

**Assessing the Impact of
Andhra Pradesh Community Managed Natural Farming (APCNF)
A Comprehensive Approach using Crop Cutting Experiments**

First Interim Report of 2022-23 Study
**Situational Analysis of Pre-Monsoon Dry Sowing [PMDS]
Practices in 2022**

Submitted to
Rythu Sadhikara Samstha
Department of Agriculture
Government of Andhra Pradesh



Institute for Development Studies Andhra Pradesh
Madhurawada, Visakhapatnam 530041

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Situational Analysis of PMDS in 2022-23

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Acronyms

APCNF	Andhra Pradesh Community Managed Natural Farming.
APPI	Azim Premji Philanthropic Initiatives
BC	Backward Caste
CAs	Cluster Anchor
CRPs	Community Resource Persons
CSA	Climate Smart Agriculture
DGC	Days Green Cover
DPMs	District Project Managers
FAO	Food and Agricultural Organization
FYM	Farmyard Manure
GHG	Greenhouse Gas
GoAP	Government of Andhra Pradesh
GoI	Government of India
GP	Gram Panchayat
HAT zone	High Altitude and Tribal Areas Zone
ICRPs	Internal Community Resource Persons
IDSAP	Institute for Development Studies Andhra Pradesh
MAs	Mandal Anchors
MT	Master Trainer
NGO	Non-governmental organization
Non-CNF	Non-Community Managed Natural Farming
NPM	Non-Pesticide Manage
OC	Open category
PKVY	Prime Minister Krishi Vikas Yojana
PMDS	Pre-Monsoon Dry Sowing
PPS	Probability Proportional to Size
PRDS	Pre-Rabi Dry Sowing
RKVY	Rastriya Krishi Vikas Yojana
RySS	Rythu Sadhikara Samstha
SC	Scheduled Caste
SES	Socio Economic Survey
SHG	Self Help Group
SIFF	Sustainable India Finance Facility
ST	Scheduled Tribe
TV	Television
VO	Village Organization
ZBNF	Zero Budget Natural Farming

Executive Summary

0.1. Introduction

Frequent nature calamities and excessive exploitation of natural resources have become the order of the day and these have become a challenge in the efforts to achieve sustainable development goals. To counter this, the Government of Andhra Pradesh (GoAP) promoted “community managed natural farming (henceforth CNF or APCNF)” in the state which is a paradigm shift in agriculture aiming at an increase in agricultural productivity and incomes besides building resilience and reducing and/or removing greenhouse gases. The field level implementation has commenced from Kharif 2016 on a pilot-basis in 704 villages, and it has been expanded to 3,730 villages covering 4.80 lakh farmers by 2020-21 and by 2021-22 it covered 5.92 lakh farmers. One of the main objectives of the CNF is the promotion of 365 Day Green Cover (365 DGC), i.e., growing crops during four seasons, viz., (a) Pre-Monsoon Dry Sowing (PMDS), (b) Kharif crops, (c) Pre-Rabi Dry Sowing (PRDS) and (d) Rabi crops, besides a set of practices. The number of farmers practicing PMDS is increasing year after year, i.e., from 24,307 farmers in 2019-20 to 2,63,826 farmers in the year 2022-23. The present report highlights the progress and impact of PMDS under overall APCNF. Objectives of the present report are: coverage of the PMDS, extent of adoption of PMDS practices, analyzing the input use, costs, returns and other benefits of PMDS, assessing the major challenges in practicing PMDS, and suggesting measures for further expansion of the programme.

0.2. Methodology

As this report is a part of the larger report of assessing the impact of the CNF during the year 2022-23, the sample selection was based on the larger study design. The main study intended to capture the comparative picture, i.e., comparison of CNF with other farming practices using chemical fertilizers, which is referred as non-CNF. A stratified and two stage random sampling design is adopted to cover both the categories of farmers, i.e., CNF farmers and non-CNF farmers. The stratification is based on a combination of the six agroclimatic zones and 26 districts of the state totalling 30 strata. The sample frame for CNF (treatment) is the list of Gram Panchayats (GPs), provided by the project implementing agency - Rythu Sadhikara Samstha (RySS), where CNF practices are initiated and the rest of GPs in the state

is the sample frame for non-CNF. The total sample size of GPs is allocated to the strata in proportional to their size. The sample size is fixed at 130 GPs for CNF and 65 GPs for non-CNF. In the case of treatment (CNF), the sample GPs are selected using probability proportionate to size with number of cultivators as size. For non-CNF survey, the selection is based on simple random sampling without replacement. In each selected GP, a list of all cultivators is prepared through a listing survey along with information required for deciding the eligibility of cultivator for the survey. Totally 1,328 cultivators are selected for CNF survey. In addition, 380 farmers at the state level are continued as panel farmers and these farmers are included for the PMDS survey and the final sample for the present report is 1,708, spread over across all the agroclimatic zones. Simple statistical tools are deployed to arrive at the results by agroclimatic zones and by different categories of farmers.

0.3. Status and Coverage of PMDS in the state

The spread is examined in terms of percentage of farmers adopting the PMDS in the total listed farmer households, their farming as well as social status, extent and percentage of operational area under PMDS, percentage of sample farmers willing to continue PMDS and percentage of those willing to take-up PMDS on their entire operational holding. All these are analyzed by agroclimatic zone-wise, social category-wise, and farm size-wise.

Out of total listed households, 64 percent are farmer households, i.e., 54,574 and of these, 33 percent are practicing PMDS, and 83 percent of them practicing CNF on PMDS plots in the Kharif season. Practice of PMDS in CNF villages varies across agroclimatic zones: 64 percent of farmers are in Southern zone, followed by 58 percent from High Altitude and Tribal Areas (HAT) zone and only 14 percent from Scarce rainfall zone respectively. The spread also varies across farm sizes, while 65 percent of small holders (36 percent of marginal farmers and 29 percent of small farmers) are practicing PMDS as against 21 percent of other farmers comprising of medium and large farmers. Within the sample farmers, 86 percent are small and marginal holders. Among social categories, 35 percent of sample of sample farmers belong to SCs and STs. Thus, the PMDS spread is seen across all farm sizes and among all social groups.

With regards to area and plots allocation to PMDS, each cross-section sample farmer allocated 1.05 plots to PMDS, and each panel farmer allotted 1.08 plots for PMDS. On an average, 0.43 hectares are allotted for PMDS practices which constitute 38.2 percent in the

total operating area, but it varies across zones. However, the spread is steadily progressing, and the progress is observed among all categories of farmers. Almost all of them expressed to continue PMDS practices though there are variations in willingness to take up PMDS in their entire operational area.

0.4. Adoption of PMDS protocols

As per the protocol, each practitioner must grow PMDS in at least half-an-acre or 0.2023 hectare, and on an average, each sample farmer has grown PMDS in 0.43 hectare, thus exceeding protocol by big margin. Of the suggested protocol of growing 15 to 20 crops in a plot, our sample farmers grow 13 crops in a PMDS plot. RySS recommended 12 to 15 kgs seeds per acre. It turns out to be 30 to 37.5 kgs per hectare. At the state level, the farmers used 33 kgs of seed per hectare. It is very much within the prescribed seed rate. However, there are marked variations across the agroclimatic zones, varying from 19 kgs in HAT zone, 22 kgs in North coastal zone to 40 kgs in Krishna zone and 42 kgs in Southern zone. One of the protocols is to pelletize the seed before sowing for better spacing to reduce the seed rate. Very less percent of farmers followed the protocol, but one should be cautious in interpreting as some of the seeds need not require pelletizing. It is heartening to note that 100 percent of the sample farmers followed the protocol related to seed treatment with Beejamrutham. About 55 to 63 percent of the sample farmers used growth stimulated biological inputs such as Ghana- and Dravajeevamrutham respectively, though the usage varied across zones. It may be noted that Ghana- and Dravajeevamrutham can be used as substitutes. Probably each farmer might have used either Ghana- or Dravajeevamrutham. However, less percent of farmers resorted to use plant protection which again depends on the necessity. Though the crops grown in general under PMDS are rainfed or mist based, minimal irrigation is also suggested depending upon the condition. Nearly 41 percent of the sample farmers resorted to minimal irrigation from different sources. It is mandatory to follow mulching with locally available materials and 43 percent of our sample farmers followed this practice, and it is mostly from Scarce rainfall zone and HAT zone. Nearly, two thirds of the farmers applied soil layer on the non-live mulch material. One third of the farmers had some sort of fencing to the PMDS plots. Thus, farmers are aware of the protocols to be followed and depending upon the necessity they are adopting the procedure. However, it is advised that grassroot level functionaries need to continuously propagate these principles for better results.

0.5. Input use, costs, returns and other benefits of PMDS farming

Seed use depends upon the crop and agroclimatic conditions of the area. For instance, as expected, farmers from Scarce rainfall zone used the highest seed rate per hectare (42.06 kgs) while it is 33.20 kgs at the state level. Around 9 litres of Beejamrutham are used to treat the seed and most of the quantity is prepared by farmers themselves. There are significant differences between the zones in the quantities of growth stimulating inputs used, such as Ghana and Dravajeevamrutham though farmers from Scarce rainfall zone used the highest quantities. At state level, 405 kgs of Ghanajeevamrutham and 381 litres of Dravajeevamrutham are used per hectare. With respect to the plant protection inputs, the use is mostly visible in Southern and Scarce rainfall zones. More quantities of Asthrams compared to Kashayams are used and they are mostly homemade. Labour use at the overall level is 42 days per hectare, but its requirement varied across zones. Farmers from Scarce rainfall zone employed 56 days per hectare, followed by Southern zone employing 48 days and HAT zone using 46 days respectively. PMDS practices not only brought additional income to the farmers but also created higher self-employment to the farmers especially small holders and socially marginalised groups.

