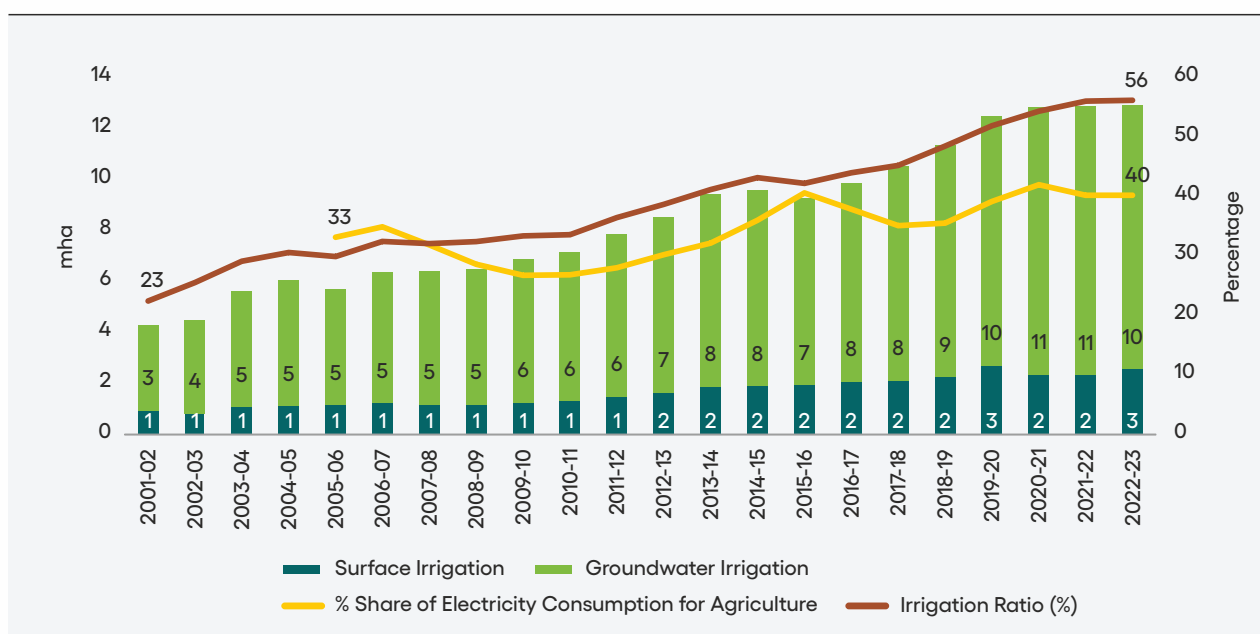
Source: MP State Budget Documents, CAG

4.3.2.1 Irrigation schemes and power subsidy

Acting as a significant driver of growth in MP, electricity consumption has undergone a substantial increase from 7001 GWh in the triennium ending (TE) 2008 to 25061 GWh in TE 2022. This surge has resulted in the share of agriculture electricity consumption rising from 33 percent to 40 percent during the same period (Figure 4.15). The gross irrigated area in MP has

also witnessed growth, expanding from 3 mha to 10 mha between 2001-02 to 2022-23, propelled primarily by capital expenditure on irrigation and an assured electricity supply. In 2000-01, the irrigation ratio in MP started at 23 percent, lagging behind the All-India average by 17.2 percentage points. However, by 2013-14, this ratio had climbed to 41.2 percent, narrowing the gap to 6.2 percent—an impressive feat for the state. In 2021-22, the irrigation ratio in MP reached 56 percent, surpassing the national average.

Figure 4.15: Irrigation and electricity expansion in MP

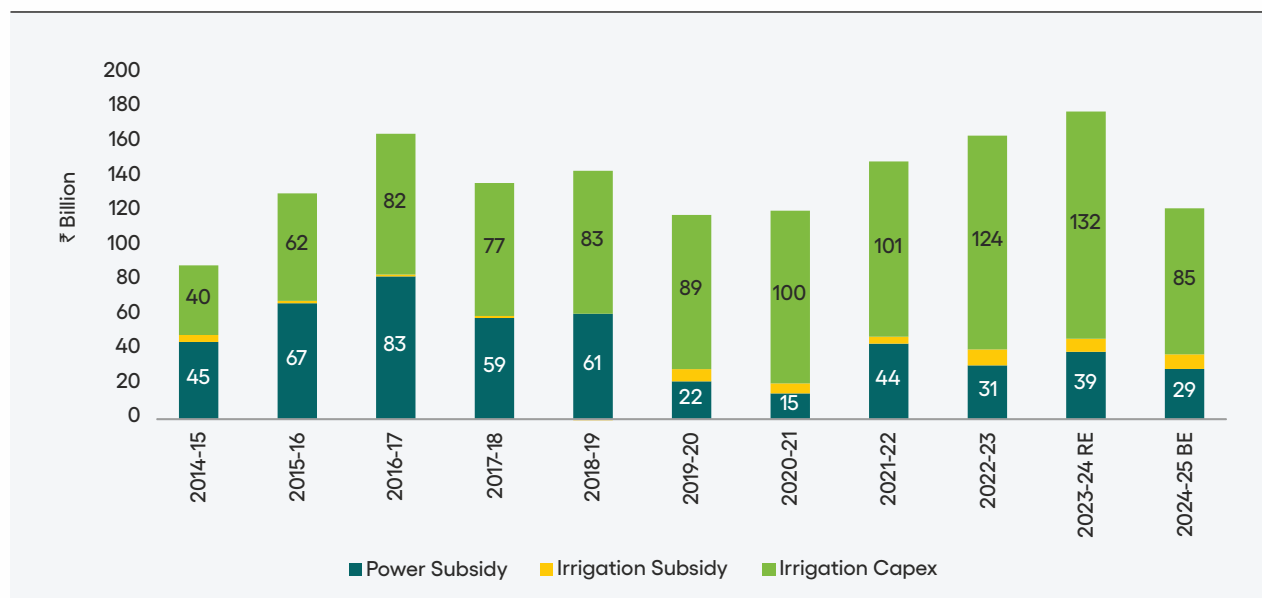


Source: MoAFWb 2024

During TE 2025, out of the total AFBS from GoMP, capital expenditure on irrigation constituted 33 percent, totalling ₹155 bn (US\$ 2 bn). The irrigation subsidy made up 2 percent of the total, amounting to ₹8 bn (US\$ 98 mn) (Figure 4.16), while the power subsidy accounted for 7 percent, totalling ₹33 bn (US\$ 0.4 bn) in TE 2025. Despite

an increase in irrigation subsidy from ₹4 bn (US\$ 65 mn) in FY15 to a peak at ₹9 bn (US\$ 109 mn) in FY24, irrigation capital expenditure has steadily risen from ₹40 bn (US\$ 0.6 bn) in FY15 to ₹85 bn (US\$ 1 bn) in FY25 (BE), with a peak at ₹132 bn (US\$ 1.5 bn) in FY23.

Figure 4.16: Expenditure on irrigation and power in MP



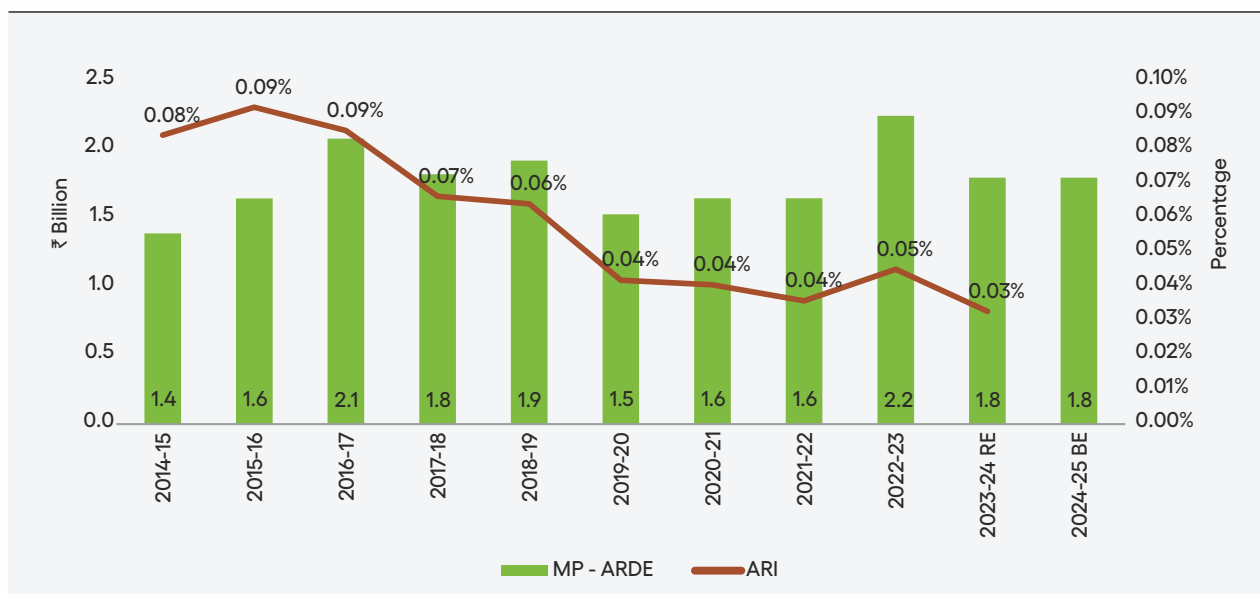
Source: MP State Budgets Documents

This expenditure has translated into an increase in gross irrigated area. Analyzing source-wise irrigation data, it is evident that dug wells and tubewells constitute the majority, accounting for 66 percent, followed by government canals at 21 percent, other sources at 14 percent, and tanks/ponds at 2 percent. The most notable surge in expanding irrigation coverage occurred through tubewells, with canals following closely behind. Private sector investment has also played a pivotal role in incentivizing the expansion of irrigation through tubewells, wells, ponds, and tanks. This encouragement was facilitated by the establishment of a robust procurement system and the assurance of electricity provided by the government. Additionally, canal irrigation in MP exhibited robust growth across all river basins (Gulati et al, 2021). The Madhya Pradesh State Water Policy, 2022 has been developed to address the state's evolving water needs and challenges, updating the 2003 policy to focus on conservation, storage, management, and control of water resources.

4.1.1.1 Agriculture R&D in MP

Through the vast network of ICAR, MP has research institutes and State Agricultural Universities (SAUs) that are involved in conducting R&D activities through their network of 113 establishments. The SAUs are Rajmata Vijayaraje Scindia Krishi Vishwavidyalaya, Gwalior; Nanaji Deshmukh Pashu Chikitsa Vishwavidyalaya, Jabalpur; and Jawaharlal Nehru Krishi Viswa Vidyalaya, Jabalpur. The research institutes include the National Institute of High-Security Animal Diseases, Bhopal; Indian Institute of Soil Science, Bhopal; Directorate of Weed Research, Jabalpur; Central Institute Of Agricultural Engineering, Bhopal; Agricultural Technology Application Research Institute, Jabalpur; and Indian Institute Of Soybean Research, Indore. The state's expenditure on agriculture R&D has increased from ₹1.4 bn (US\$ 23 mn) in FY15 to ₹1.8 bn (US\$ 22 mn) in FY25 (BE). The ARI however decreased from 0.08 percent to 0.03 percent in the same period (Figure 4.17).

Figure 4.17: MP's ARDE expenditure & ARI



Source: MP State Budget Documents, NAS

Some key initiatives highlighted by the state include: The government's "Krishi-Unnati" programme aims to provide essential services to farmers through technologically integrated platforms. The MP Kisan Mobile App offers centralized land and agriculture-related information and services. The Unique Farmer ID (UFID) programme creates an integrated farmer database for localized data-driven planning, accurate estimations of crop area and production, streamlined claim settlements, and increased farmers' income. (MP Economic Survey 2022-23).

The National Mission on Agriculture Extension, known as "ATMA," was launched to acknowledge and promote innovative farmers in the state, particularly in the realm of agriculture mechanization. The state has spent ₹0.7 bn (US\$ 10 mn) in TE 2022 for the same. The scheme is designed to strengthen the agriculture extension system, making it more farmer-centric and accountable.

4.3.2.3 Demand-based Agriculture Diversification Scheme

MP's diverse agro-climatic zones and weather conditions offer significant potential for expanding demand-driven, market-oriented crops. To leverage this, an incentive scheme for crop diversification was launched in 2022-23. The scheme targets crops not covered under the MSP system—such as pulses, oilseeds, horticulture, medicinal plants, and other market-focused crops—grown as alternatives to traditional staples like wheat and rice.

So far, 12 proposals have been approved by the Ministerial Committee on Budget Programme and Coordination, with two additional proposals awaiting final approval after clearance from the State-Level Project Screening Committee. Approved institutions are actively engaging farmers to shift from wheat and rice to more profitable crops, including spices, vegetables, tulsī, coriander, peas, alfalfa, potatoes, bamboo, chili,

sericulture, sugarcane, pulses, sesame, corn, millets, and medicinal plants like ashwagandha, safed musli, and fenugreek. A total investment of ₹2.75 bn has been allocated for diversification over 18,625 ha. This includes ₹1.7 bn from institutions and farmers, ₹0.68 bn under the Crop Diversification Scheme, and ₹0.3 bn from the National Bamboo Mission.

4.3.2.4 Madhya Pradesh State Millet Mission

Millet Mission Scheme was launched in FY24 to expand millet cultivation, boost production and productivity, and promote advanced millet farming practices and products. The initiative focused on increasing the cultivation, production, and productivity of millet crops such as sorghum, pearl millet, finger millet, and foxtail millet, while also building a strong brand value for millet-based products. A budget of ₹110 mn was allocated for the

scheme, with ₹42 mn spent so far, benefiting approximately 62,290 farmers.