At the state level, total cost of PMDS cultivation per hectare works out to be ₹28,637, and there are significant zonal variations. Cost per hectare varied depending upon the major crop grown along with other crops. Overall, in the total cost, own input costs that include labour, seeds, and other materials used for cultivation accounted for 75 percent. Cost per hectare is inversely related to the farm size and the average cost per hectare is around ₹3,000 decreasing as the farm size increases. In the total cost, the share of human labour is the highest at 43.3 percent followed by growth stimulating inputs such as Ghana and Dravajeevamrutham (27.8 percent) and machine and bullock labour at 14.7 percent.

Total value of output from PMDS has recorded at ₹34,932 per hectare, but there are huge inter-zonal differences. Among the different forms of returns, the highest returns from final output are from Scarce rainfall zone, whereas the highest value of fodder and intermittent products is from Southern zone, and the highest value of green manure ploughed back into the soil is in Krishna, HAT and North coastal zones. The share of these different forms of returns in the total value varied across zones because of growing different combination of crops.

Net returns per hectare over total cost are ₹6,295 but it varies substantially across the zones. Since own human labour cost in total cost is substantially high in HAT zone, North coastal and Godavari zones, the net returns over total cost are not attractive. Overall, ₹19,509 is the net returns over paid-out cost and it varied from ₹2,499 in North coastal zone to ₹21,186 in Southern zone. The benefit-cost ratio is 2.26 times over the paid-out cost, implying that every rupee spent as paid-out cost, has given profit of ₹1.26. More than three fourths of farmers perceived that their soil has been improved due to practice of PMDS and a little over half of them admitted that they are eating quality and nutritious food, getting fodder to the livestock, and noticing enhanced soil moisture.

0.6. Major issues, challenges and way forward

The major challenges faced by the farmers in PMDS cultivation are: shortage of biological stimulants (56 percent reported) followed by shortage of seeds (51 percent), protecting the crop from grazing animals during summer (47 percent), non-availability of tools and instruments required for preparation of required inputs as well as for practicing PMDS (46 percent), and shortage of mulching materials (42 percent).

Against recommendation of 15-20 crops in a plot, the farmers in Southern zone could sow less than 10 crops and the farmers of Krishna and Scarce rainfall zone could plant 13 crops only. Non-availability of certain seeds could be one of the reasons. It is well known that the crop diversity has been declining significantly in recent years. Some of the traditional crops and seeds are endangered. Special efforts are needed to revive and propagate those crops. The RySS' field staff are doing commendable work in procuring and distributing the seeds of different crops, especially the seeds of endangered crops. Another issue with respect to seeds is over dependence on purchased or procured seeds. Only 9 percent of the farmers used their own seed for PMDS farming, while 32 percent used both own and purchased seeds. Nearly three-fifths of the farmers (59 percent) used purchased seed only.

There are zone specific challenges, more than three fourths of the farmers from Godavari zone reported non-availability of hired labour. It is encouraging to note that 97 percent expressed confidence on PMDS and 87 percent did not agree that PMDS practices are non-remunerative. Master farmer or ICRP is the dominant source for extension services to the farmers irrespective of the zone (95 percent). The average level of satisfaction in the scale of 1 to 5 (5 being the highest satisfaction level) shows that they are happy with extension services though they varied across zones.

0.7. Suggestions for expansion of PMDS

There is a large scope for expansion in Krishna zone and Scarce rainfall zone where only 12 and 14 percent of farmer households respectively are following the PMDS. There is need to activate ground level staff in the CNF gram panchayats in these zones. Even in HAT zone, less than 10 percent of farmers are practicing PMDS in their entire operational area which need attention of grassroot level functionaries.

The average number of crops grown in PMDS plots is less than the recommended number. Farmers in general and in Southern zone in particular, need to be educated to go for a greater number of crops in a PMDS plot, with the slogan ***“higher the number of crops in a plot higher the benefits from it”***. The State Agriculture Department supplies every year, the kits, with the seeds of 3-5 green manure crops to be raised before Kharif or main crop. RySS may collaborate with the Department to supply PMDS seeds kits, in place of green manure crops’ seeds kits.

Most of the PMDS practitioners of Scarce rainfall zone, Southern zone, and Krishna zone are not aware about the practice of PMDS, which would capture the atmospheric water vapor and protect the microorganisms and soil moisture. Hence, the attention of the extension personnel is needed to propagate these benefits, so that other farmers also fall in line to practice PMDS. It is necessary to explore the possibility of handholding the PMDS farmers by the Government to counter the challenges faced by the farmers in the larger interest of climate protection and health of the people. Around one fifth of farmers in the state and half of the farmers in HAT zone reported lack of extension services which need to be strengthened.

By making the grassroot level functionaries more responsible with incentives, in identifying and addressing zone specific challenges, there is a large scope for expanding the PMDS both in terms of number of farmers following the PMDS as well as area under PMDS.

Chapter-1: The Context of Pre-Monsoon Dry Sowing and the Methodology of the Report

1.1. Context

Agriculture in Andhra Pradesh is a key driver in the state's economy, and it has increasingly become water intensive and expensive. Its activities are one of the main contributors to human emissions of greenhouse gases due to intensive fertilizer usage and deforestation which has negatively impacted the well-being of the farmers. There is enough evidence to show that returns from chemical-based agriculture are not commensurate with the increased cost of cultivation, making the farmers indebted, on the one hand, and the chemical usage has caused the degradation in the land quality, on the other. Continuous vegetation cover on the farms and reduced tillage of farms may result in reversing the land degradation and improving the carbon content in the soils. These are also some of the cost-effective greenhouse gases' mitigation activities, besides enhancing the food and water security, reviving the biodiversity in agricultural landscapes, and supporting the achievement of sustainable development goals.

Frequent nature calamities such as droughts, cyclones and untimely rains have become an obstacle in achieving the food security of the growing population. Because of these, excessive exploitation of natural resources has become the order of the day and it has become a challenge in the efforts to achieve sustainable development goals. To counter this, climate-smart agriculture (CSA) offers a wealth of opportunities combining a focus on sustainably increasing agricultural productivity and incomes; building resilience and adapting to climate change; and reducing and/or removing greenhouse gas (GHG) emissions, wherever possible (FAO 2019).

Considering all these, in the interest of farmers' welfare, the government of Andhra Pradesh have established "*Rhythu Sadhikara Samstha*" (RySS) which is an integrated institutional mechanism having several programmes, schemes and activities intended for farmers' empowerment, leading to farmers' welfare, development, and capacity enhancement. It is all the more important in the context of persistence of smallholder agriculture which often raises questions like whether small farms can generate the required food surpluses needed to feed a growing urban population. Can the present trend in the growth of small farms ensure

sustainable livelihood for smallholders? (Reddy, D. Narasimha, 2022). The objectives of RySS are to promote climate resilient, chemical free, ecological agriculture across all agroclimatic zones, and to provide small and marginal farmers a profitable livelihood from agriculture. To start with RySS promoted 'Zero-Budget' Natural Farming (ZBNF) in 2016 which is a holistic agroecological alternative to high-cost chemical inputs-based agriculture. This alternative agricultural system could address the impacts of climate change, reduce input costs, and create sustainable farming livelihoods in ways that are rooted both in science and Indian tradition. Later, the name, ZBNF, was changed to Andhra Pradesh Community Managed Natural Farming (APCNF). The intervention is at the household level and area wise customized APCNF interventions are identified and promoted through the selected farm households.

The field level implementation has commenced from Kharif 2016 on a pilot-basis in 704 villages with funding from GoI and GoAP through Rashtriya Krishi Vikas Yojana (RKVY). During 2020-21, it was expanded to 3730 villages covering 4.80 lakh farmers; and by 2021-22 it covered 5.92 lakh farmers (SES, 2020-21). Thus, APCNF is a paradigm shift in agricultural development. State promoted APCNF is supported by the Government of India through Rashtriya Krishi Vikas Yojana (RKVY), Prime Minister Krishi Vikas Yojana (PKVY), Azim Premji Philanthropic Initiatives (APPI), Sustainable India Finance Facility (SIFF) – an innovative partnership between UN Environment, BNP Paribas, the World Agroforestry Centre and KfW.

1.2. APCNF Progress

The main objectives of APCNF are: i) reduction in the cost of cultivation through elimination of the use of chemical fertilizers and pesticides, ii) usage of locally available inputs, iii) adoption of natural means for the soil fertility and quality enhancement, iv) 365 Day Green Cover (365DGC) through the promotion of crops during four seasons, viz., (a) Pre-Monsoon Dry Sowing¹ (PMDS), (b) Kharif crops, (c) Pre-Rabi Dry Sowing (PRDS), and (d) Rabi Crops; and different models of agriculture cropping, and v) Promotion of village seed banks. APCNF is a suite of practices that include seed treatment through liquid microbial (Beejamrutham), soil treatment and soil fertility enhancement through locally made liquid and dry microbial from cow-dung based formulations (Dravajeevamrutham and Ghanajeevamrutham), soil protection by taking crop residues back to the soil and using live

¹ Dry sowing, by definition, means cultivating crops without any irrigation, or sowing with minimum soil moisture (say, irrigation of about 2 millimetres).

mulching to keep the ground covered all the time through poly-cropping. The present report highlights the progress and impact of PMDS under overall APCNF.

1.3. Pre-Monsoon Dry Sowing (PMDS)

RySS is not only expanding the programme horizontally i.e., covering a greater number of farmers and area, but also improving the content of the programme over the time. PMDS is one among the major breakthroughs in the APCNF to advocate 365 DGC, which, in turn, is a part of climate smart agriculture. PMDS is a system of sowing, tilling, and tending the land wherein the farmer can grow crops in summer season, pre-Rabi season or on the days when there is no crop cover on the land. The thrust of the programme is that the land should always be covered with some crops, and farmers should not depend on rainy season only for growing crops, which is predominantly the case of farming in India.

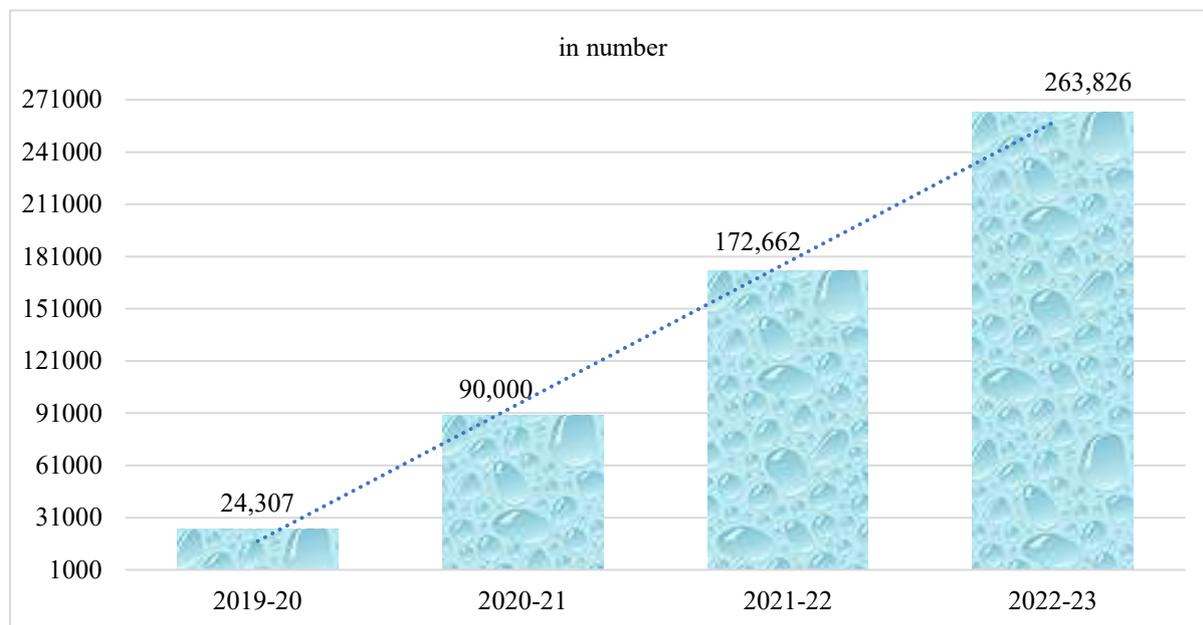
PMDS is a global breakthrough and the exact science of PMDS is yet to be determined. The enhancement of soil biology, through CNF practices and raising of multiple diverse crops as a mixed crop cultivation, creates some special conditions for the seed germination and plant survival during the dry seasons. In PMDS, mulching practice across the field acts as the catalyst to harness the water vapour from the atmosphere that drops to the land surface in the form of early morning dew. The material used for mulching facilitates the percolation of the dew into the soil and prevents its evaporation again. It is therefore recommended to the farmers to follow PMDS during March-May/June, followed by Kharif crops, Pre-Rabi dry sowing (PRDS) and Rabi crops, under the overall CNF programme. Farmers are expected to get multiple benefits through the crops grown under PMDS and PRDS that include obtaining intermittent cash income, food items, green manure, and green fodder to animals. Thus, PMDS contributes to cropping intensity, increased agricultural incomes, and continuous green cover to the soil for 365 days in a year. In turn, these practices would result in the improvements in the soil fertility besides reducing and/or removing greenhouse gas (GHG) emissions. But farmers should follow the APCNF protocols to achieve maximum benefits.

1.4. The progress of PMDS overtime

The data reveals that the number of farmers cultivating PMDS has been rapidly increasing over the years (Figure1). The number of farmers practicing PMDS were 24,307 in the year 2019-20 and this number is increasing year after year. For instance, in the second year of PMDS, i.e., 2020-21, 65,693 additional farmers joined the club of PMDS practitioners followed by another 82,662 farmers in the year 2021-22, bringing the total to 1,72,662. In the year 2022-23, another 91,164 farmers joined, adding to a total of 2,63,826 farmers practicing

PMDS. Thus, the increase in the number of farmers practicing PMDS year after year is a strong indication of growing interest of farmers in PMDS and in APCNF. It is also an indication of potential benefits from PMDS and CNF.

Figure 1.1: Year Wise Number of Farmers Practicing PMDS



Source: RySS data

As mentioned elsewhere, this report is to focus on the PMDS and its contribution to farm income besides agroecology. The study captured the data from all the districts by deploying well trained enumerators, team supervisors and zonal supervisors. The objectives of the present report are given below. In this report the word CNF is invariably means CNF practices on the PMDS plots or otherwise called PMDS+CNF.

1.5. Objectives of the Study

The broad objective of this report is to carry out a situational analysis of PMDS farming in the state of Andhra Pradesh in 2022. Specific objectives are as follows:

1. To assess the coverage of the PMDS in terms of the extent of participation and characteristics of participating farmers.
2. To examine the extent of adoption of PMDS practices in relation to the protocols suggested by the RySS.
3. To analyze the input use, costs, returns and other benefits from PMDS farming in the state.

4. To assess the major challenges faced by farmers in practicing PMDS farming.
5. To examine the extension services received by the farmers for PMDS, and to assess their views on PMDS, and consequentially to suggest measures for further expansion of the program in the state.

1.6. Methodology

This report is a part of the larger study assessing the impact of APCNF during 2022-23. The objective of the larger study is to make a comparative assessment of outcomes of CNF practices of cultivation vis-a-vis non-CNF (chemical-based) practices of cultivation. The outcomes include farm income, costs, returns, etc. A stratified and two stage random sampling design is adopted to cover all the three categories of farmers. The stratification is based on a combination of the six agroclimatic zones (Annexure-1.1) and 26 districts of the state. Each district belonging to a zone is treated as a stratum. In case a district falls in more than one agroclimatic zone, then each part of the district in a zone is treated as separate stratum. Thus, a total of 30 strata were formed.

1.7. Selection of GPs

The sample frame for CNF (treatment) is the list of all the Gram Panchayats (GPs) provided by RySS, where CNF is practiced and the list of the rest of the GPs in the state is sampling frame for non-CNF (control). The CNF frame is also used for selection of partial cultivators. To optimise the resource use, all GPs with less than 10 cultivators are excluded from the treatment sample frame. However, there is no such exclusion for non-CNF frame. The total sample size of GPs is allocated to the strata in proportion to their size. The sample size is fixed at 130 GPs for CNF and 65 GPs for non-CNF surveys. In the case of treatment (CNF), the sample GPs are selected using probability proportionate to size with number of cultivators as size. For non-CNF survey, the selection is based on simple random sampling without replacement.

In each selected GP, a list of all cultivators is prepared through a listing survey along with information required for deciding the eligibility of cultivator for the survey. The criterion for eligibility is 1) practicing both PMDS+CNF and 2) cultivating any of the identified major crops in Kharif and in Rabi (intended - not actual).

1.8. Sample Frame for Cultivators

The strategy for selection of cultivator in the present survey is guided by two important factors. First, the design should give unbiased and efficient estimates of all indicators for cultivator community as a whole and second, the design should cover all the major crops of interest in adequate numbers for both Kharif and Rabi. *The latter is important as the panel of cultivators selected in Kharif will also be covered in Rabi season.* Therefore, sample frame for drawing the sample cultivators should be able to meet both the conditions.

As in the earlier round, procedure for selection of cultivators targets a specified sample size of cultivators for each of the crops. The sample size fixed at state level for Paddy is 300, for Groundnut and Cotton 200 each, for Maize, Black gram, Red gram, Tomato, and Ragi, 100 each and for Chillies 150. For two crops, i.e., Bengal gram and Green gram which are predominantly Rabi crops, no samples are allocated as the reporting itself is very low. The crop specific sample size is spread across the GPs uniformly to ensure that the samples are not concentrated in few GPs. It is obvious that in this procedure a cultivator selected for one crop may also be selected for another. All such duplicate cultivators will be deleted from the final set of sample cultivators.

A total of 1,328 cultivators are selected for CNF survey. As mentioned earlier, except for Bengal gram and Green gram, the sample design yields adequate number of samples for each crop in Kharif. In the case of Rabi, the sample shows shortfall in a few cases. In such cases, additional sample can be taken during Rabi season. In addition to the sample selected through listing survey (cross section), 380 farmers at the state level are continued as panel farmers and these farmers are included for the PMDS survey; and the final sample for the present report is given in the table 1.1 below.

Table 1.1: Agroclimatic zone wise, farm size wise, social group wise number of cross section and panel sample farmers selected for the survey

Agroclimatic zones and farmers' categories		Number of sample farmers		
		CNF	Panel	Total
State	A P (total)	1,328	380	1,708
Agroclimatic zones	High altitude zone	214	30	244
	North coastal zone	97	58	155
	Godavari zone	82	60	142
	Krishna zone	233	91	324
	Southern zone	370	83	453
	Scarce rainfall zone	332	58	390
Farm size categories	Marginal farmers	759	206	965
	Small farmers	396	114	510

Agroclimatic zones and farmers' categories		Number of sample farmers		
		CNF	Panel	Total
Tenurial categories	Other farmers	173	60	233
	Landless tenants	47	13	60
	Owner-cum-tenants	55	16	71
	Owner-farmers	1,226	351	1,577
Social categories	SC	235	55	290
	ST	225	82	307
	BC	523	153	676
	OC	345	90	435

Source: IDSAP, Field Survey 2022-23

1.9. Structure of the report

The remaining part of this report is organized in four chapters, i.e., chapter 2 to 5. The progress of PMDS in the state, characteristics of the PMDS practitioner and their practices are covered in chapter 2. Chapter 3 covers adoption levels of different PMDS protocols by the PMDS farmers. The major inputs used in PMDS cultivation, the cost of cultivation, returns from PMDS and benefit-cost ratios are discussed in chapter 4. Chapter 5 covers the issues, challenges and way forward.