4.3.2.5 One District One Product Initiative

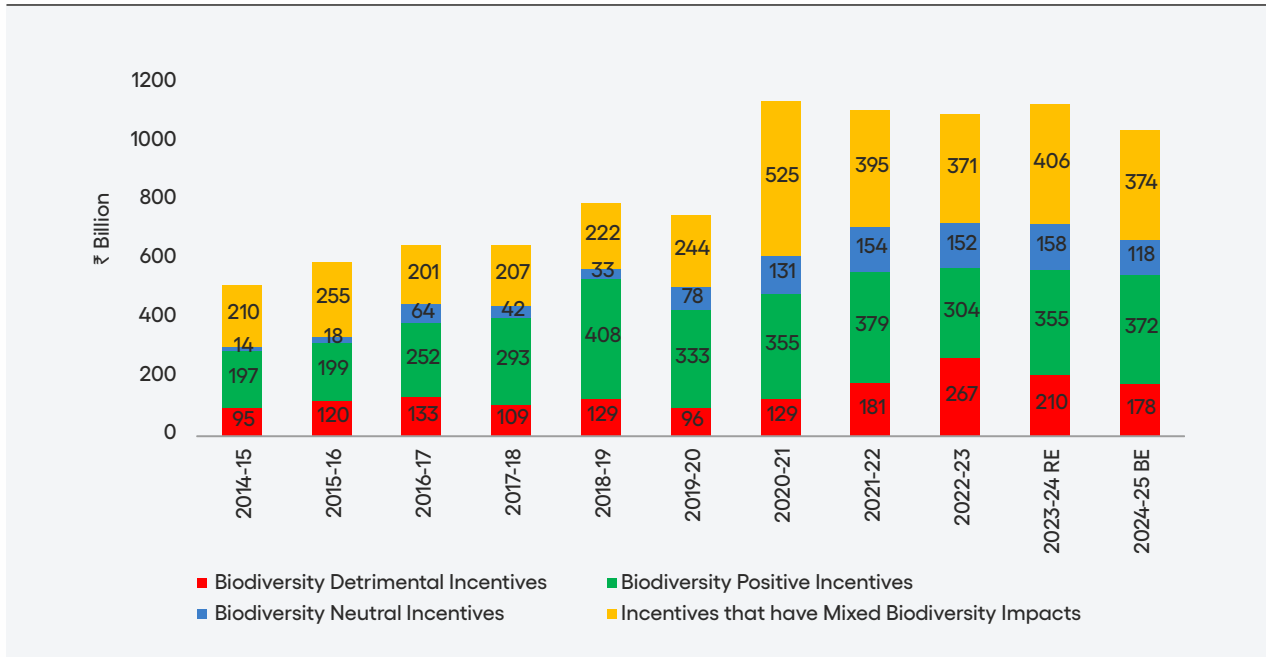
To ensure efficient resource utilization and improve the production capacity and quality of local products, it is essential to develop robust systems for branding and marketing. Under the 'One District One Product' initiative, efforts are underway at the district level to identify unique products and establish their recognition on national and international platforms. The Industrial Policy Investment and Promotion Department serves as the nodal agency for this initiative. As part of the scheme, six key agricultural products—millet, pigeon pea, chickpea, basmati rice, chinnor rice, mustard, and gooseberry—have been identified in ten districts: Anuppur, Dindori, Mandla, Singrauli, Narsinghpur, Damoh, Raisen, Balaghat, Bhind, and Morena.

4.4 Categorization of AFBS in MP

The agrifood budgetary support to Madhya Pradesh averaged ₹1111 bn (US\$ 14.2 bn) in TE 2024 (RE), with ₹387 bn (US\$ 4.9 bn) coming from the GoMP and ₹724 bn (US\$ 9.2 bn) coming from the GoI. The support from the central government was in the form of fertiliser subsidy, food subsidy, MGNREGA, PM-KISAN, credit subsidy, crop insurance and CSS for agriculture and allied sector coming from various ministries. The support from the GoMP was in the form of power subsidy, irrigation subsidy and capital expenditure, MGNREGA, loan waivers, crop insurance, CM-KISAN, input support from agriculture and allied sector, and the total budget of the department of agriculture and allied sector.

For our analysis the impact of this support on agrobiodiversity, we classify the support into four categories with ₹166 bn (US\$ 2.1 bn) in TE 2024 having detrimental impacts for the NBSAPs (**Figure 4.18**). This support is from fertiliser subsidy. Support in the form of overall development of agriculture is classified as having positive biodiversity impacts, which averaged at ₹346 bn (US\$ 4.4 bn). Income support to the tune of ₹155 bn (US\$ 2 bn) was found to be neutral in terms of its impacts on biodiversity. Support having mixed impacts on biodiversity with ₹429 bn (US\$ 5.5 bn) came from food subsidy, power subsidy and irrigation expenditures.

Figure 4.18: Categorization of AFBS in MP

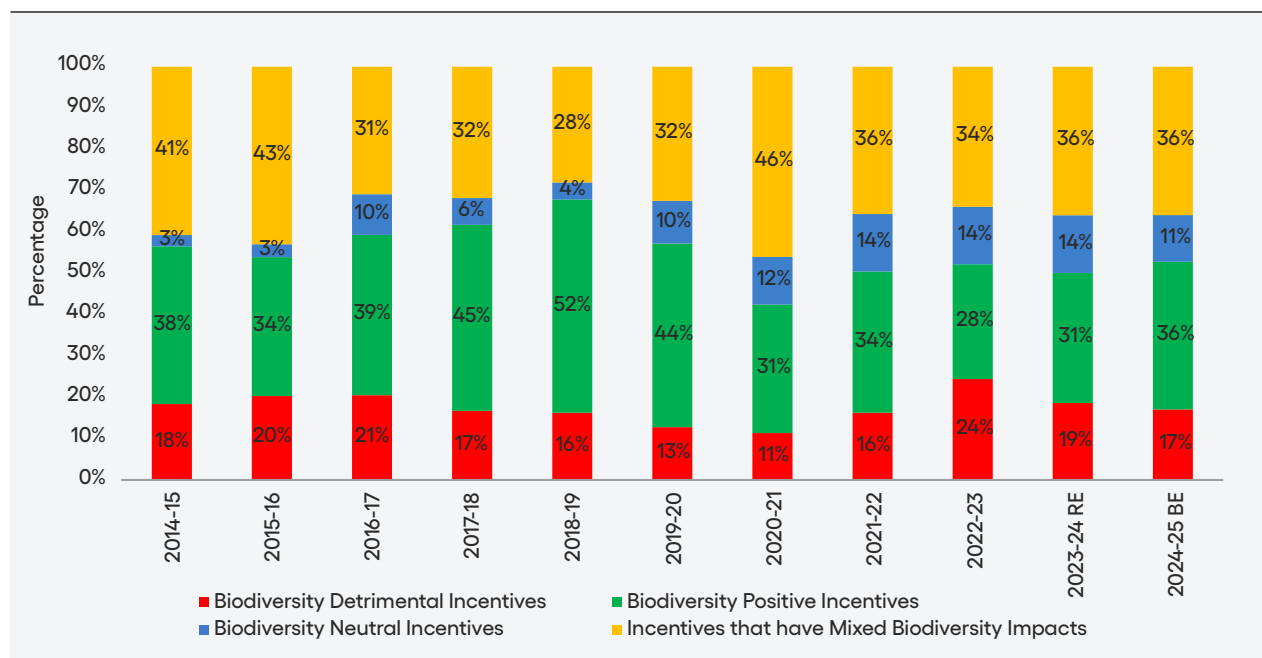


Source: Authors compilation based on MoF, MP State Budget Documents, CAG

In TE 2024 RE, the largest shares accounting for 39 percent and 32 percent, came from incentives having mixed and positive biodiversity impacts

respectively (Figure 4.19). Neutral support accounted for 14 percent while the detrimental incentives were only 15 percent during the same period.

Figure 4.19: Categorization of AFBS in MP

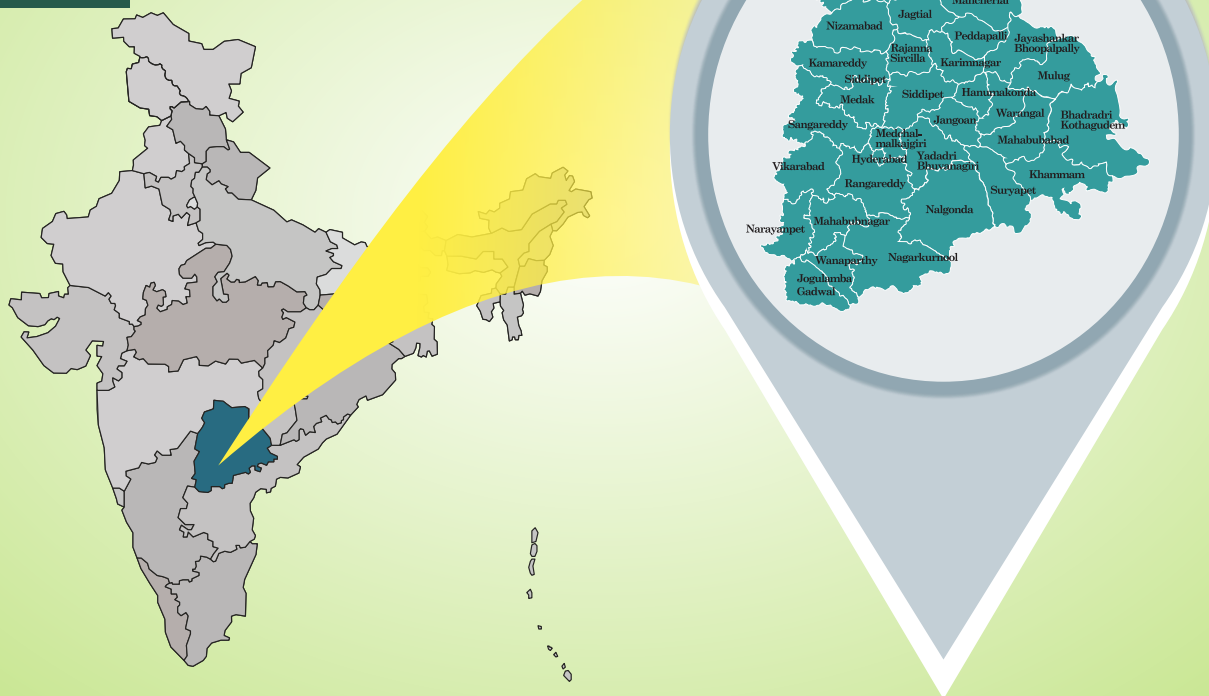


Source: Authors compilation based on MoF, MP State Budget Documents, CAG

MP, is abundant in natural resources, with vast forest cover and a rich diversity of ecosystems. The state is home to an array of wildlife, making it a key region for biodiversity in India. Its natural wealth, including forests, wildlife, water bodies, and mineral resources, forms an essential part of its heritage and is vital for both present and future needs. Renowned as one of the country's major breadbaskets, MP thrives as an agrarian state, where fertile soil and varied climatic zones support a diverse agricultural landscape.

The state's agricultural systems are varied, ranging from rice-wheat cropping in the Kymore Plateau

and Satpura Hills to wheat-jowar combinations in the Gird Region and Bundelkhand. However, policies such as assured procurement for wheat and rice, power and irrigation subsidies, and bonus MSP for wheat have led to a dominance of these two crops, leading to a reduction in nitrogen-fixing pulses. To encourage crop diversification, refocusing the PDS on a more varied and nutritious food basket could be beneficial. While initiatives like the MP Millet Mission and Demand-Based Agriculture Diversification Scheme promote agrobiodiversity, further efforts are needed to align with the goals outlined in the NBSAP.



Telangana: Agrifood budget

Support by Gol and GoT

Established in 2014, Telangana, the 29th state of India is a crucial player in nation's agriculture. This chapter explores the policies and the budgetary trends of agrifood sector in Telangana over the past decade, highlighting growth, challenges, and implications on agrobiodiversity. This trend underscores the urgent need for policy realignment to promote more balanced cropping patterns, which the state is already exploring.



5.1 Overview of Telangana

The Telangana region was part of Hyderabad state from September 17, 1948, to November 1, 1956, when it merged with Andhra state to form Andhra Pradesh. On June 2, 2014, Telangana was carved out of Andhra Pradesh, becoming the 29th state of the Indian Republic. The state covers an area of 11.2 mha and has a population of 38 mn. The state is bordered by Maharashtra and Chhattisgarh to the north, Karnataka to the west, and Andhra Pradesh to

the south and east. The state comprises of 33 districts.

In FY24, the size of Telangana's economy was ₹15 tn (US\$ 182 bn), with the GSVA standing at ₹13.8 tn (US\$ 167 bn). Between 2014-15 and 2023-24, the state's AAGR for its GSDP was 7.5 percent higher than the national average of 6 percent. Detailed statistics of the state are given below in **Appendix V**.