Annexure 1: List of Agroclimatic zones and their demarcation

Name of the Zone	Districts and Mandals
High-altitude and Tribal areas (HAT) Zone	This zone consists of 37 High altitude and Tribal area mandals. These include eight Mandals, viz., (1) Hiramandalam, (2) Seethampeta, (3) Kothuru, (4) Bhamini, (5) Meliaputti, (6) Saravakota, (7) Pathapatnam, and (8) Mandasa of erstwhile Srikakulam district ; seven mandals, viz., (9) Gummalakshmipuram, (10) Komarada; (11) Kurupam, (12) Makkuva, (13) Pachipenta, (14) Parvathipuram, and (15) Saluru of erstwhile Vizianagaram district ; and eleven mandals, viz., (16) Ananthagiri, (17) Arakuvalley, (18) Hukumpeta, (19) Koyyuru, (20) Chintapalle, (21) G. madugula, (22) Gudem Kotha Veedhi, (23) Dumbriguda, (24) Munchingiputtu, (25) Paderu, and (26) Pedabayalu of erstwhile Visakhapatnam district ; and eleven mandals, viz., (27) Addatheegala, (28) Chinthuru, (29) Devipatnam, (30) Gangavaram, (31) Kunavaram, (32) Maredumilli, (33) Rajavommangi, (34) Rampachodavaram, (35) V.R. Puram, (36) Y. Ramavaram, and (37) Yetapaka of erstwhile East Godavari district . ²
North Coastal Zone	All mandals of erstwhile Srikakulam, Vizianagaram, and Visakhapatnam districts, excluding first 26 mandals (i.e., 1 to 26) of HAT zone, mentioned above.
Godavari Zone	All mandals of erstwhile East Godavari, excluding last 11 mandals (i.e., 27 to 37) of HAT zone, mentioned above and all mandals of West Godavari district
Krishna Zone	All mandals of erstwhile Krishna, Guntur and Prakasam districts
Southern Zone	All mandals of erstwhile Nellore, Chittoor, and Kadapa districts
Scarce rainfall Zone	All mandals of erstwhile Kurnool and Anantapur districts

² Information was provided by Associate Director of Research (ADR), Chintapalle.

Chapter-2: Status and Coverage of PMDS in Andhra Pradesh

2.1. Introduction

This chapter discusses the status and coverage of PMDS in the state. Information collected in the listing survey conducted in the sample CNF Gram Panchayats (GPs) is utilized to assess the spread of PMDS in these GPs and the PMDS survey conducted captured the spread among the sample farmer households. The spread is examined in terms of:

- a. number and percentage of farmers adopting the PMDS in the total listed farmer households in the selected sample CNF gram panchayats (GPs),
- b. PMDS sample farmer households and their farming as well as social status,
- c. extent and percentage of operational area under PMDS by CNF and panel farmers,
- d. percentage of sample farmers willing to continue PMDS, and
- e. those willing to take-up PMDS on their entire operational holding.

All these are analyzed by agroclimatic zone, social category, tenurial category and farm size category, to see the spread and adoption of PMDS.

2.2. Spread of PMDS in the sample CNF Gram Panchayats

Out of 84,688 listed households, 64 percent are farmer households, i.e., 54,574 households. Of these farmer households, 33 percent are practicing PMDS (Table 2.1). Thus, in the state, one third of the farmer households are adopting PMDS in CNF promoted GPs and 83 percent of them practicing CNF on PMDS plots in the following Kharif season.

Percentage of farmer households in the GPs and percentage of PMDS practitioners vary across agroclimatic zones. Though one third of the farmers at the state level followed PMDS in CNF promoted GPs, it varies across agroclimatic zones. For instance, 62 percent of the farmer households in Southern zone comprising erstwhile Nellore, Kadapa and Chittoor districts were practicing PMDS, followed by high altitude tribal (HAT) zone (58 percent) and only 14 percent in Scarce rainfall zone comprising erstwhile Kurnool and Anantapur districts. However, in this Scarce rainfall zone, 99 percent of those practicing PMDS have followed CNF in PMDS plots during Kharif season

Table 2.1: Agroclimatic zone wise status on number of farmer households, adoption of PMDS and practicing CNF in PMDS plots in CNF Gram Panchayats during 2022-23

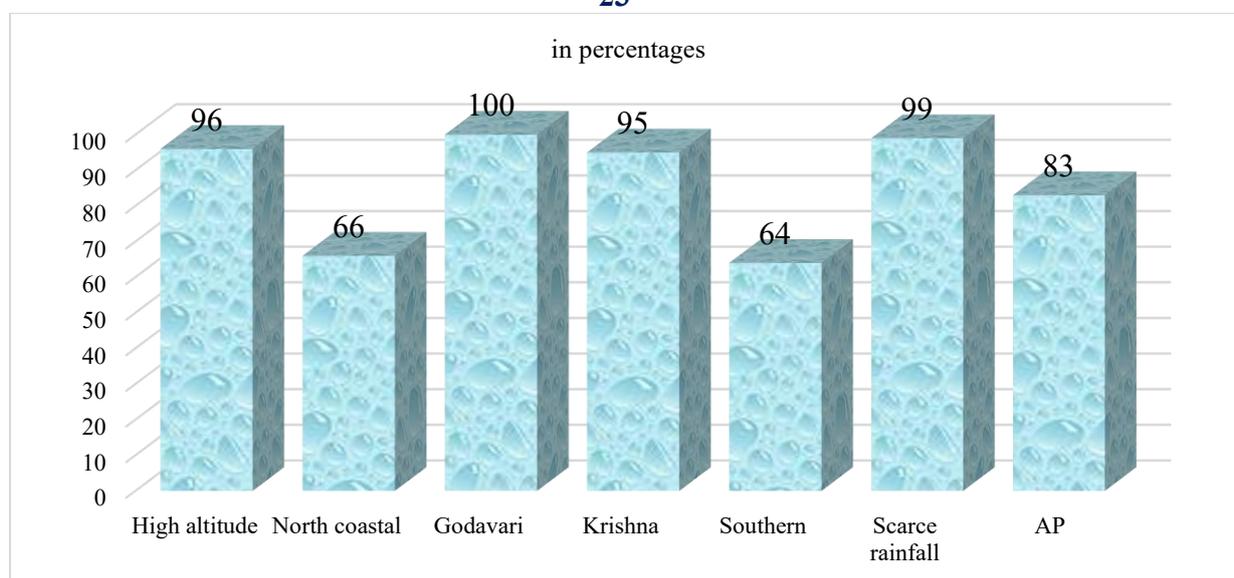
Agroclimatic zones	Total number of listed households	No. of farmer households and their %	No. of farmers and their % practicing PMDS	No. of PMDS farmers and their % practicing CNF on PMDS plot in Kharif
High altitude	4,832	4,322 (89%)	2,517 (58%)	2,405 (96%)
North coastal	9,389	4,994 (53%)	1,991 (40%)	1,320 (66%)
Godavari	15,188	7,215 (48%)	3,540 (49%)	3,536 (100%)
Krishna	15,841	11,134 (70%)	1,312 (12%)	1,243 (95%)
Southern	16,085	10,043 (62%)	6,242 (62%)	3,998 (64%)
Scarce rainfall	23,353	16,866 (72%)	2,420 (14%)	2,400 (99%)
AP	84,688	54,574 (64%)	18,022 (33%)	14,902 (83%)

Note: Figures in parentheses are percentages

Source: IDSAP, Field Survey 2022

In Southern zone which recorded the highest percentage of farmer practicing PMDS recorded the lowest percentage in continuing Kharif crop in PMDS plots (64 percent) (Figure 2.1). In Godavari zone, all the PMDS farmers are practicing CNF in PMDS plots during Kharif. Thus, significant presence of PMDS is observed across all agroclimatic zones though the spread varies.

Figure 2.1: Percentage of PMDS farmers practicing CNF on PMDS plot in Kharif 2022-23



Source: IDSAP, Field Survey 2022

The spread of PMDS also varies across farm size categories within the state. About 65 percent of small holders (36 percent of marginal farmers and 29 percent of small farmers) are practicing PMDS as against 21 percent of other farmers comprising of medium and large

farmers. Variation is also seen in practicing CNF in PMDS plots in Kharif season (Table 2.2). Percentage of farmers practicing PMDS is negatively related to the farm size, i.e., as the size increases percentage practicing PMDS decreases. In contrast, percentage of farmers practicing CNF in PMDS plots is positively related to the farm size. It is encouraging to note that 90 percent of the medium and large farmers and 92 percent of landless tenants are practicing CNF in PMDS plots.