5.2 Overview of agriculture and allied sector of Telangana

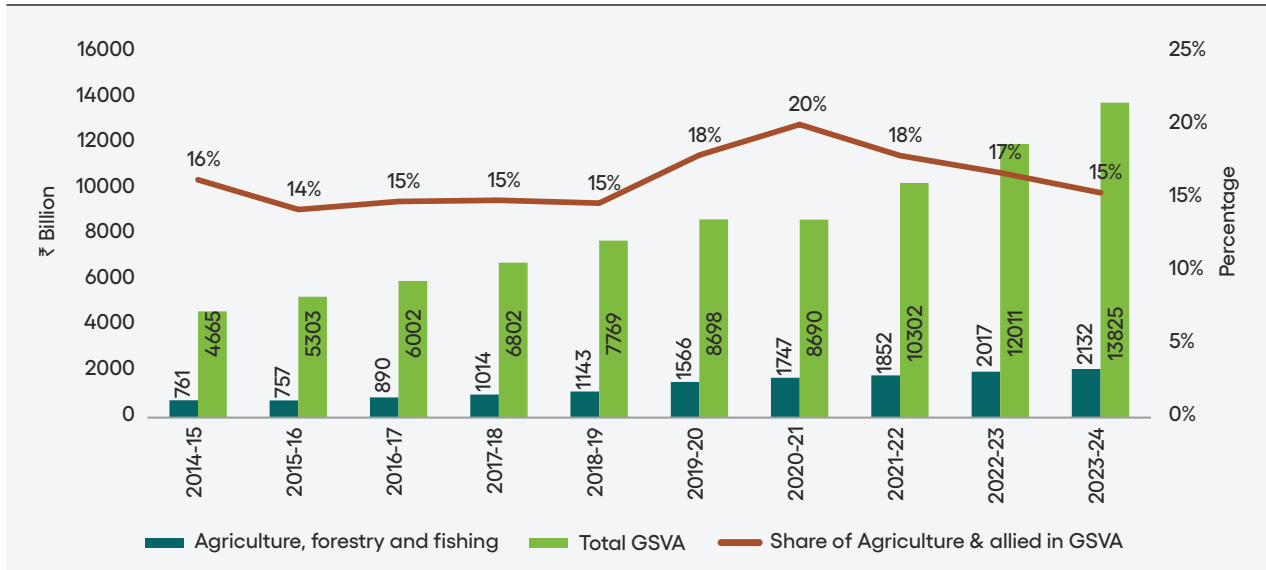
With 53 percent (5.9 mha) of the total reporting area for land utilisation, Telangana's agriculture contributes 15 percent to the state GVA, almost close to India's share of agriculture in GVA of 17.7 percent. Telangana accounts for 4 percent of India's net sown area and has a cropping intensity of 157.3 percent. The important crops grown are rice (4.9 mha), cotton (2 mha) and maize (0.5 mha). 79 percent of the area is grown in kharif and the remaining 21 percent is cultivated in rabi. The average size of landholding in Telangana is 1 ha, similar to that of India's of 1.08 ha. Agriculture employed 42.49 percent of the workforce in 2023-24 and provided an average monthly agricultural

household income of ₹9,403 (US\$ 137) remains below the national average of ₹10,218 (US\$ 149) (SAS, 2018-19).

Much like its impressive GDP growth, the AGVA) growth in Telangana stands out. From FY15 to FY24 AAGR of agriculture in Telangana is 1.5 times that of India, registering at 5.6 percent compared to India's 3.75 percent (constant prices). In FY24, the GVA from agriculture in Telangana reached ₹2.1 tn (US\$ 25 bn), constituting a significant 15 percent of the state's GSVA at current prices (**Figure 5.1**).



Figure 5.1: GSVA and percentage share of agriculture & allied sector in Telangana

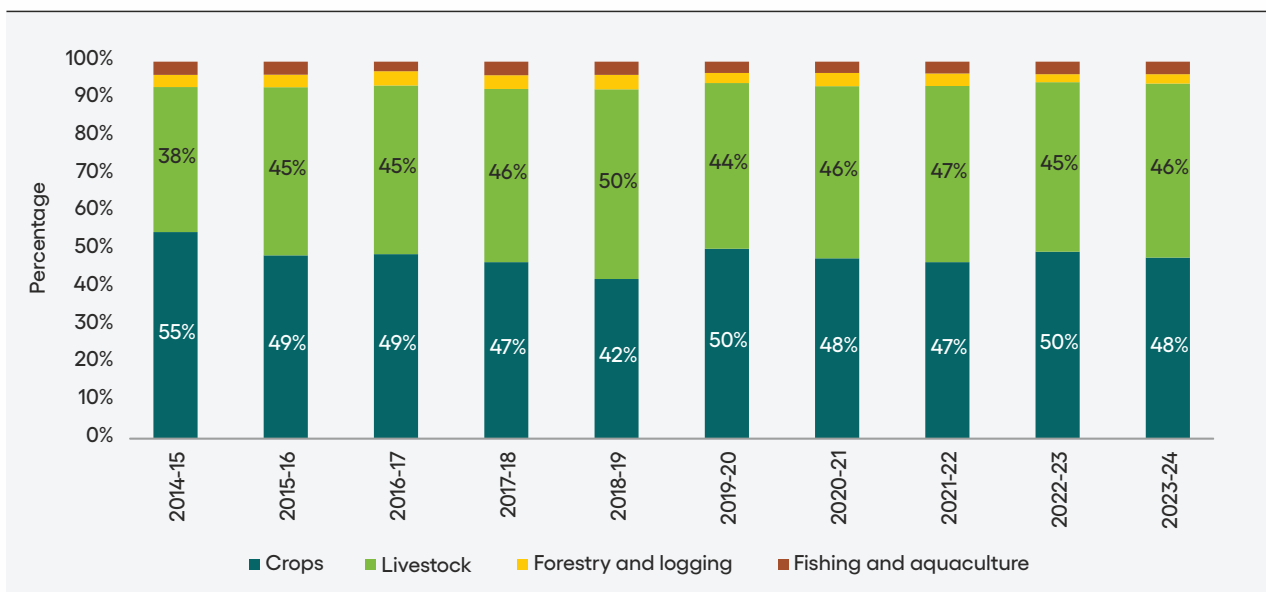


Source: MoSPI (2024b)

Within the agricultural sector, the crop husbandry sector maintains a major contribution, accounting for 48 percent between FY15 to FY24 (Figure 5.2)

while livestock sector comes a close second at 43 percent. Forestry and logging as well as fisheries contribute 3 of the AGVA.

Figure 5.2: Share of agriculture and its sub-sectors in GSVA in Telangana



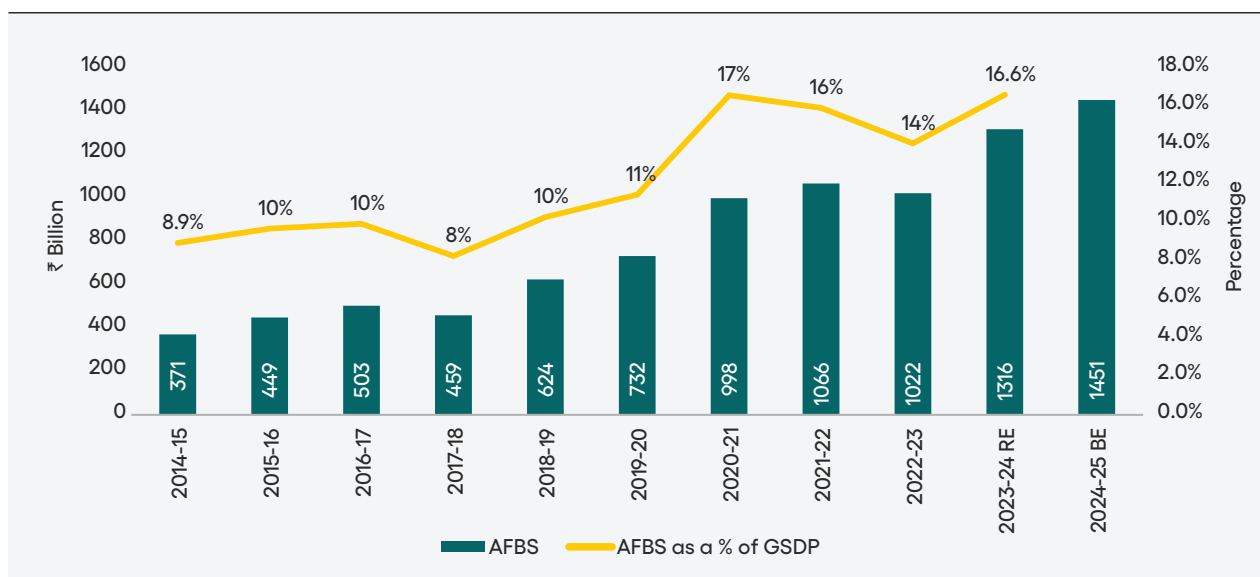
Source: MoSPI (2024b)

5.3 AFBS in Telangana

Together, the total AFBS (GoT and GoI) has increased significantly from ₹347 bn (US\$ 6 bn) to ₹1412 bn (US\$ 17 bn) between FY15 and FY25 (BE) (Figure 5.3). The AFBS averaged 12 percent of the GSDP between FY15 and FY24 (RE). The

AFBS-GoI has increased substantially from ₹143 bn (US\$ 2 bn) to ₹417 bn (US\$ 5 bn) between FY15 and FY25 (BE), while that of AFBS-GoT has increased from ₹228 bn (US\$ 4 bn) to ₹1034 bn (US\$ 12 bn), during the same period.

Figure 5.3: Trends of AFBS in Telangana

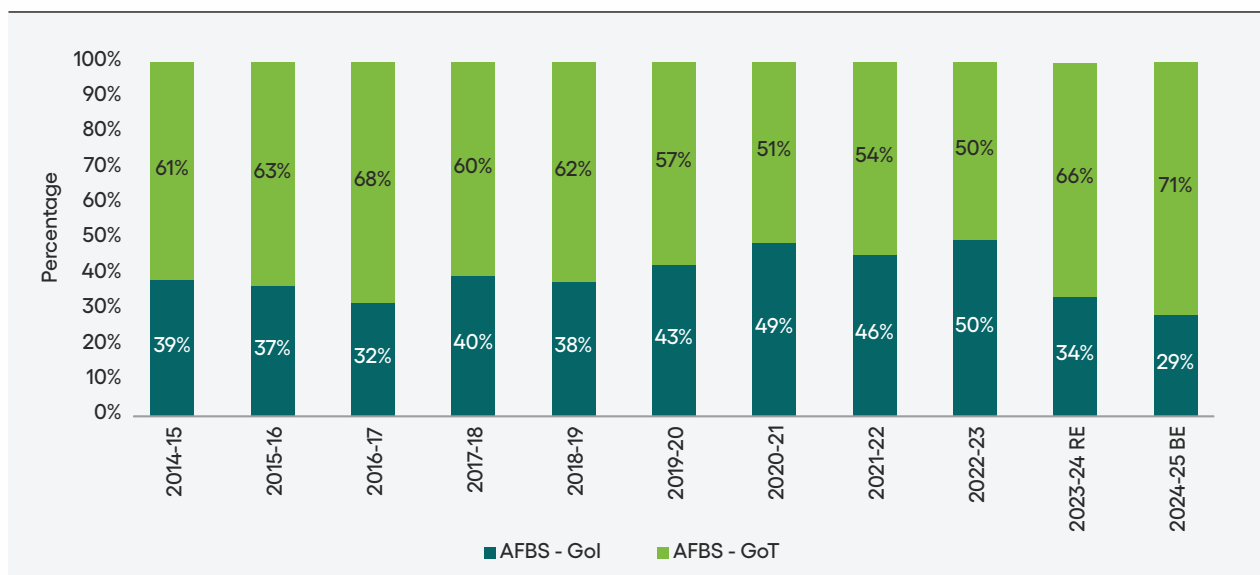


Source: Telangana State Budget Documents, MoF, CAG, MoSPI (2024b)

The share of the GoI support to the total AFBS was 39 percent in FY15, and 29 percent in FY25 (BE), fluctuating with a peak of 50 percent in FY23. In comparison, the GoT share was 61 percent in FY15 and 71 percent in FY25 (BE). It peaked at 71

percent in FY25 (BE) and hit a low of 50 percent in FY23 (Figure 5.4). On average, between FY15 and FY25 (BE), the GoI share was 40 percent and the GoT share were 60 percent.

Figure 5.4: GoI and GoT share of AFBS in Telangana



Source: Telangana State Budget Documents, MoF, CAG

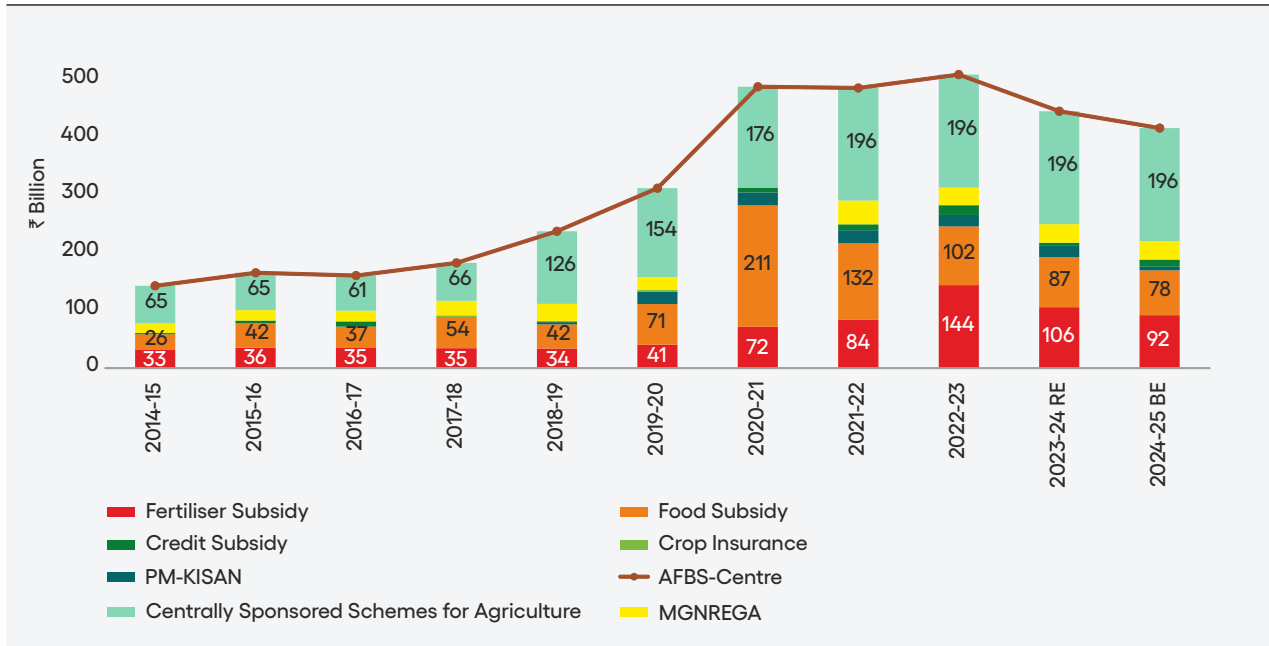
5.3.1 Budgetary support by GoI to Telangana

The AFBS to Telangana by GoI has increased from ₹143 bn (US\$ 2 bn) to ₹417 bn (US\$ 5 bn) (Figure 5.5) accounting for an average 5 percent of the GSDP between FY15 and FY25 (BE). In TE 2024, the major support from the centre was in the

form of CSS (41 percent), followed by fertiliser subsidy (23 percent) and food subsidy (22 percent). The rest of the support came from PM-KISAN, MGNREGA, crop insurance and credit subsidy (Figure 5.6).