Table 2.2: Farm size wise status on number of farmer households, adoption of PMDS and practicing CNF in PMDS plots in CNF Gram Panchayats of A.P during 2022-23

Farmers categories	No. of farmer households	No. of farmers and their % practicing PMDS	No. of PMDS farmers and their % practicing CNF on PMDS plots in Kharif
Marginal farmers	37,837	13,454 (36%)	10,913 (81%)
Small farmers	12,365	3,632 (29%)	3,147 (87%)
Other farmers	4,372	936 (21%)	842 (90%)
Landless tenant farmers	4,178	1,052 (25%)	967 (92%)
Owner-cum-tenant farmers	3,997	1,129 (28%)	1,006 (89%)
Owner farmers	46,399	15,841 (34%)	12,929 (82%)
All farmers	54,574	18,022 (33%)	14,902 (83%)

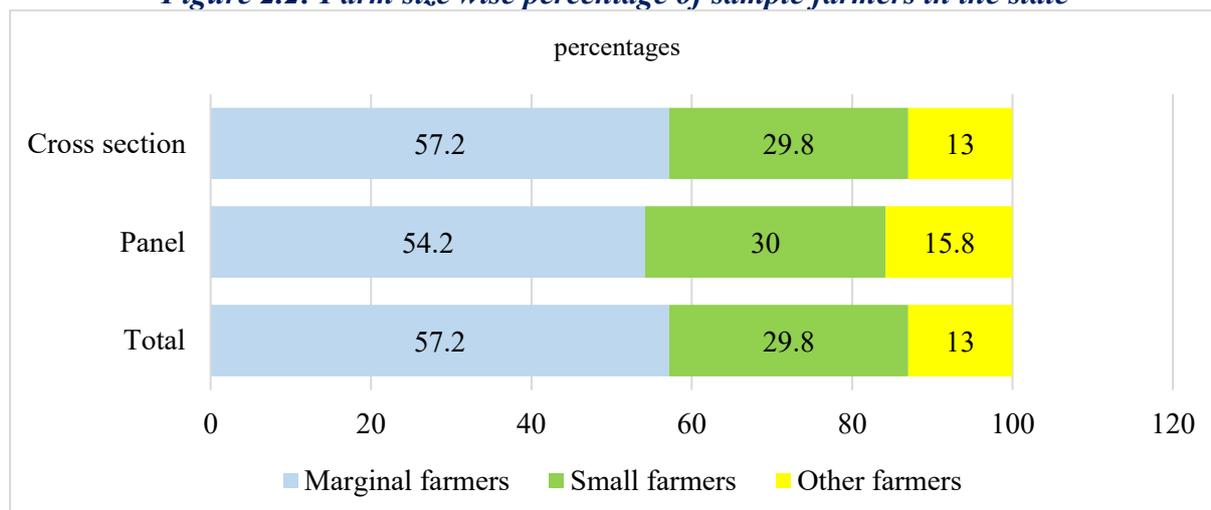
Note: Other farmers include medium and large farmers; Figures in parentheses are percentages

Source: IDSAP, Field Survey 2022

2.3. PMDS sample farmers and their status

It is apt to examine the PMDS sample farmers both cross section and panel and their status to understand who are involved in the practice of PMDS. Distribution of farm size sample households is depicted in Figure 2.2. A little over 86 percent are small holders (having less than 5.00 acres) in our sample, i.e., 56.5 percent are marginal farmers and 29.9 percent are small farmers. By and large, similar distribution among cross section and panel farmers is observed in our sample and broadly it is in consonance with the land holding structure at the state level.

Figure 2.2: Farm size wise percentage of sample farmers in the state



Source: IDSAP, Field Survey 2022

Distribution of PMDS farmers by social category both cross section as well as panel reveals that 17 percent are of SCs, 18 percent of STs, 39.6 percent of BCs and 25.4 percent are of OCs. Thus, the practice of PMDS is spreading across all the social groups and not confining to particular social group (Table 2.3). Within the social groups, little over 92 percent of SCs and STs, 86.2 percent of BCs, and 78.4 percent of OCs are small holders. Thus, it is evident that all the categories of farmer households are practicing the PMDS in the state. Zone wise, farm size wise and social group wise distribution of farmers is given in the Annexure-1.

Table 2.3: PMDS sample distribution by social group, and by farm size

Caste	Marginal farmers	Small farmers	Other farmers	All
SC	209 (72.1%)	58 (20.0%)	23 (7.9%)	290 (17%)
ST	162 (52.8%)	122 (39.7%)	23 (7.5%)	307 (18%)
BC	388 (57.4%)	195 (28.8%)	93 (13.8%)	676 (40%)
OC	206 (47.4%)	135 (31.0%)	94 (21.6%)	435 (25%)
All	965 (56.5%)	510 (29.9%)	233 (13.6%)	1,708 (100%)

Note: Figures in parentheses are percentages

Source: IDSAP, Field Survey 2022

2.4. Extent and percentage of operational area under PMDS

In addition to the distribution of PMDS practitioners, it is even more important to assess the number of plots a farmer allotted to PMDS and the percentage of PMDS area in their total operational area to assess the spread. Cross section sample may consist of new practitioners of CNF whereas panel farmers are experienced in CNF and hence it is expected that a greater number of plots are allotted to PMDS by the panel sample households. It reveals that panel farmers allotted 1.08 plots for PMDS as against 1.05 plots by cross section sample farmers at the state level (Table 2.4).

Table 2.4: Agroclimatic zone wise, farm size wise, social group wise number of PMDS plots per farmer

Agroclimatic zone	Number of PMDS plots per farmer	
	Cross section	Panel
High altitude	1.04	1.04
North coastal	1.04	1.14
Godavari	1.09	1.02
Krishna	1.06	1.10
Southern	1.09	1.09
Scarce rainfall	1.00	1.00
Andhra Pradesh	1.05	1.08

Source: IDSAP, Field Survey 2022

Like in agroclimatic zones, the variations across the farm size categories, tenurial categories and social categories are small in the number of plots allocated for PMDS irrespective of the cross section or panel sample (Table 2.5).

Table 2.5: Farm size wise, social group wise number of PMDS plots per farmer

Category of farmers – Farm size, tenancy, and social group		Number of PMDS plots per farmer	
		Cross section	Panel
Farm size categories	Marginal farmers	1.02	1.06
	Small farmers	1.09	1.10
	Other farmers	1.11	1.10
Tenurial categories	Landless tenants	1.04	1.20
	Owner-cum-tenants	1.22	1.07
	Owner-farmers	1.04	1.07
Social categories	SC	1.03	1.05
	ST	1.04	1.04
	BC	1.06	1.10
	OC	1.06	1.09
Total	All categories	1.05	1.08

Source: IDSAP, Field Survey 2022

On an average, 0.43 hectare is allotted for PMDS, which constitutes 38.2 percent in the total operating area (Table 2.6). The average area under PMDS as well as percentage area in the total operating area differed between the zones as well as the farm size groups. Farmers from Godavari zone allocated a higher percent of their area under operation towards PMDS (46.7 percent), while farmers from Scarce rainfall zone assigned only 29.3 percent in their operational area.

Table 2.6: Operational area and percentage area allocated to PMDS during 2022

Agroclimatic zone	Average operational area (hectares)	Average area allocated to PMDS (hectares)	percent of operational area put under PMDS
High altitude	1.02	0.34	33.2
North coastal zone	0.89	0.38	42.3
Godavari zone	1.14	0.53	46.7
Krishna zone	1.06	0.44	41.6
Southern zone	1.21	0.51	42.4
Scarce rainfall zone	1.23	0.36	29.3
Andhra Pradesh	1.12	0.43	38.2

Source: IDSAP, Field Survey 2022

Within the farm size groups, marginal farmers earmarked two thirds of their operational area for PMDS as against little over one fifth of their area by medium and large farmers (Table 2.7, Figure 2.3 and Annexure-2.2). Within the social groups, SC farmers assigned 47 percent of their operational area towards PMDS cultivation.

Table 2.7: Operational area and percent area allocated to PMDS during 2022

Farmers categories		Average operational area (hectares)	Average area allocated to PMDS (hectares)	percent of operational area put under PMDS
Farm size categories	Marginal farmers	0.56	0.36	64.2
	Small farmers	1.36	0.47	34.7
	Other farmers	2.92	0.61	21.0
Tenurial categories	Landless tenants	0.88	0.45	51.3
	Owner-cum-tenants	1.62	0.51	31.7
	Owner-farmers	1.11	0.42	38.2
Social categories	SC	0.84	0.40	47.0
	ST	1.02	0.39	37.8
	BC	1.09	0.41	37.5
	OC	1.44	0.51	35.6
Total	All farmers	1.12	0.43	38.2

Note: Other farmers include medium and large farmers

Source: IDSAP, Field Survey 2022

2.5. Farmers practicing PMDS in their entire operational area

About 32 percent of the PMDS farmers in the sample GPs in the state are practicing PMDS in their entire operational area. Within the agroclimatic zones, 51 percent of farmers in Krishna

zone are practicing PMDS in their entire area under cultivation, followed by 46 percent in Godavari zone and 37 percent from Southern zone (Table 2.8). It is important to note that only 9 percent of farmers in HAT zone are practicing PMDS in their entire operational area.

Table 2.8: Agroclimatic zone wise percentage range of operational area under PMDS and percent of farmers keeping their operational area under PMDS

Agroclimatic zone	Percentage range of operational area under PMDS					
	less than 24.99	25 to 49.99	50 to 74.99	75 to 99.99	100	All
High altitude zone	24	45	21	1	9	100
North Coastal zone	11	26	26	1	36	100
Godavari zone	12	23	19	-	46	100
Krishna zone	14	21	15	-	51	100
Southern zone	14	26	22	1	37	100
Scarce rainfall zone	24	30	22	-	24	100
Andhra Pradesh	17	29	21	1	32	100

Source: IDSAP, Field Survey 2022

About 60 percent of the landless tenants, 54 percent of marginal farmers, and 47 percent of SCs have allotted their entire area for PMDS (Table 2.9). At the state level, 54 percent of farmers are practicing PMDS in more than 50 percent of their operational area, and even in tribal zone, nearly one third of the farmers have earmarked more than 50 percent of their operational area for PMDS. In all other zones except Scarce rainfall zone, more than 60 percent of farmers are practicing PMDS in more than 50 percent of their operational area. Thus, the spread is observed among all categories of farmers.