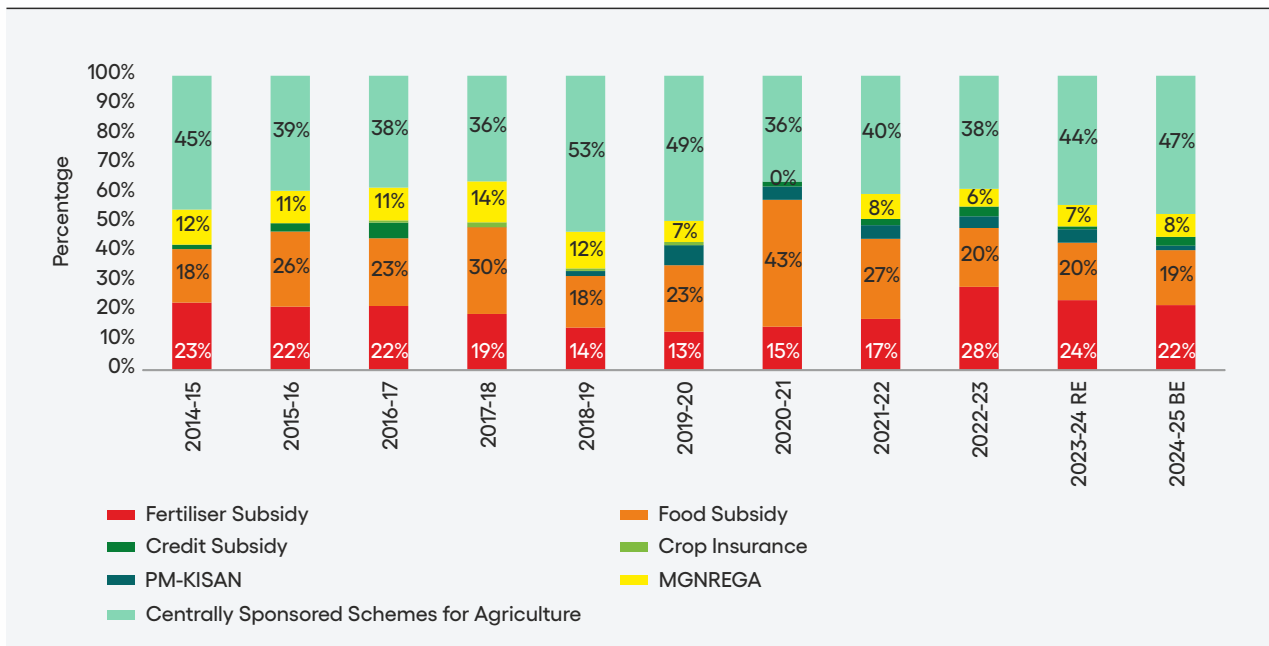


Figure 5.5: Gol support to Telangana



Source: MoF, CAG

Figure 5.6: Gol support to Telangana



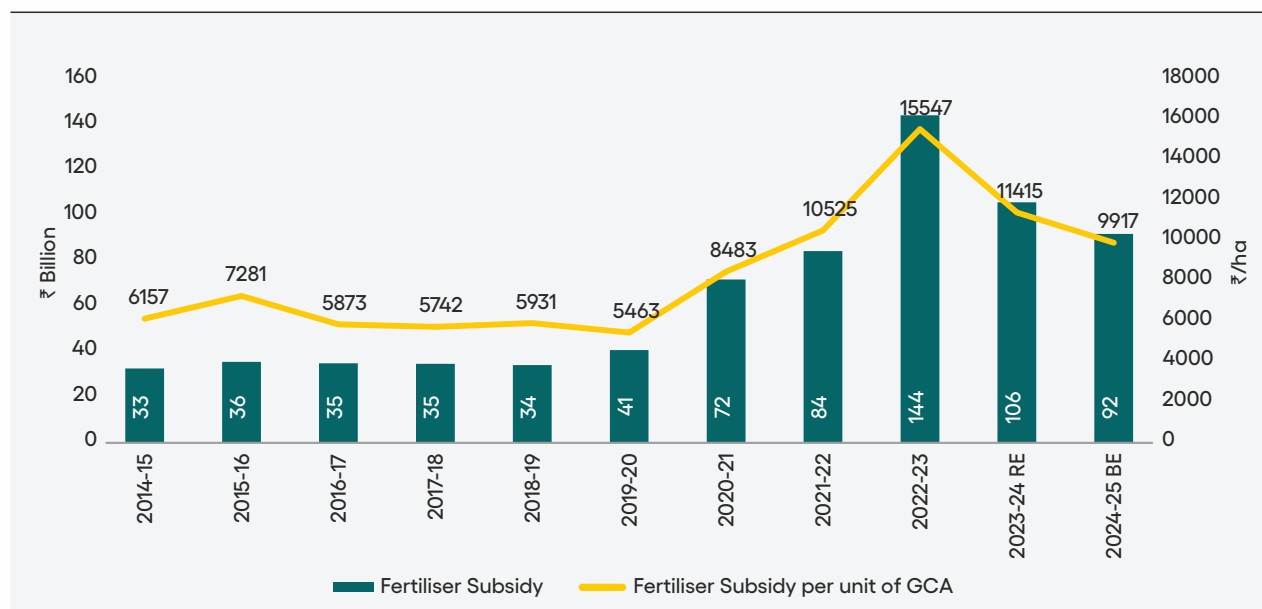
Source: Authors Calculations using MoF, CAG

5.3.1.1 Fertiliser subsidy

Fertiliser usage in Telangana has seen significant growth over the years. The total nutrient consumption in the state increased from 1.2 MMT in 2014-15 to 1.7 MMT in 2022-23. Fertiliser consumption per unit of gross cropped area is

notably high at 200 kg/ha, compared to the All-India average of 140 kg/ha in TE 2022-23. Consequently, the fertiliser subsidy burden for Telangana has risen sharply, from ₹33 bn (US\$ 541 mn) in FY15 to ₹92 bn (US\$ 1099 mn) in FY25 (BE). This trend is further reflected in the growing subsidies on a per-hectare basis (**Figure 5.7**).

Figure 5.7: Fertiliser subsidy for Telangana

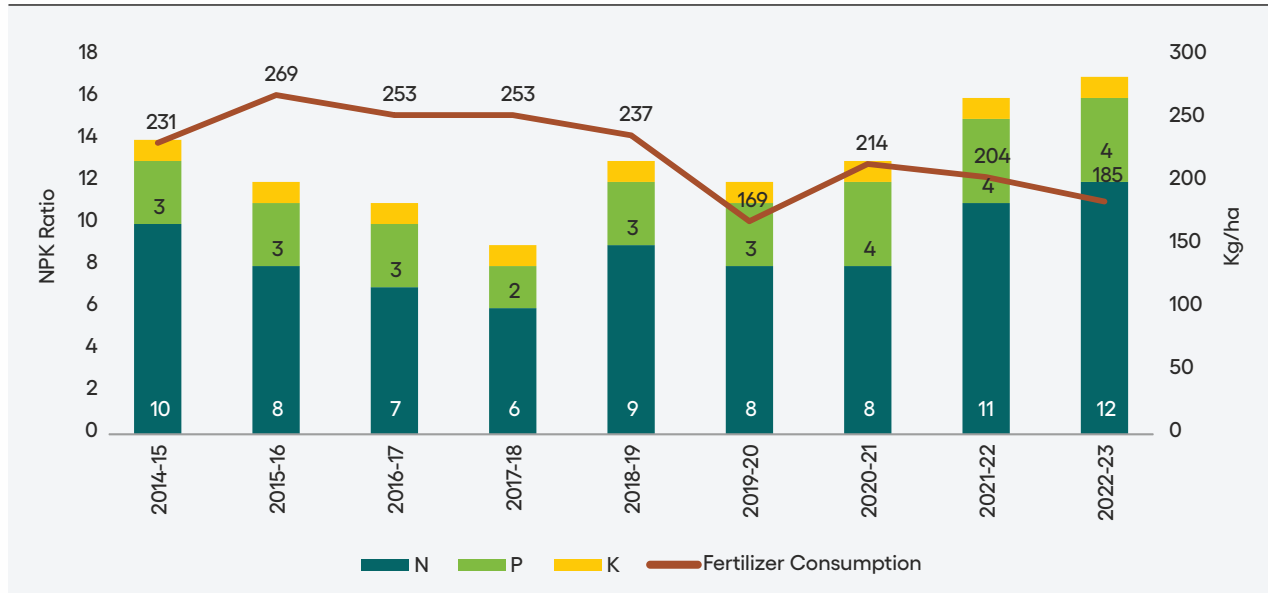


Source: MoF, MoAFWa 2024

A study estimating the ideal NPK ratio for both India and individual states determined that Telangana's optimal ratio is 2.2:1.4:1. However, as shown in **Figure 5.8**, neither this ideal ratio nor the

commonly recommended 4:2:1 ratio has been maintained over the years in Telangana. In 2022-23, the NPK ratio in the state was 12:4:1 reflecting a persistent imbalance in nutrient usage.

Figure 5.8: NPK consumption and NPK ratios in Telangana

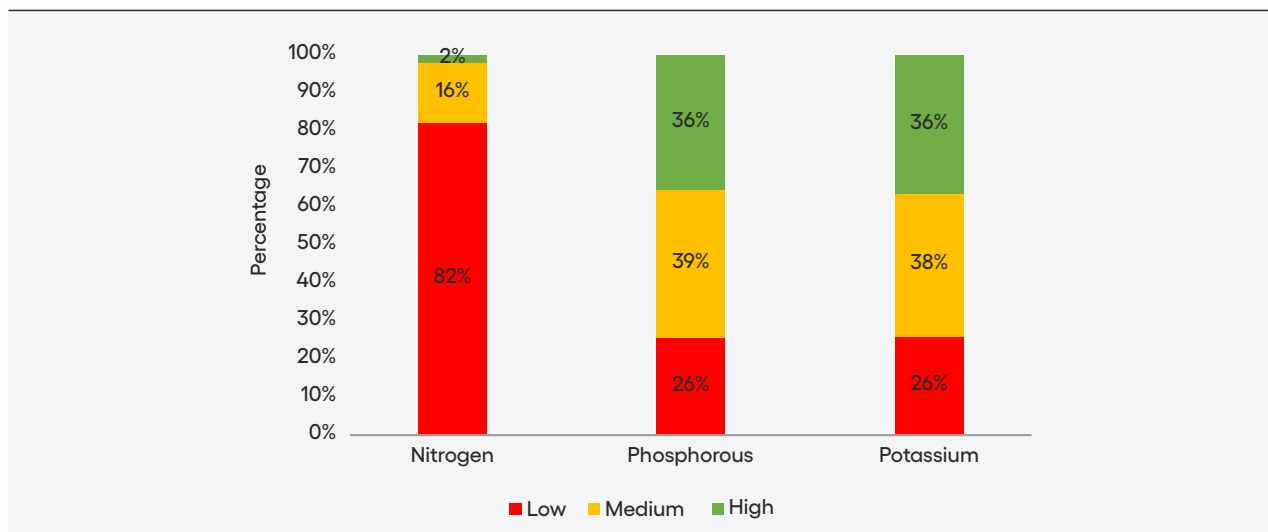


Source: MoAFWb 2024, FAI | Figures in bars are NPK ratios

This imbalance, heavily skewed towards nitrogen, is a consequence of the fertiliser subsidy policy. SHC data underscores the impact of this imbalance, revealing significant deficiencies in macronutrients and organic carbon in Telangana's soils

(Figure 5.9). 82 percent of the samples tested in cycle I and cycle II of the soil health survey were deficient in nitrogen, while the status of phosphorous and potassium are at 26 percent deficiency.

Figure 5.9: Macronutrient status of Telangana soils



Source: Soil Health Card

Direct impacts to Target 4, 7, 8 and 11 of the NBSAPs are observed and will become more pronounced in the future. The high fertiliser consumption as compared to other states, the trends observed in its cropping pattern of moving to a rice-wheat system can pose a greater threat to soil health and other related issues.