Table 2.9: Percentage range of operational area under PMDS wise distribution of farmers among different farmers categories during 2022

Farmers categories		Percentage range of operational area under PMDS					
		less than 24.99	25 to 49.99	50 to 74.99	75 to 99.99	100	All
Farm size categories	Marginal farmers	3	15	29	0	54	100
	Small farmers	23	57	12	1	7	100
	Other farmers	68	21	5	0	5	100
Tenurial categories	Landless tenants	7	16	16	2	60	100
	Owner-cum-tenants	38	35	17	0	10	100
	Owner-farmers	17	29	21	1	33	100
Social categories	S C	9	20	23	0	47	100
	S T	21	41	23	1	14	100
	B C	18	27	20	0	35	100
	O C	19	28	18	1	34	100
Total	All farmers	17	29	21	1	32	100

Note: Other farmers include medium and large farmers **Source:** IDSAP, Field Survey 2022

2.6. Farmers willing to continue PMDS, and expand PMDS on their entire operational holding.

At the state level, 98 percent of the farmers expressed the view that they are willing to continue PMDS, while it is 100 percent in HAT zone, Godavari, and Krishna zones. It shows growing confidence in PMDS. But only 61 percent of farmers are willing to take up PMDS on their entire operational area. However, 95 percent farmers in HAT zone and 82 percent in North Coastal are willing to cover their entire operational area under PMDS. On the other hand, less than 50 percent of farmers in Rayalaseema region and erstwhile Nellore district area opined to take up PMDS in their entire operational holding (Table 2.10). More efforts are required in these areas to spread PMDS and thereby protecting environment besides getting economic benefits to the farmer.

Table 2.10: Agroclimatic zone wise percentage of farmers willing to continue PMDS and to take up PMDS on their entire operational holding

Category of Zone / Farm size/social group	percent of farmers willing to continue PMDS	percent of farmers willing to take PMDS on their entire operational holding
High altitude	100	95
North coastal	99	82
Godavari	100	59
Krishna	100	60
Southern	95	50
Scarce rainfall	95	45
All Zones (A P)	98	61

Source: IDSAP, Field Survey 2022

Willingness to take up PMDS in their entire operational holding is inversely related to the farm size, i.e., higher the farm size lesser the percent of farmers willing to take up PMDS in their entire operational area (Table 2.11). Similarly, more ST farmers and other marginalized groups are keen to practice PMDS in their entire operational holding. Thus, irrespective of the social category or geographical area, willingness to grow and percent area allotted in the entire operational holding is steadily progressing. It is a time-consuming process to bring the attitudinal changes among the humans and farmers as well, but the progress is encouraging.

Table 2.11: Percentage of farmers willing to continue PMDS and to take PMDS on their entire operational holding by category of farmer.

Category of Farm/social group		% of farmers willing to continue PMDS	% of farmers willing to take PMDS on their entire operational holding
Farm size categories	Marginal farmers	99	77
	Small farmers	97	45
	Other farmers	94	30
Tenurial categories	Landless tenants	98	67
	Owner-cum-tenants	100	35
	Owner-farmers	97	62
Social categories	SC	100	59
	ST	100	86
	BC	95	58
	OC	98	50
	All farmers	98	61

Note: Other farmers include medium and large farmers

Source: IDSAP, Field Survey 2022

Chapter-3: Adoption of PMDS Practices vis-à-vis prescribed protocols

3.1. Introduction

While promoting the PMDS, RySS suggested a set of protocols to be followed by the farmers which are suitable to the local conditions and farmers can easily follow these protocols. It is expected that those farmers who follow core protocols will achieve better results. Against this backdrop, this chapter analyses the extent of adoption of core protocols by the farmers by agroclimatic zone, farm size, and social group categories. The Protocols issued by RySS about PMDS practices are presented in Box 3.1. This report captured major protocols suggested by RySS and were discussed one by one.

Box 3.1: Protocols for PMDS farming: Highlights

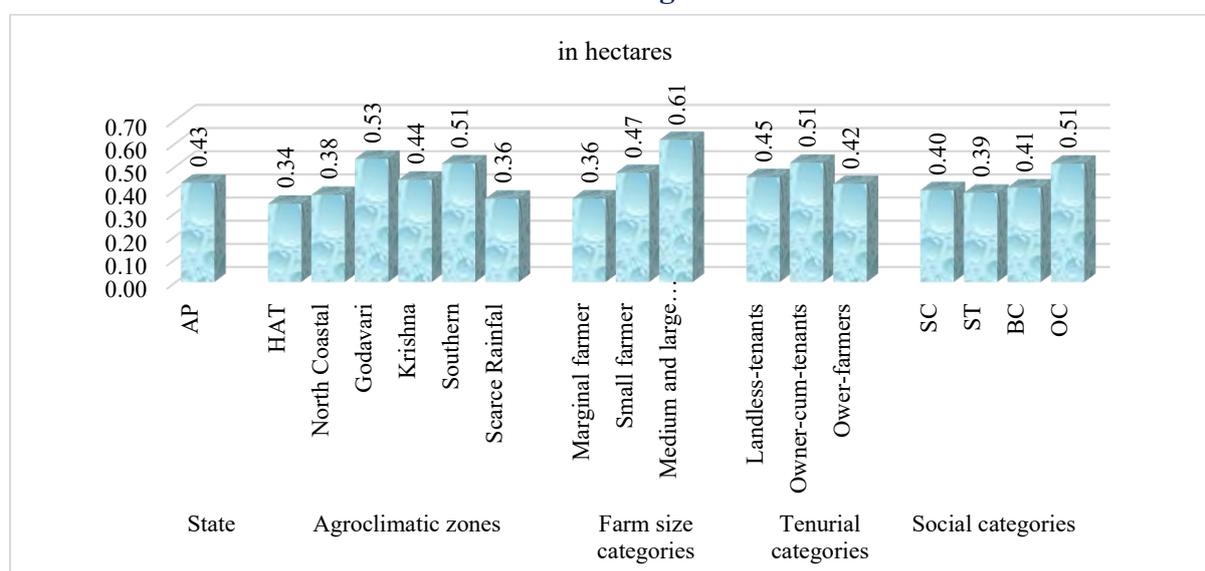
1. To maintain at least 0.5 acre under PMDS by each cultivator.
2. Grow at least 15 to 20 varieties of crops depending on local preferences in PMDS plot with a combination of Cereals, Pulses, Oil seeds, Fodder, Vegetables, Tubers, Creepers, Leafy vegetables and flowers.
3. The seed rate should be 12-15 Kg/acre and optimized based on the local farming situation
4. Seeds should be treated with Beejamrutham
5. Pelletize the Seed with clay, Ghana Jeevamrutham and Ash.
6. Application of Ghana Jeevamrutham in case of line sowing
7. Spraying of Drava Jeevamrutham in the soil before and also after germination of seeds.
8. Restrict to minimal tillage and inter-cultural operations.
9. Mandatory mulching with locally available items. Paddy husk should not be used as mulching material.
10. Application of a thin soil layer on the mulch material to prevent the loss of mulch material due to wind.
11. Fencing is mandatory for all PMDS plots—fencing may be temporary of short period of time or live fencing with Sesbania, Glyricidia, or Drumstick or any other species.

Source: RySS, GoAP

3.2. Average area allocated for PMDS

RySS prescribed to allocate **at least half acre** (0.2023 hectare) under PMDS by each farmer. However, the survey results reveal that on an average, each farmer has allocated 0.43 hectare. The farmers have, on average, allocated more than doubled recommended area to PMDS in 2022. It shows the potential benefits from PMDS. Farmers from Godavari and Southern zones have allocated 0.53 and 0.51 hectares respectively (Figure 3.1). HAT zone, North coastal and Scarce rainfall zones, in that order, have relatively smaller areas under PMDS, during the study period. Medium and large farmers, OCs and owner-cum-tenants are among the farmer categories who allocated a larger area for PMDS.

Figure 3.1: Agroclimatic zones and farmers' category wise average area allocated to PMDS during 2022



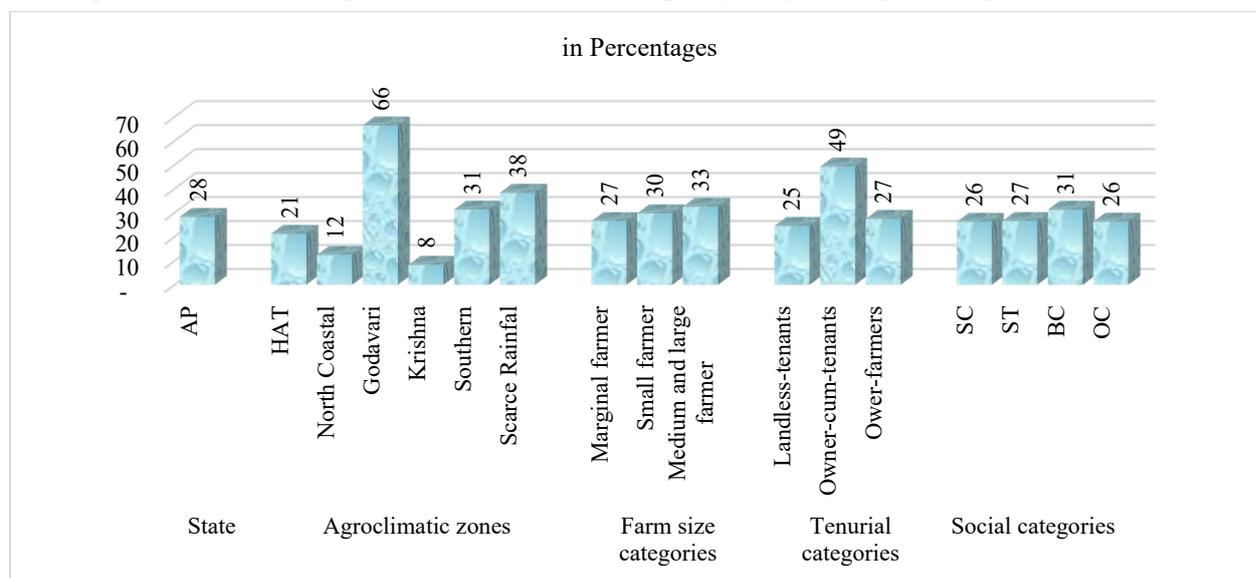
Source: IDSAP, Field Survey 2022

3.3. Number of crops grown

Growing at least 15 to 20 varieties of crops depending on local preferences in PMDS plot with a combination of Cereals, Pulses, Oil seeds, Fodder, Vegetables, Tubers, Creepers, Leafy vegetables, and flowers is another important protocol suggested to farmers. The protocols clearly indicates that PMDS is meant for promoting crop diversity in the fields. The underlying assumption is that the crop diversity in the fields would lead to more diversity (of microorganism) in the soils. It implies that PMDS is different from normal cultivation, in which focus was on the yields of one or two crops. However, there is no bar on raising a major or main crop along with other crops in the PMDS plots. At the state level, 28 percent farmers have raised a main crop (meant for yields) in their PMDS plots. Among the Agroclimatic zones, the percent of farmers taking a main/ major crop, varies from 8 percent

in Krishna zone to 66 percent in Godavari. The variations are much less across different farmers' categories (Figure 3.2).