5.3.1.2 MSP for procurement and food subsidy

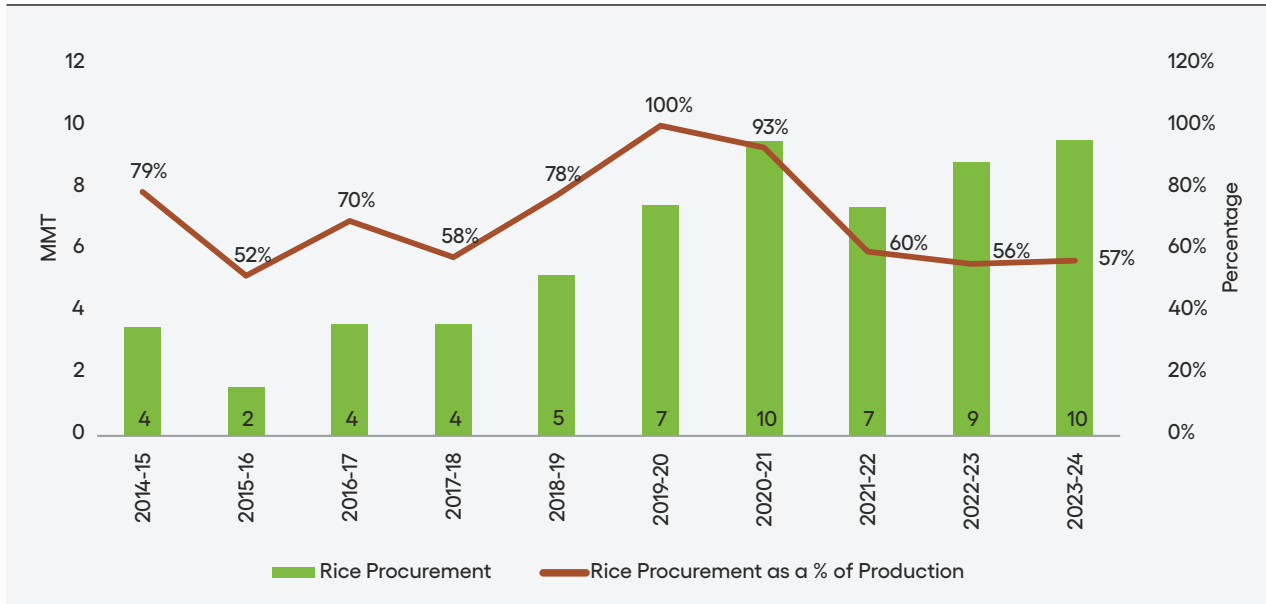
“The increase in rice procurement in Telangana, will soon discourage farmers from crop diversification and have environmental impacts in the form of excessive fertiliser application, higher GHG emissions from rice cultivation and nitrate leeching in the ground water. This will impact Targets 4, 8, 16 and 16 of the NBSAPs.

The production of rice in the state steadily increased from 4.4 MMT to 16.9 MMT between 2014-15 and 2023-24. Likewise, the procurement of rice has also seen a similar trend increasing from 3.5 MMT to 9.6 MMT in 2023-24. Rice procurement as a percentage of production in Telangana was exceptionally high, reaching 100.3 percent in 2019-

20 from 79 percent in 2014-15 (**Figure 5.10**). MSP-backed assured procurement has driven a substantial increase in the area dedicated to rice cultivation. The area under rice expanded dramatically from 1.4 mha in 2014-15 to 4.9 mha in 2022-23, further altering crop diversity in the state.



Figure 5.10: Procurement of rice as a percentage of production in Telangana, 2014-2024



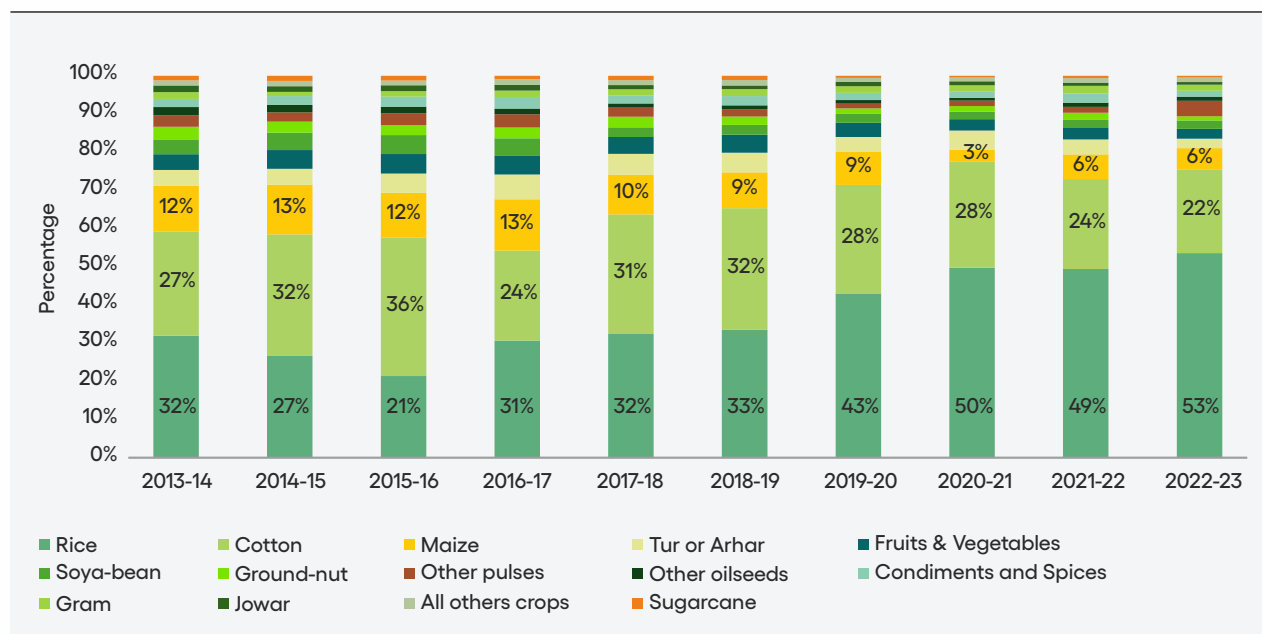
Source: FCI, MoAFWc 2024

Due to assured income from rice production, the preference of the farmers changed in terms of the cultivation of rice and their share in total cropped area has increased over the years. From 27 percent share of rice in 2013-14 it has reached to 53 percent share in 2022-23 (Figure 5.11). Government

schemes such as Rythu Bandhu and enhanced irrigation projects have played a critical role in supporting this growth. The percentage share of cotton has reduced from 27 percent to 22 percent and that of maize from 12 percent to 6 percent during the same period.



Figure 5.11: Cropping pattern in Telangana



Source: MoAFWa 2024

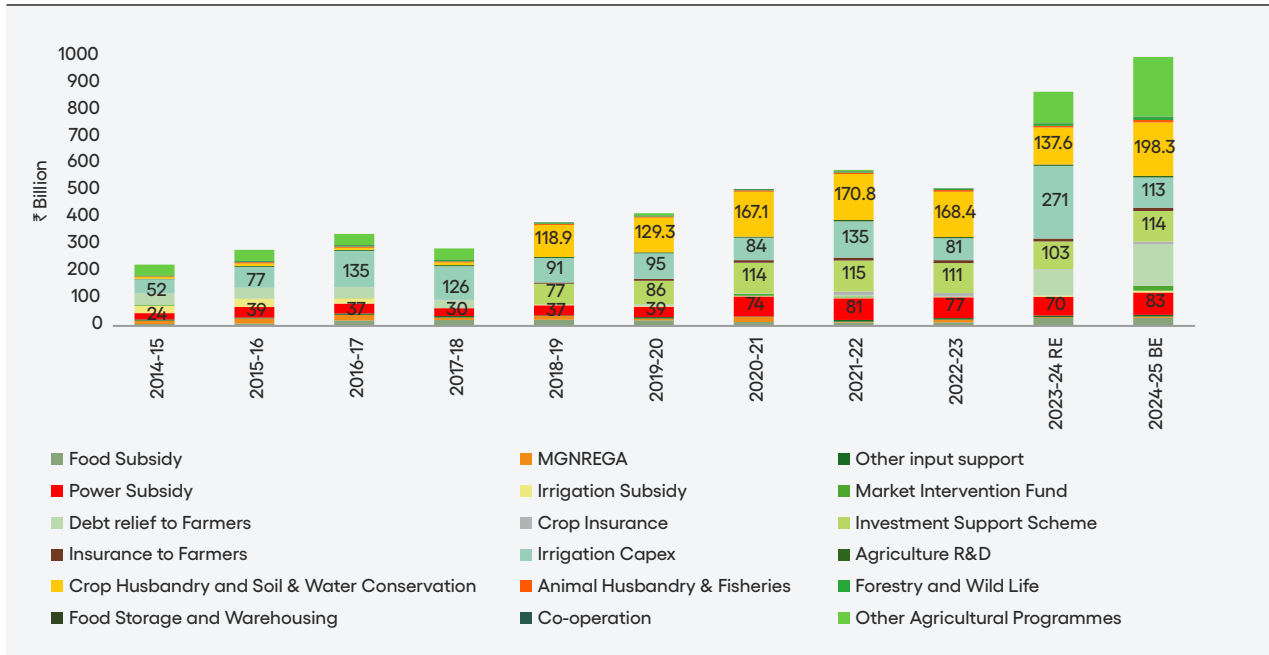
PM-KISAN and credit subsidies provided to Telangana by GoI are efforts to boost farmers income. These are decoupled support and are neutral with respect to their impact on biodiversity. The main objective of MGNREGA is to augment livelihoods of millions of rural families. However, indirect impacts like improved vegetation, retaining of soil moisture, and arresting of soil erosion are the positive environmental impacts of MGNREGA.

5.3.2 Budgetary support by GoT

The total AFBS-GoT has increased substantially from ₹228 bn (US\$ 4 bn) to ₹1034 bn (US\$ 12 bn) between FY15 and FY25 (BE) which accounted for a 5 percent share in the GSDP in FY15 and 11 percent in FY24 (RE) (Figure 5.12). In TE 2024 RE, two-thirds of the support came from capital expenditure on irrigation (25 percent), development expenditure of crop husbandry (24 percent) and investment support scheme (17

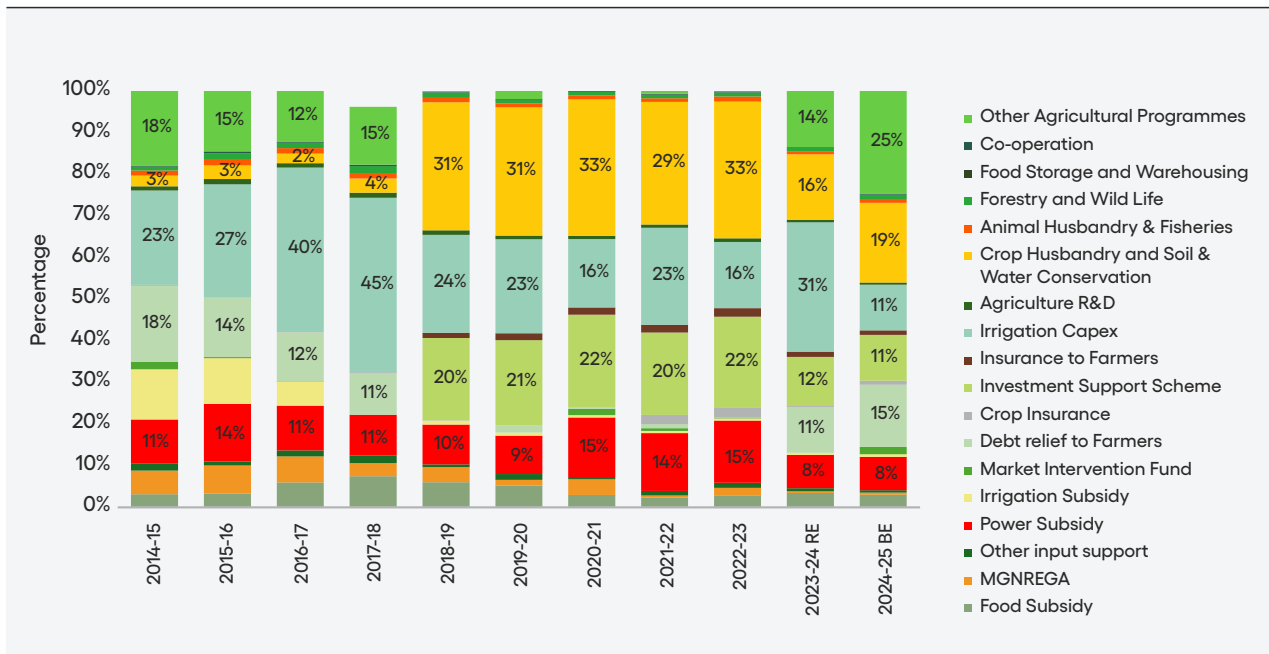
percent) (Figure 5.13). The rest of support was in the form of power subsidy (12 percent), other agricultural programmes (6 percent), debt relief to farmers (5 percent) and food subsidy (3 percent). Other support including crop insurance, farmers insurance (Rythu Bhima), MGNREGA, input subsidies, market intervention funds, irrigation subsidy and development expenditure from the total budget of the agriculture and allied departments were also included in the state's support to agrifood sector of Telangana.