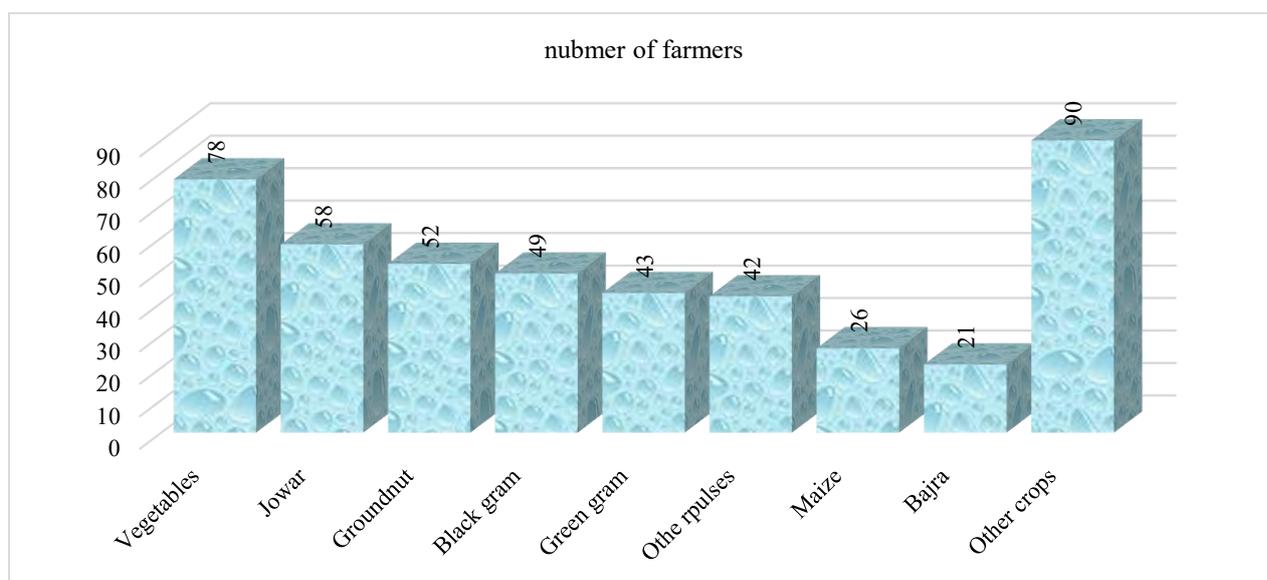
Figure 3.2: Percentage of farmers cultivating any major crop during PMDS 2022



Source: IDSAP, Field Survey 2022

Short duration crops like vegetables, pulses, Jowar (could be for fodder), and Groundnut are grown as major crops in the PMDS plots during 2022 (Figure 3.3). In total 459 (28 percent of sample) farmers have raised main crops in their PMDS plots. Major crops grown include vegetables (78), Jowar (58), Groundnut (52), Black grams (49), Green gram (43), other pulses (42), Maize (26) and Bajra (21) which is in consonance with the suggested protocol.

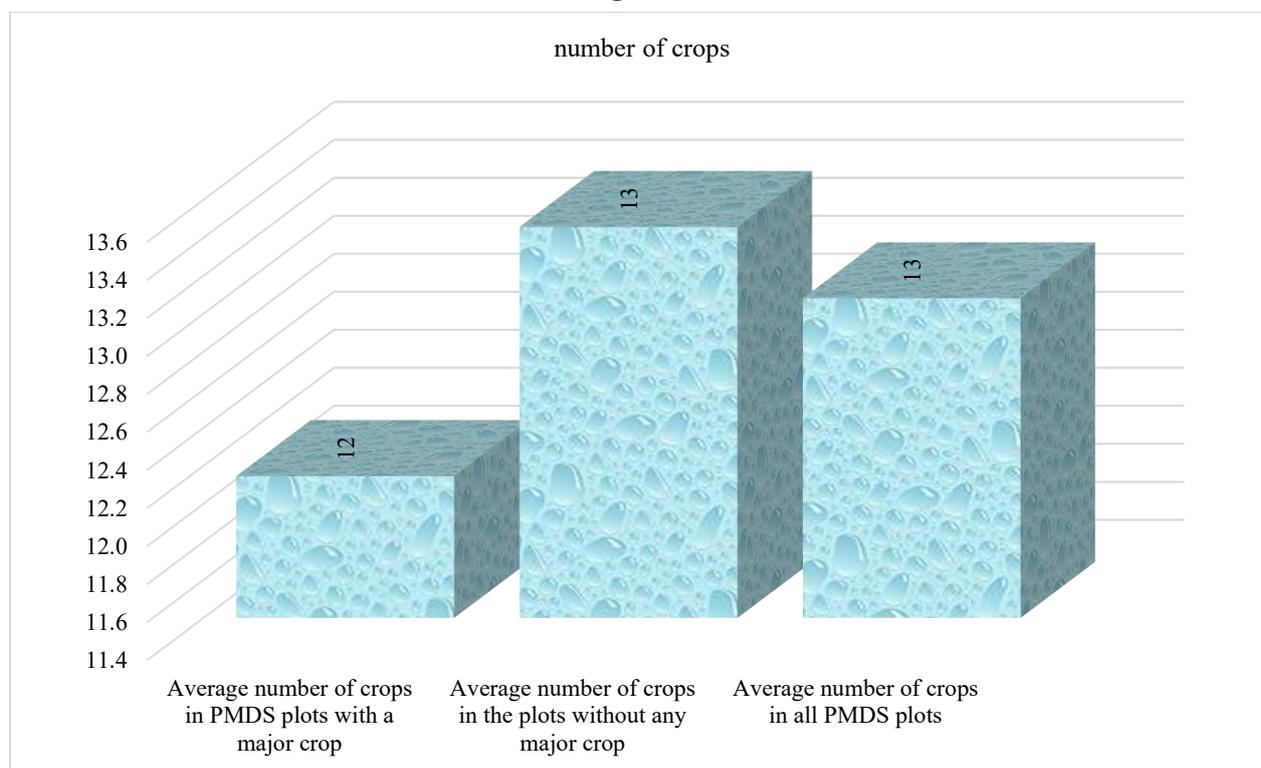
Figure 3.3: Number of farmers growing different major crops in PMDS plots during 2022



Source: IDSAP, Field Survey 2022

Raising a main crop does not mean that there is no or less crop diversity in the PMDS plots. The average number of crops in PMDS plots with a major crop is 12.1. The same in the PMDS plots without any major crop is 13.5. The average number of crops in all PMDS plots during 2022 is 13.1 (Figure 3.4).

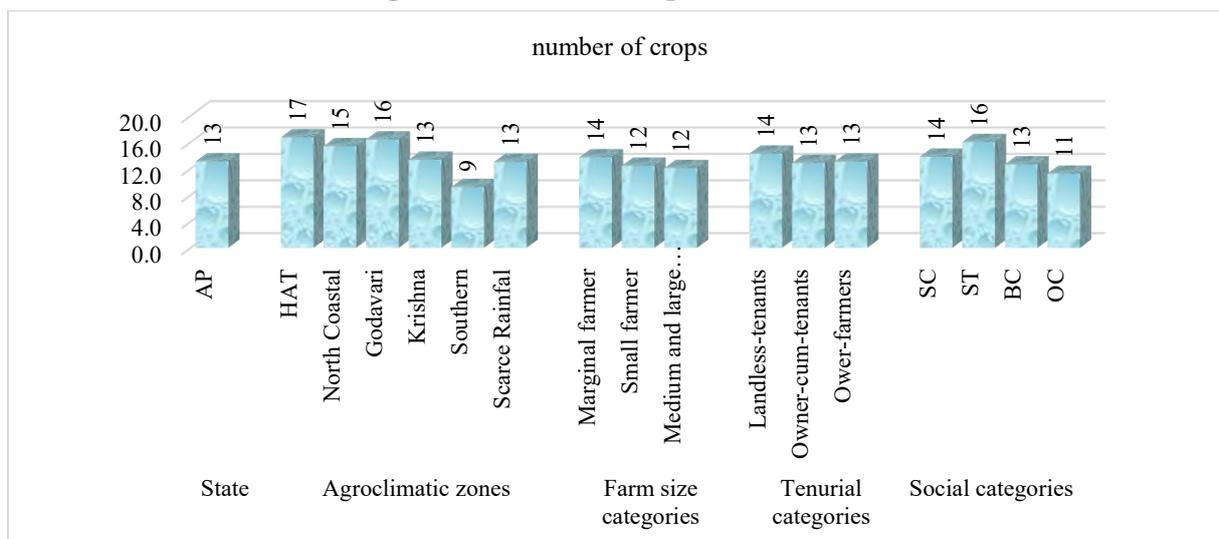
Figure 3.4: Average number of crops in the PMDS with and without major any crop during 2022



Source: IDSAP, Field Survey 2022

At the state level, farmers, on average, have grown 13.1 crops in a plot, while farmers from HAT zone, Godavari and North coastal zones followed the suggestions by growing around 16 crops in a plot (Figure3.5). Farmers from Southern zone are lagging by growing only 9 crops in a plot. Within the social groups, only ST farmers followed the protocol by growing 16 crops in a plot (Table 3.1). It may be interesting to note that the variations in the number of crops grown across the different categories of farmers is quite least compared to the variation across the agroclimatic zones. One potential reason for such wider variation in the number of crops grown across the zones could be the local conditions. Since, the concept of PMDS is new and evolving, it is apt to examine the region-specific protocols on the number of crops. Yet another reason could be non-availability of seeds in some zones.