Figure 5.12: AFBS by GoT



Source: Telangana State Budget Documents, CAG

Figure 5.13: Category-wise AFBS by GoT



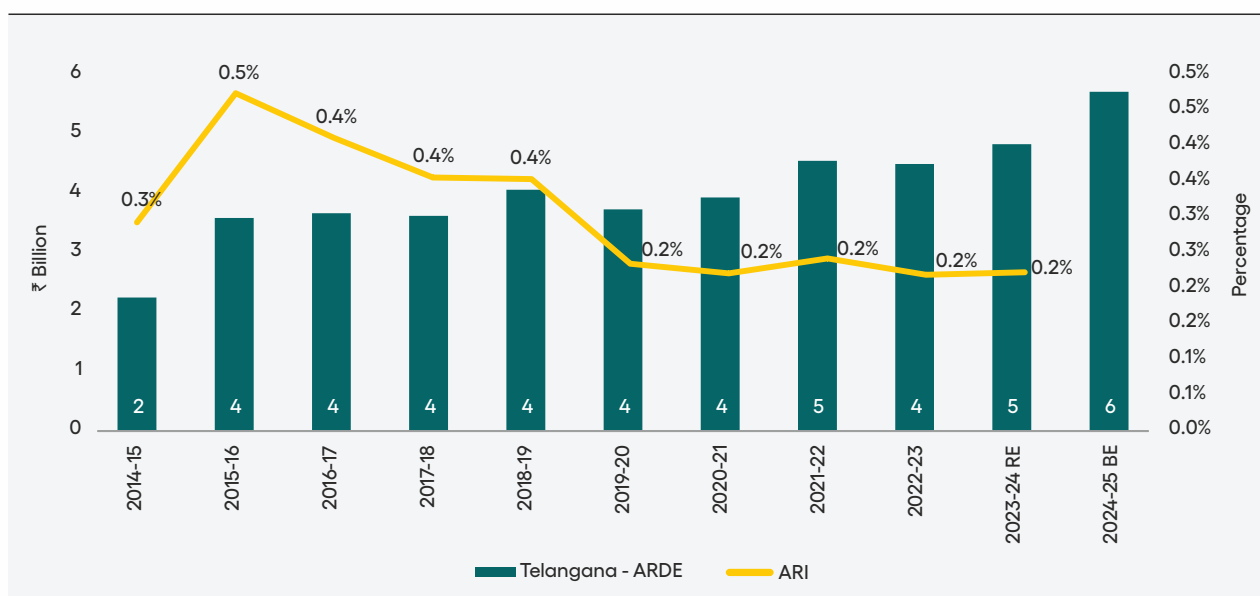
Source: Telangana State Budget Documents

5.3.2.1 Agriculture R&D in Telangana

The state's ARDE expenditures have increased from ₹2 bn (US\$ 33 mn) in FY15 to ₹6 bn (US\$ 72 mn) in FY25 (BE) (Figure 5.14). Agricultural research, education, and extension activities are carried out through a network of institutions, including the Agricultural Technology Application Research Institute, Sri Konda Laxman Telangana

State Horticultural University, Sri PV Narasimha Rao Telangana Veterinary University, Professor Jayashankar Telangana State Agricultural University, and 16 Krishi Vigyan Kendras. Despite the increase in funding, the growth in the budget has not kept pace with the state's AGVA. As a result, the ARI has remained stagnant at 2 percent from FY20 to FY24, showing a decline from 0.3 percent in FY15, with a peak of 0.5 percent in FY16.

Figure 5.14: Telangana's ARDE expenditures & ARI



Source: Telangana State Budget Documents, MoSPI (2024b)

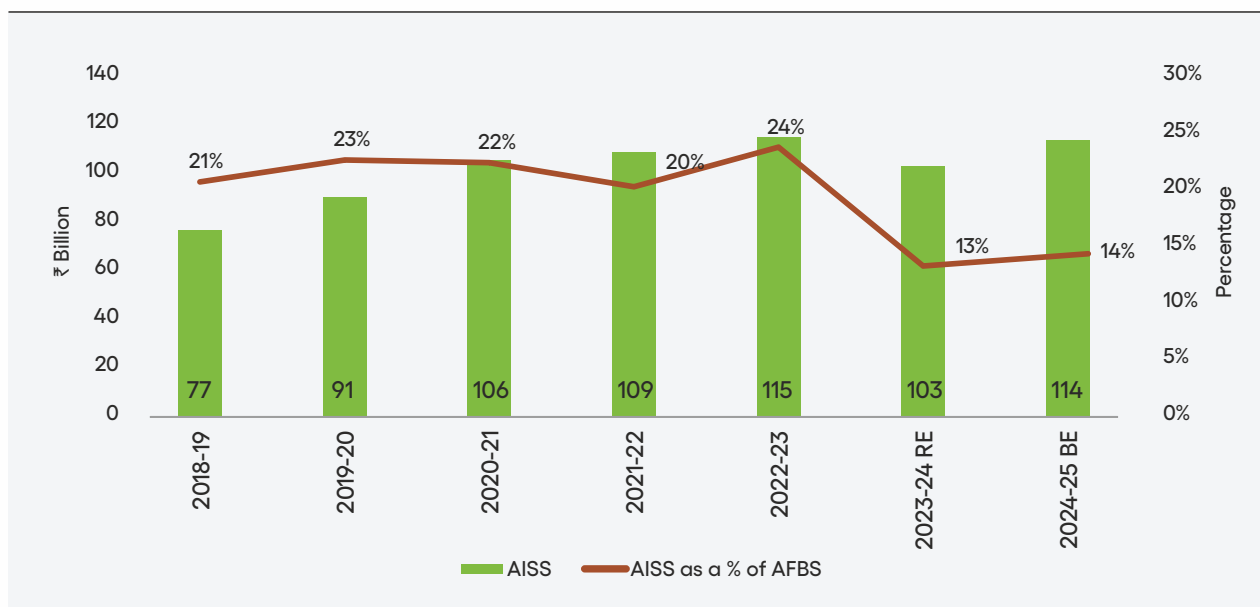
5.3.2.1 Rythu Bandhu

The Rythu Bandhu Scheme, introduced by the GoT in the FY19 Kharif season, aims to enhance agricultural productivity, improve farmers' incomes, and break the cycle of rural indebtedness. Officially termed the 'Agriculture Investment Support Scheme (AISS),' it provides financial assistance of ₹5,000 per acre per farmer per season for both kharif and rabi crops. This grant helps farmers cover initial investment costs for inputs like seeds, fertilisers, pesticides, labor, and other

field operations, offering flexibility based on crop season requirements.

At its inception, the scheme had a budgetary allocation of ₹77 bn, with ₹50 bn distributed to 4.7 mn landholding farmers during the kharif season through cheques handed out at gram sabhas. The scheme's allocation has grown substantially over the years, reaching ₹114 bn in FY25 (BE) (Figure 5.15). Since its launch, Rythu Bandhu has consistently represented on average 20 percent of the state's agrifood support, underlining its importance in Telangana's agricultural landscape.

Figure 5.15: AISS in Telangana



Source: Telangana State Budget Documents

5.3.2.3 Rythu Bhima - Farmers Group Life Insurance Scheme: (Rythu Bandhu)

The main objective of the scheme is to provide immediate and adequate financial relief to bereaved family members/dependents of the farmer in case of his/her death due to any reason. The sum assured ₹0.5 mn payable to the Nominee designated by the insured farmer. The entire premium amount is to be borne by Government.

5.1.1.1 Farm Mechanisation

GoT is promoting extensive mechanisation of agriculture by providing incentives. Government is supplying machinery and spare parts at a subsidy ranging from 50 percent to 95 percent to the farmers in Telangana.

5.1.1.2 Drip Irrigation

GoT is providing 100 percent subsidy to scheduled castes and schedules tribes, 90 percent subsidy to

small and marginal farmers and backward communities, and 80 percent subsidy to others for purchase of micro irrigation equipment for a maximum of 12.5 acres and up to ₹0.6 mn.

5.1.1.3 Polyhouses and greenhouses

GoT is giving a subsidy of 75 percent to small and marginal farmers for establishing polyhouses and greenhouses.

5.1.1.4 Development of Marketing facilities

GoT has taken up a number of initiatives to strengthen the agricultural marketing in the State. Some of the major initiatives include establishment of procurement centres as per the requirement/demand, exclusive market yards for vegetables, fruits, integrated markets for the convenience of consumers, etc. Emphasis is given on construction of Rythu Bazaars with all modern facilities and development of roadside vegetable markets with all facilities for the benefit of street vegetable vendors.

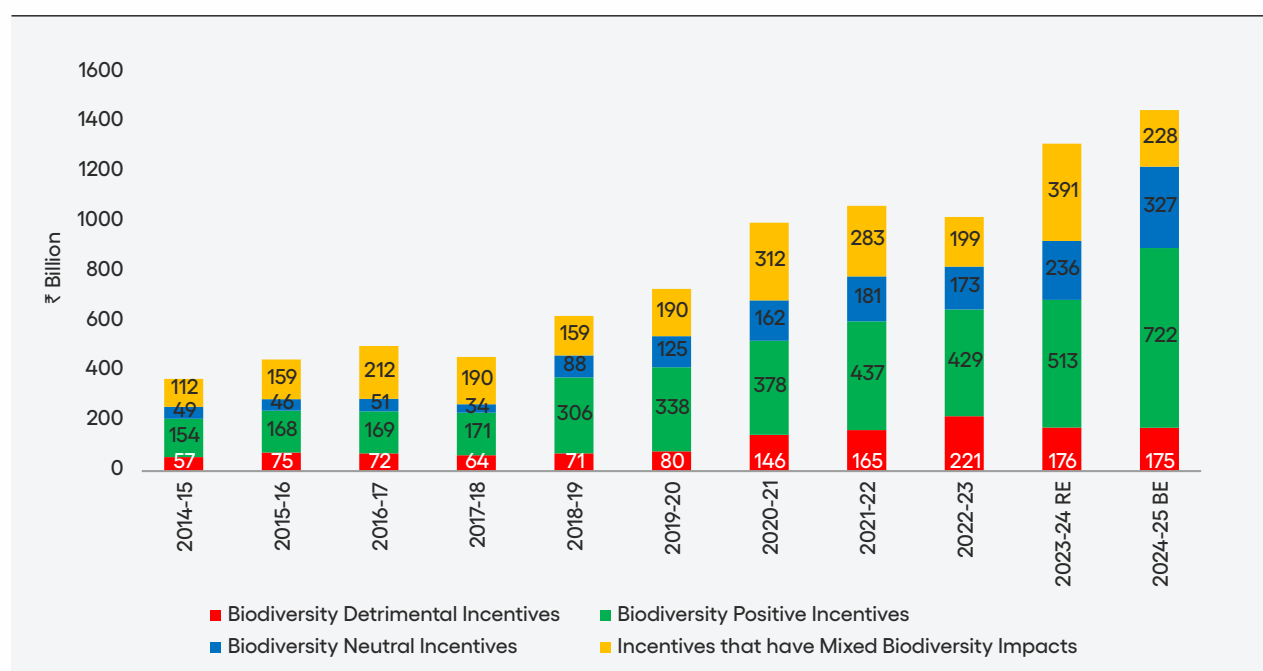
5.4 Categorization of AFBS in Telangana

The analysis of agrifood budgetary support to Telangana revealed an average allocation of ₹1135 bn (US\$ 14.5 bn) in TE 2024. The central government's contributions included fertiliser subsidies, food subsidies, MGNREGA, PM-KISAN, credit subsidies, crop insurance, and various CSS across multiple ministries. The state government's budgetary support primarily originated from the agriculture and allied, water, and energy departments. It comprised expenditures on agriculture and allied activities, irrigation, power subsidies, MGNREGA, market intervention funds, crop insurance, debt relief, farmer insurance, food subsidies, and other input subsidies.

The support was categorized into four groups based on its impact on agrobiodiversity for TE 2024: (i) Biodiversity Detrimental Incentives: Support

detrimentally impacting agrobiodiversity, primarily fertiliser subsidies, averaged ₹112 bn (US\$ 1.4 bn), which can impact NBSAP targets (Figure 5.16), (ii) Biodiversity Positive Incentives: Support with positive biodiversity impacts, including agriculture development initiatives, MGNREGA, agricultural R&D, and input subsidies, averaged ₹459 bn (US\$ 5.9 bn), (iii) Biodiversity Neutral Incentives: Income support measures, such as crop insurance, farmer insurance, and debt relief schemes, totaling ₹197 bn (US\$ 2.5 bn), were found to have a neutral impact on biodiversity, (iv) Incentives that have mixed Biodiversity Impacts: Support with mixed biodiversity impacts, such as food subsidies, power subsidies, and irrigation expenditures, averaged ₹367 bn (US\$ 4.7 bn).

Figure 5.16: Categorization of AFBS in Telangana

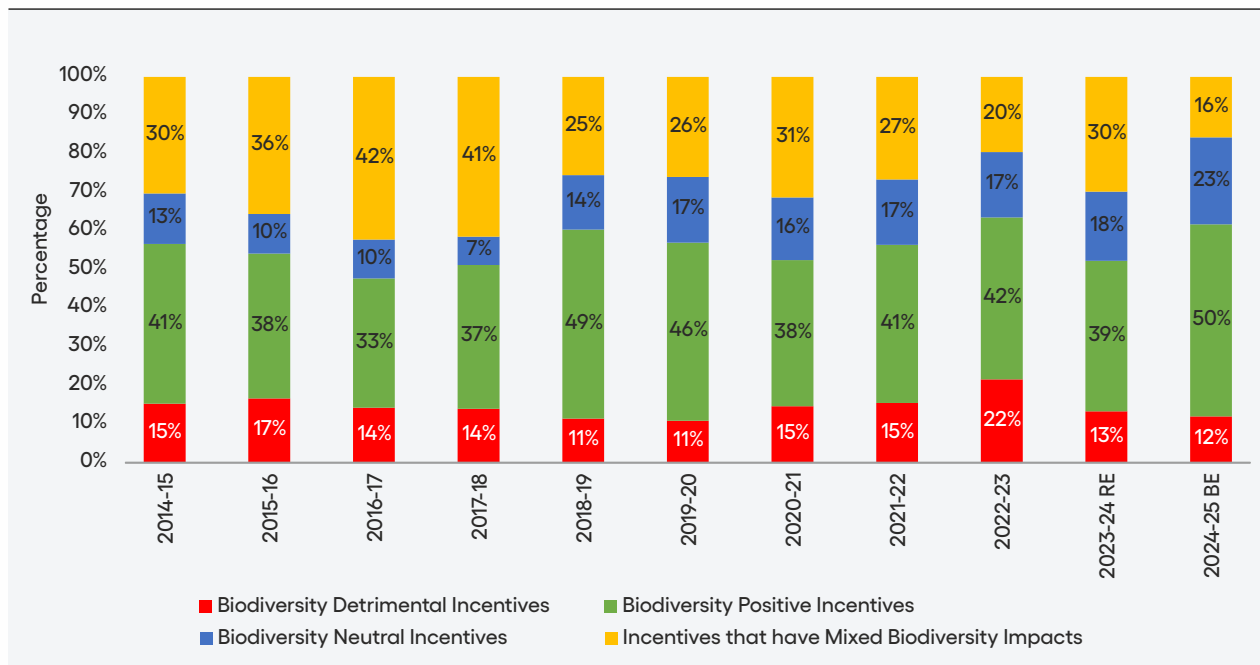


Source: Authors compilation based on MoF, Telangana State Budget Documents, CAG

In TE 2024, 41 percent of the total support was directed toward initiatives with positive agrobiodiversity impacts (Figure 5.17). Mixed

impact support accounted for 32 percent, neutral impact support for 17 percent, and detrimental impact support for 10 percent.

Figure 5.17: Categorization of AFBS in Telangana



Source: Authors compilation based on MoF, Telangana State Budget Documents, CAG

Subsidies, including MSP-backed procurement and heavy fertiliser support, especially for urea, have contributed to the dominance of rice monocropping at the expense of crop diversity. This trend underscores the urgent need for policy realignment to promote more balanced cropping patterns, which the state is already exploring. The Rythu Bandhu scheme, which provides investment support to farmers enables the purchase of inputs but currently

lacks conditionality. Along with other subsidies like fertilisers (central), seeds (state), and power (state), this scheme could be redesigned to encourage biodiversity-friendly agricultural practices. Conditional support tied to the adoption of diverse and sustainable inputs could help mitigate the ecological impacts of monocropping and promote long-term agricultural resilience.



Conclusions and way forward

The current system of agrifood incentives are oriented towards food security objective of the country. However, serious concerns are now emerging in agricultural sustainability as observed in ground water decline, soil deterioration, increasing GHG emissions, air pollution, changing crop patterns (monocropping with HYVs) and biodiversity losses. This chapter recommends that instead of further incentivizing biodiversity detrimental practices, India should assess options to repurpose subsidy policies to neutralize their effects on biodiversity which is also critical to the resource mobilization needed to implement the KM-GBF and NBSAP.







India is committed to the Post-2020 KM-GBF adopted during the UN Biodiversity Conference held in December 2022. Aligning with KM-GBF, India has launched its updated NBSAP at CoP 16 to the 2024 CBD. Target 18 of the framework proposes to repurpose detrimental incentives for biodiversity. The food and agriculture sector of India has the responsibility to provide healthy and nutritious food for a population of 1.4 billion populations while protecting the natural systems that sustain life. This is a critical challenge for the agriculture policy makers to gear the public support

towards biodiversity positive or neutral incentives while achieving food and nutritional security and ensuring livelihood of 46.1 percent of workforce employed in agriculture.

46 major schemes (87 sub-components) that were relevant for agrifood sector and were spreading across eight ministries of the Union Government were evaluated for the duration FY01 to FY25 (Appendix I). **Table 6.1** summarizes the potential impact of agrifood support on biodiversity and the targets that are being impacted.



Table 6.1: Impact of agrifood subsidies and incentives on biodiversity

Subsidies/ Incentives	Average Value (₹ bn, TE 2024)	Activities affecting biodiversity	Impact on biodiversity		Impact on biodiversity (Scale)
			Ecosystem	Species	
Fertiliser Subsidy 	1,980	Skewed application of urea due to higher urea subsidy Discourage organic practices Favor cultivation of high yielding varieties	Nutrient pollution, eutrophication affecting aquatic ecosystem, air pollution, soil degradation, mineralization, climate change	Change in species composition and diversity of soil microbiota and aquatic life Increase in area of high yielding crop varieties over indigenous varieties	Medium to High (Impacts KM-GBF and NBSAP Targets 4, 7, 8, 10, 11 and 18)
Food Subsidy (through procurement at MSP) 	2,580	Requires procurement of wheat and rice crops thus leading to increase in monocropping of wheat-rice system	Increased cultivation of rice leading to unsustainable extraction of ground water and higher GHG emissions	Narrow genetic base in production diversity	Medium (Impacts KM-GBF and NBSAP Targets 4, 8, and 9)
Crop Insurance	129	No impact	No impact	No impact	Neutral
PM-KISAN	617	No impact	No impact	No impact	Neutral
Credit Subsidies	193	No impact	No impact	No impact	Neutral
MGNREGA 	918	Plantation, water harvesting ponds, soil and water conservation	Positive impact on soil and water	Positive impact with the improvement in soil.	Positive
Agriculture Research and Development 	89	Development of new varieties Ex situ conservation of genetic diversity	Productivity gains thus less land use but could lead to high chemical inputs.	Positive impact with respect to ex situ conservation of genetic diversity but new varieties can lead to replacement of traditional varieties and changes in soil microflora.	Positive

During TE 2024, agrifood sector received ₹7,076 bn (US\$ 90 bn). Out of this, ₹1,980 bn (US\$ 25 bn) was found to detrimentally impact the targets of NBSAP. This support primarily comprises of fertiliser subsidy. ₹1,483 bn (US\$ 19 bn) was categorized as positive with respect to biodiversity. This includes the schemes related to sustainable agriculture development of agriculture like PKVY, natural farming, KY, RKVY, agriculture research and extension, PM-KSY, Rashtriya Gokul Mission etc. The schemes related to income support such as PM-KISAN, credit subsidies, PM-KMY, crop insurance are categorized as neutral with respect to biodiversity outcomes and comprise of ₹940 bn (US\$ 12 bn). Food subsidies comprise the highest share with allocation of ₹2,673 bn (US\$ 34 bn) and have mixed impacts on biodiversity outcomes. As a percentage share, biodiversity detrimental incentives comprise 28 percent share, whereas biodiversity positive incentives have a share of 22 percent during TE 2024. Biodiversity neutral incentive comprise 13 percent share and 36 percent of the agrifood support is going for agri-practices and schemes that have both positive as well as detrimental impact.

The agrifood support by GoI and state governments (GoP, GoMP and GoT) in three pilot states viz Punjab, Madhya Pradesh and Telangana was also estimated for the duration FY15 to FY25. During TE 2024, ₹399 bn (US\$ 5.1 bn) annually was spent by GoI and GoP on AFBS (Annexure II). Of the total support, ₹209 bn (US\$ 2.7 bn) per year was found to detrimentally impact the targets of NBSAP. This support primarily comprises of fertiliser subsidy from centre and power subsidy from state government. Incentives with respect to resource conservation and overall-agriculture development were to the tune of ₹69 bn (US\$ 0.9 bn) per year and was found to be positive with respect to biodiversity. The schemes related to income support such as PM-KISAN, credit subsidies, PM-KISAN and loan waivers are neutral with respect to biodiversity outcomes and comprise of ₹22 bn (US\$ 0.3 bn) per year. Food subsidies for

decentralized procurement of foodgrains comprise ₹98 bn (US\$ 1.3 bn) per year and have mixed impacts on biodiversity outcomes. The analysis of the biodiversity targets in Punjab provides evidences that fertiliser subsidy (by GoI), food subsidy (through procurement of crops at MSP by GoI) and power subsidy (by GoP) has led to considerable changes in the area and varieties of crops under cultivation in Punjab. The area under wheat has increased by 2.42 times, area under rice has increased by 11.5 times from 1960-61 to 2020-21. At the same time, area under bajra has decreased by 24.6 times, under barley by about half, and under jowar it is less than 500 ha now. Further, considerable varietal changes have taken place. Prior to green revolution, 41 varieties of wheat, 37 varieties of rice, 4 varieties of maize, 3 varieties of bajra, 16 varieties of sugarcane, 19 species/varieties of pulses, 9 species/varieties of oil seeds and 10 varieties of cotton were in use. Out of 49 post green revolution varieties of wheat released by PAU, only 3 are widely used. Out of 27 varieties of rice released, only 9 are currently in use. Further, the population of domesticated livestock has increased by 8.7 percent in the last two decades. Though two desi breeds of cattle have been reported, but the pure breed has been cross-bred with Jersey and Holstein and only 2 percent of desi Sahiwal is domesticated now. Further three native breeds of buffaloes, three breeds of sheep, two of goat, one of horse and two of poultry are of use in the state (Punjab Biodiversity Board, Livestock Breed Census).

To come out from this monocropping, it is recommended that the farmers shifting from paddy to pulses, oilseeds, millets, and even kharif maize can be given roughly ₹35,000/ha on 50:50 basis for at least five years under the joint package of GoP and GoI (Singh et al. 2024).

There is hardly any additional expenditure involved. It is the GoP savings on power, canal waters, and GoI savings on fertiliser subsidies that need to be given back to farmers in a different form. The government must also ensure the purchase of alternative crops at MSP as a safety net to farmers who choose crop diversification. FCI bought 92.5 percent of the rice produced in Punjab at MSP during KMS TE 2023-24. If this support is redirected towards other crops, it could release funds for a revolving MSP pool. This amount could then be utilized as a Stabilization Fund to ensure that agencies like NAFED, CCI, or FCI purchase pulses, oilseeds, cotton, millets, and kharif maize at MSPs, thereby mitigating market risks for non-paddy crops. Transitioning to alternative crops could potentially enable farmers to earn up to 2.5 to 4 carbon credits per hectare, and can open the doors of farmers for carbon market. In parallel, market-oriented cluster-based approach for high-value horticulture crops should be prioritized. FPOs, FPCs, federations, cooperatives, state agriculture and marketing boards, as well as other public sector

entities can assume the responsibility of aggregating farmers for scaling up production, post-harvest management, marketing and branding of crops that is suited to different region in sync with export demand. Logistics facilities to be created to export agricultural produce to other states and internationally through air-lifting.

In MP, during TE 2024, the combined agrifood budgetary support from the GoI and the GoMP amounted to ₹1111 bn (US\$ 14.2 bn) (Annexure III). Of this, ₹166 bn (US\$ 2.1 bn) per year was found to have a detrimental impact on the biodiversity targets outlined in the NBSAPs. This primarily included fertiliser subsidies. Biodiversity-positive incentives, such as agriculture development programmes, accounted for ₹346 bn (US\$ 4.4 bn) annually. Income support measures like PM-KISAN and crop insurance were biodiversity-neutral, constituting ₹155 bn (US\$ 2 bn). Mixed-impact incentives, including food subsidies, power subsidies, and irrigation expenditures, averaged ₹429 bn (US\$ 5.5 bn).

“Policies promoting assured procurement of wheat and rice, power subsidies, and irrigation expansion have increased monocropping at the expense of pulses and other nitrogen-fixing crops.”

Such shifts could lead to soil nutrient imbalances and ecological challenges. To address these concerns, MP should prioritize crop diversification, emphasizing pulses, oilseeds, and millets, supported by incentives, enhanced irrigation systems, and market access for alternative crops. The state's proactive initiatives, like the Millet Mission and crop diversification schemes, provide a pathway to align agricultural growth with biodiversity preservation.

In Telangana, during TE 2024, the combined AFBS from GoI and the GoT averaged ₹1135 bn (US\$ 14.5 bn) (Annexure IV). Fertiliser subsidies

constituted ₹112 bn (US\$ 1.4 bn) detrimentally impacting biodiversity and the NBSAP targets. Biodiversity-positive incentives, including agriculture development programs and MGNREGA, amounted to ₹459 bn (US\$ 5.9 bn). Income support measures such as crop insurance, farmer insurance, and debt relief schemes were biodiversity-neutral, averaging ₹197 bn (US\$ 2.5 bn). Mixed-impact incentives, including food subsidies, power subsidies, and irrigation expenditures, averaged ₹367 bn (US\$ 4.7 bn). Subsidies favouring rice cultivation, including assured MSP-backed procurement and fertiliser subsidies, have significantly increased rice

monocropping, reducing crop diversity. The Rythu Bandhu scheme, while impactful in providing financial support, currently lacks biodiversity-oriented conditionalities. Telangana should

implement reforms to encourage sustainable farming practices, incentivise crop diversification, and promote balanced nutrient application to address ecological challenges.

“ As the first state to launch its 'Telangana State Biodiversity Strategy and Action Plan (TSBSAP) 2023-2030', the GoT must prioritise aligning fertiliser consumption with biodiversity conservation goals by integrating the objectives of the PM-PRANAM scheme, which incentivises reduced chemical fertiliser use. ”

Market reforms, conditional support tied to biodiversity-friendly practices, and enhanced infrastructure for alternate crops can ensure

sustainable agricultural development while maintaining the state's pivotal role in national food security.



Way Forward

The current system of agrifood incentives are oriented towards food security objective of the country. However, serious concerns are now emerging in agricultural sustainability as observed in ground water decline, soil deterioration, increasing GHG emissions, air pollution, changing crop patterns (monocropping with HYVs) and biodiversity losses. Instead of further incentivizing biodiversity detrimental practices, India should assess options to repurpose subsidy policies to neutralize their effects on biodiversity which is also critical to the resource mobilization needed to implement the KM-GBF and NBSAP.

1. Repurposing fertiliser subsidy

The subsidies on fertilisers, which are currently skewed towards urea, should be rationalized to have parity in nutrient pricing to promote balanced fertiliser use. Under PM-PRANAM scheme, 50 percent of the fertiliser subsidy saved by a State/UT by way of reduction in chemical fertilisers consumption (Urea, DAP, NPK, MOP) compared to previous 3 years' average consumption, will be provided to State/UT as grant for the benefit of people in the state, including farmers. This scheme is not yet taken off and needs to be monitored for states which are using high dosages of fertilisers.

2. Reorienting agricultural priorities away from 'more' foodgrains and towards 'diverse' food

Policies related to contracts and procurement can be used to encourage diverse diets from sustainable food systems in places like workplaces, schools, and public meal venues. Public distribution programmes aimed at low-income households and individuals can enhance diversity in diets. Under PMGKY, the

procured foodgrains are distributed through FPS in India, which are 0.5 mn in number (NFSA Portal). These are operated by 0.3 mn individuals; 83000 co-operatives; 9700 Panchayat; 26,000 self-help groups and 92,000 other FPS. To increase the consumption diversity from wheat-rice to other nutritious crops – biofortified rice and wheat, millets, pulses, edible oils, soybean products, fortified milk, eggs etc. – these FPS needs to be upgraded. At least 10 percent of these fair price shops may be declared as nutrition food hubs containing diversified food basket, from which the consumers can chose using electronic vouchers, similar to e-food coupons in a food court (Gulati, 2023).

3. Premium support price for low-carbon crops

The GoI procures foodgrains (wheat and rice) at MSP for buffer stock requirements for TPDS and other welfare schemes. Every year CACP provides recommendations for MSP of various crops to the central government. At present, CACP is not accounting carbon cost while recommending MSP for various commodities. To encourage farmers to shift to low-carbon cultivation practices and crops (such as legumes and oilseeds), premium prices (which can be linked to the carbon price and can be recommended by CACP) should be offered to the farmers. This measure will not only address food security objective but will encourage farmers to grow low-carbon and diverse crops.

4. Practice precision agriculture

Scaling up and subsidizing precision agriculture techniques is essential. To maximize water efficiency, selecting the right crop

cultivar, planting density, timing, and rotation is crucial. Practices such as water capture (to increase reliance on green water), soil restoration, drip irrigation, soil water harvesting, and soil conservation are also important. This approach will require reducing nutrient applications in some states while

increasing them in others. As the technologies needed for precision agriculture are currently expensive, private sector companies should help scale them for affordability. Government should provide subsidies to enable their adoption in the country.



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Appendices

Appendix I: List of GoI schemes relevant for agrifood sector

A. Centre Sector Schemes and Projects

Ministry of Agriculture and Farmers Welfare

1. Crop Insurance Scheme
2. Pradhan Mantri Kisan Samman Nidhi (PM-Kisan)
3. Modified Interest Submission Schemes (MISS)
4. Market Intervention Scheme and Price Support Scheme (MIS-PSS)
5. Pradhan Mantri Annadata Aay Sanrakshhan Yojana (PM-AASHA)
6. Distribution of Pulses to State / Union Territories for Welfare Schemes
7. Pradhan Mantri Kisan Maandhan Yojana (PM-KMY)
8. Formation and Promotion of 10,000 Farmer Producer Organizations (FPOs)
9. Agriculture Infrastructure Fund (AIF)
10. National Beekeeping Honey Mission (NBHM)
11. Blended Capital Support to Finance Startups for Agriculture and Rural Enterprise Relevant for Farm Produce Value Chain
12. Agriculture Research and Education (20 schemes)

Ministry of Chemical and Fertilisers

13. Urea Subsidy
14. Nutrient Based Subsidy

Ministry of Consumer Affairs, Food and Public Distribution

15. Food Subsidy

Ministry of Environment, Forests and Climate Change

16. Environmental Knowledge and Capacity Building (2 schemes)
17. Environment Protection, Management and Sustainable Development (4 schemes –including Climate Change Action Plan and National Adaptation Fund)
18. Decision support System for Environmental Awareness, Policy, Planning and Outcome Evaluation (3 schemes)
19. Environment Education, Awareness, Research and Skill Development
20. Control of Pollution

Ministry of Fisheries, Animal Husbandry and Dairying

21. Fisheries and Aquaculture Infrastructure Development Fund (FIDF)
22. Livestock Health and Disease Control Programme
23. Infrastructure and Development Fund
24. Dairy Development
25. Rashtriya Gokul Mission

Ministry of Jal Shakti

26. Major Irrigation Projects
27. Medium Irrigation Projects
28. Minor Irrigation Projects

Ministry of New and Renewable Energy

29. Kisan Urja Suraksha evam Utthaan Mahabhiyan (KUSUM)

B. Centrally Sponsored Schemes

Ministry of Agriculture and Farmers Welfare

30. National Food Security Mission (NFSM)
31. Rashtriya Krishi Vikas Yojana
32. National Mission on Natural Farming
33. Krishionnati Yojana (10 schemes - Food and Nutritional Security, edible oil palm, edible oil-oilseeds, organic value-chain development for North-East Region, Integrated Development of Horticulture, seed and planting material, agriculture extension, digital agriculture, agriculture census and statistics, and agriculture marketing)
34. Pradhan Mantri Krishi Sinchayee Yojna (Per Drop More Crop)

35. Sub-Mission on Agriculture Mechanization
36. Intervention in Agriculture for Resource Conservation and Crop Diversification
37. National Horticulture Mission
38. National Mission on Sustainable Agriculture
39. Parampragat Krishi Vikas Yojana

Ministry of Environment, Forests and Climate Change

40. National Mission for a Green India (3 schemes)
41. Conservation of Natural Resources and Ecosystems (3 schemes)
42. Integrated Development of Wildlife Habitats (5 schemes)

Ministry of Fisheries, Animal Husbandry and Dairying

43. Pradhan Mantri Matsya Sampada Yojana (PMMSY)
44. National Livestock Mission

Ministry of Rural Development

45. Mahatma Gandhi National Rural Employment Guarantee Programme
46. Pradhan Mantri Gram Sadak Yojna

Appendix II: List of GoP schemes relevant for agrifood sector

1. Schemes for power subsidy to farmers
2. Save Water Earn Money Scheme of Direct Benefit Transfer for Electricity to Agriculture Consumers
3. Compensation for stubble management
4. Debt Relief to Farmers
5. Incentivizing Direct Seeding of Rice
6. Project for Promotion of Micro Irrigation in the State (National Bank for Agriculture and Rural Development) Assistance-Rural Infrastructure Development Fund XIII
7. Project For Judicious Use of Available Water And Harvesting of Rain Water For Enhancing Irrigation Potential In Punjab State (RIDF-17)
8. Project for utilization of Treated Water for Irrigation from Sewerage Treatment Plants in Punjab (NABARD-RIDF-24)
9. Solar-Electric Hybrid Community Lift-Micro Irrigation Projects form Canal Outlets in Punjab (NABARD-RIDF-24)
10. Scheme for Underground Pipelines System (UGPS) for Promoting Efficient on Farm Usage of Irrigation Water (RIDF-28)
11. Project for conservation of available water resources by promoting underground pipeline system among farmers in Punjab (NABARD-RIDF-29)
12. Major Irrigation Schemes
13. Medium Irrigation Schemes
14. Minor Irrigation Schemes

Appendix III: List of GoMP schemes relevant for agrifood sector

1. Agriculture diversification scheme for demand-driven agriculture
2. CM Farm Crop Procurement Assistance Scheme
3. CM Farmers Co-op Loan Assistance Scheme
4. CM Loan Waiver Scheme
5. CM Solar pump scheme
6. Cotton Development Scheme
7. Crop residue management plan
8. Export promotion scheme
9. Incentive scheme for protected cultivation of commercial horticulture crops
10. Interest subsidy on manual storage
11. Interest subsidy on short-term loans to farmers through cooperative banks
12. MP Millet mission
13. MPVM 5HP reimbursement for free electricity supply to agricultural pumps, threshers & one light connection and Tariff subsidy
14. One district one product operational plan
15. Sorted sex semen project
16. Spice sector expansion scheme
17. Subsidy on tractors & agricultural equipment
18. Major Irrigation Schemes
19. Medium Irrigation Schemes
20. Minor Irrigation Schemes

Appendix IV: List of GoT schemes relevant for agrifood sector

1. Assistance to Small and Marginal Farmers towards Premium for Crop Insurance Scheme
2. Assistance to TRANSCO for Agriculture and Allied Subsidy
3. Farm Mechanization
4. Green Houses/Poly Houses, Shade Net House, Loose Shade Net for Pre-eminent Pandals
5. Incentives for Livestock and Poultry Production
6. Incentives for Milk Production
7. Insurance to Farmers (Rythu Bhima)
8. Investment Support Scheme
9. Major irrigation schemes
10. Market Intervention Fund
11. Medium Irrigation Schemes
12. Micro Irrigation Schemes
13. Minor Irrigation Schemes
14. Oil palm Cultivation
15. Promotion of Horticulture Activities
16. Rythu Bharosa for Landless Agriculture Labour
17. Scheme for Debt Relief to Farmers
18. Subsidy on Rice
19. Supply of Seeds to Farmers

Appendix V: Overview of States

	Punjab	MP	Telangana	India	Source
Population (2024)	32 mn	87 mn	38 mn	1.4 bn	MoSPI, 2024b
Per Capita Income (FY24) (₹)	2,27,950	1,56,381	3,93,385	2,11,725	MoSPI, 2024b
MPI Poverty (FY23) (%)	4.35	15.01	3.76	11.28	NITI Aayog, 2024
MPI Rural Poverty (2019-21) (%)	4.7	25.3	5.88	19.3	NITI Aayog, 2023
GDP at current prices in FY24 (₹)	7.4 tn	13.6 tn	15 tn	294 tn	MoSPI, 2024b
AAGR of GDP (FY06 to FY24) (%)	6	7.02	7.5	6.3	MoSPI, 2024b
AAGR of Agri-GDP (FY06 to FY24) (%)	2	6.78	5.6	3.7	MoSPI, 2024b
Workforce in agriculture (FY24) (%)	27	61.56	42.49	46	PLFS, 2023-24
Average land holding size (ha)	3.62	1.57	1	1.08	MoAFWb
Average monthly income per agricultural household (₹)	26,701	8,339	9,403	10,218	Situation Assessment Survey (SAS), 2018-19
Geographical Area (mha)	5.04	30.8	11.2	328.7	MoAFWa
Cultivated Land (2022-23) (mha)	4.2	16.2	6.2	154.3	MoAFWa
Net Area Sown (2022-23) (mha)	4.1	15.8	5.9	141	MoAFWa
GCA (2022-23) (mha)	8.3	30	7.3	219	MoAFWa
Gross Irrigation Area (mha)	7.7	16.9	6.5	120	MoAFWa
{Irrigation ratio} (%) (2022-23)	{93.5}	{56.3}	{69.8}	{55}	
Cropping Intensity (2022-23)	203	190	157	155	MoAFWa
Forest Area (mha)	0.2	8.7	2.8	72	MoAFWa
{% of Geographical area} (2022-23)	{4.7}	{28.2}	{25}	{22}	
Infant Mortality Rate (IMR) (1992-93)	53.7	70	27.7*	78.5	NFHS
IMR (2019-21)	28	41.3	26.4	35.2	NFHS
Anaemia in children (6-59 months) (%) (2005-06)	66.4	74	60.7*	69.4	NFHS
Anaemia in children (6-59 months) (%) (2019-21)	71.1	72.7	70	67.1	NFHS
Anaemia in women (15-49 years) (%) (2005-06)	41.4	55.9	56.6*	51.8	NFHS
Anaemia in women (15-49 years) (%) (2019-21)	58.7	54.7	57.6	57	NFHS
Anaemia in men (15-49 years) (%) (2005-06)	13.6	25.4	15.3*	24.2	NFHS
Anaemia in men (15-49 years) (%) (2019-21)	22.6	22.4	15.3	25	NFHS

*2015-16

About the Authors



Reena Singh is a Senior Fellow at ICRIER, where she leads work on sustainable agriculture and environmental policy. Her career spans academic research and policy-driven implementation. For more than two decades, she has contributed significantly to advancing eco-friendly farming practices and biodiversity conservation. She has led 15 national and international projects and has developed methodological framework of estimating Green House Gas Emissions for agriculture and allied sector for addressing climate change, low footprint agriculture, Nature-based solutions (NBS) and wasteland management. She has over 50 publications on her name that includes research papers, reports, policy brief, op-eds, newsletters etc.



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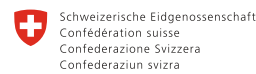
Ruchi Pant is a development professional with over three decades of experience in biodiversity conservation, natural resource management, rural livelihoods, public policy, and decentralized governance, with a particular focus on Himalayan states and tribal communities in India and Nepal. She currently serves as the Head of Natural Resource Management and Biodiversity at UNDP India. Dr.Pant has contributed to several Central and State Government committees on conservation and has represented India in global forums on these issues. A strong proponent of regenerative agriculture, she has actively advocated for the recognition of Unique Agricultural Systems as a distinct category under Other Effective Area-Based Conservation Measures (OECMs), aiming to protect agrobiodiversity and the traditional knowledge of farming communities in India.



Ashok Gulati is currently Distinguished Professor at ICRIER. Prior to this, he was the Chairman of the Commission for Agricultural Costs and Prices (CACP) from 2011 to 2014 and was Director at the International Food Policy Research Institute (IFPRI) for over a decade (2001-11). He has also been an Independent Director on the Boards of the Reserve Bank of India (RBI), NABARD, and NCDEX. Currently, he serves on the Boards of Kotak Mahindra Bank, Godrej Agrovet, and the Eleventh Audit Advisory Board of the Comptroller and Auditor General of India. Dr. Gulati was the youngest member of the Economic Advisory Council to Prime Minister Atal Bihari Vajpayee and has advised the governments of Andhra Pradesh and Karnataka. He has authored 20 books, written extensively in national newspapers, and holds a Ph.D. from the Delhi School of Economics.



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