Figure 3.5: Agroclimatic zone wise and farmers' category wise average number of crops grown in the PMDS plots in 2022



Source: IDSAP, Field Survey 2022

Table 3.1: Agroclimatic zone and farmers' category wise percentage of farmers cultivated any main crop, and average number of crops in PMDS plots in 2022

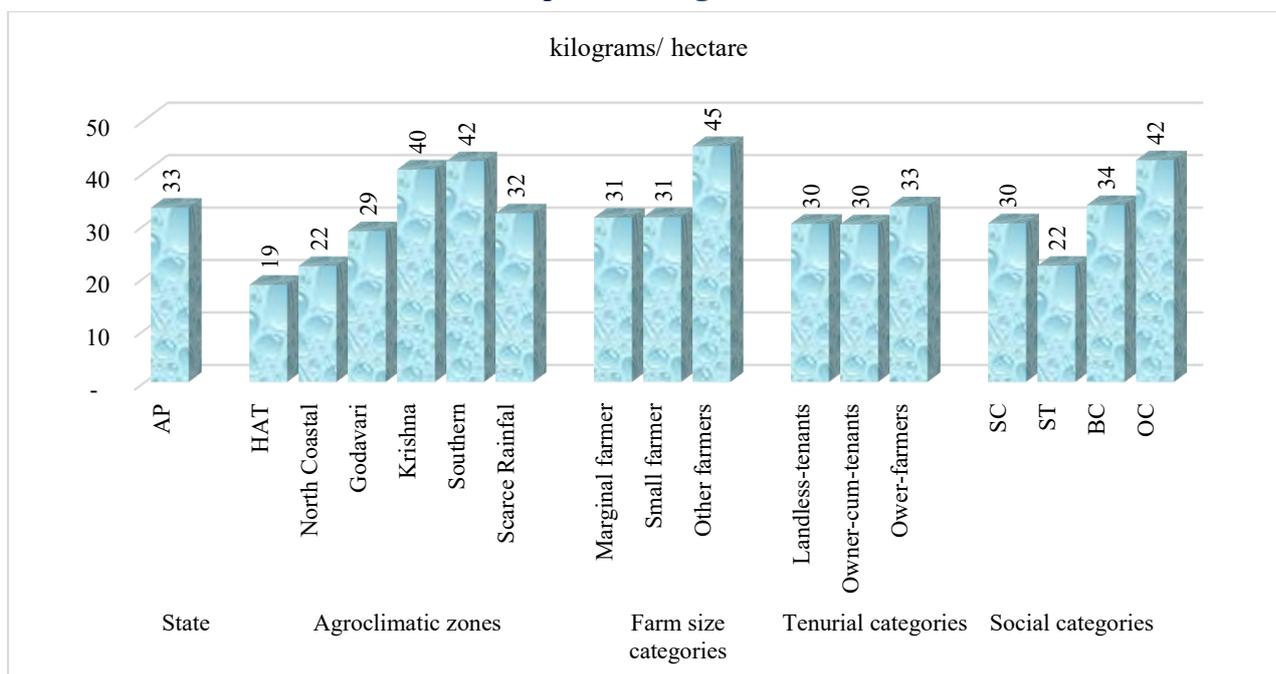
Agroclimatic zones and farmers categories		Percentage of farmers cultivated any major crop	Average number of crops in PMDS plots with a major crop	Average number of crops in the plots without any major crop	Average number of crops in all PMDS plots
Agroclimatic zones	HAT	21	15.0	17.2	16.7
	North Coastal	12	16.3	15.3	15.4
	Godavari	66	16.6	15.5	16.4
	Krishna	8	11.3	13.5	13.3
	Southern	31	8.5	9.5	9.2
	Scarce rainfall	38	10.5	14.6	13.0
	Andhra Pradesh	28	12.1	13.5	13.1
Farm size categories	Marginal farmer	27	12.5	14.1	13.7
	Small farmer	30	11.6	12.8	12.4
	Medium and large farmer	33	11.9	12.2	12.1
	All farmers	28	12.1	13.5	13.1
Tenurial categories	Landless-tenants	25	14.6	14.1	14.3
	Owner-cum-tenants	49	13.5	12.4	12.8
	Owner-farmers	27	11.9	13.5	13.0
	All farmers	28	12.1	13.5	13.1
Social categories	SC	26	13.6	13.9	13.8
	ST	27	14.1	16.7	16.0
	BC	31	10.9	13.4	12.6
	OC	26	11.9	11.0	11.2
	All farmers	28	12.1	13.5	13.1

Source: IDSAP, Field Survey 2022

3.4. Seed rate

Seed rate is another important protocol for PMDS. RySS recommended 12 to 15 kgs seeds per acre. It turns out to be 30 to 37.5 kgs per hectare. At the state level, the farmers used 33 kgs of seed per hectare. It is very much within the prescribed seed rate. However, there are marked variations across the agroclimatic zones, varying from 19 kgs in HAT zone, 22 kgs in North coastal zone to 40 kgs in Krishna zone and 42 kgs in Southern zone. But the variations are moderate among different farmers' categories (Figure 3.6). The same factors, which explain variations is the number of crops grown across agroclimatic zones and farmers' categories, appear to be influencing factors here also. Suitability of different crops across different agroclimatic conditions could be one major reason. Availability of seeds in required quantities could be another influencing factor.

Figure 3.6: Agroclimatic zone wise and farmers' category wise seed rate used in the PMDS plots during 2022



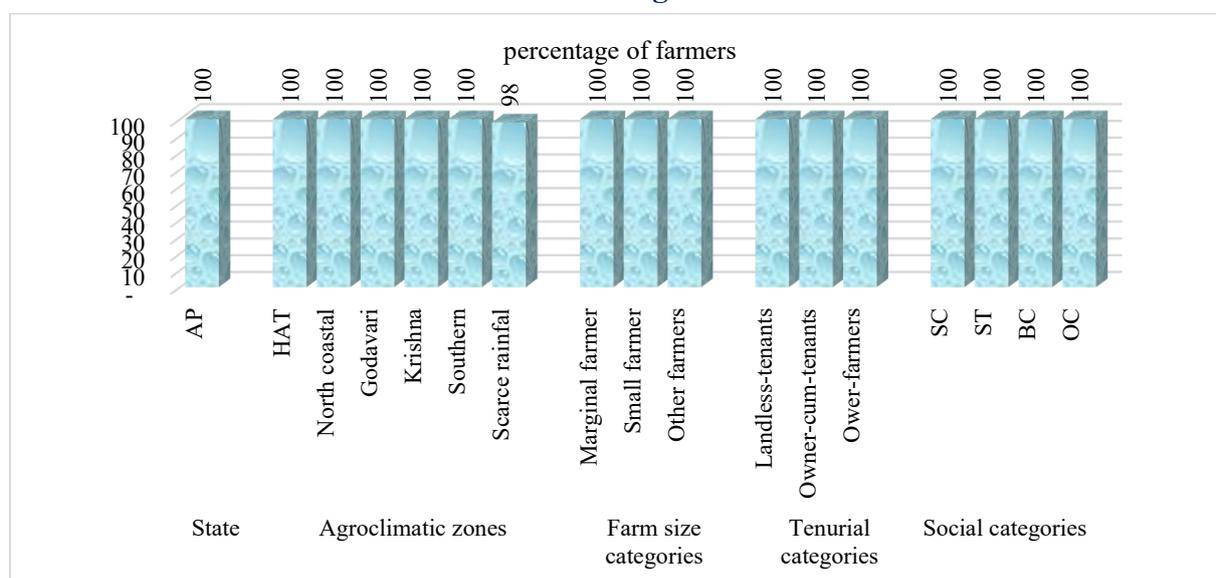
Source: IDSAP, Field Survey 2022

3.5. Seed treatment and pelletizing

It may be noted that PMDS is taken in driest months of the year, mostly in April and May. During this period seed germination is a big challenge. To facilitate the seed germination, RySS recommended for seed treatment with Beejamrutham and pelletizing of the seed with

Clay, Ghanajeevamrutham and Ash. Seed treatment is essential as seed coating and seed priming could improve the seed germination and seedling vigour particularly under unfavourable environmental conditions. These treated seeds are designed to reduce, control, or repel disease organisms, insects, or other pests which attack the seed or seedlings. At the state level, 100 percent of farmers have treated their seeds before sowing. Obviously, 100 percent of farmers in all, but one, agroclimatic zones and 100 percent of farmers in every farmer's category have treated their seeds before sowing. Only exception is the Scarce rainfall zone, in which 98 percent of farmers treated their seeds (Figure 3.7).

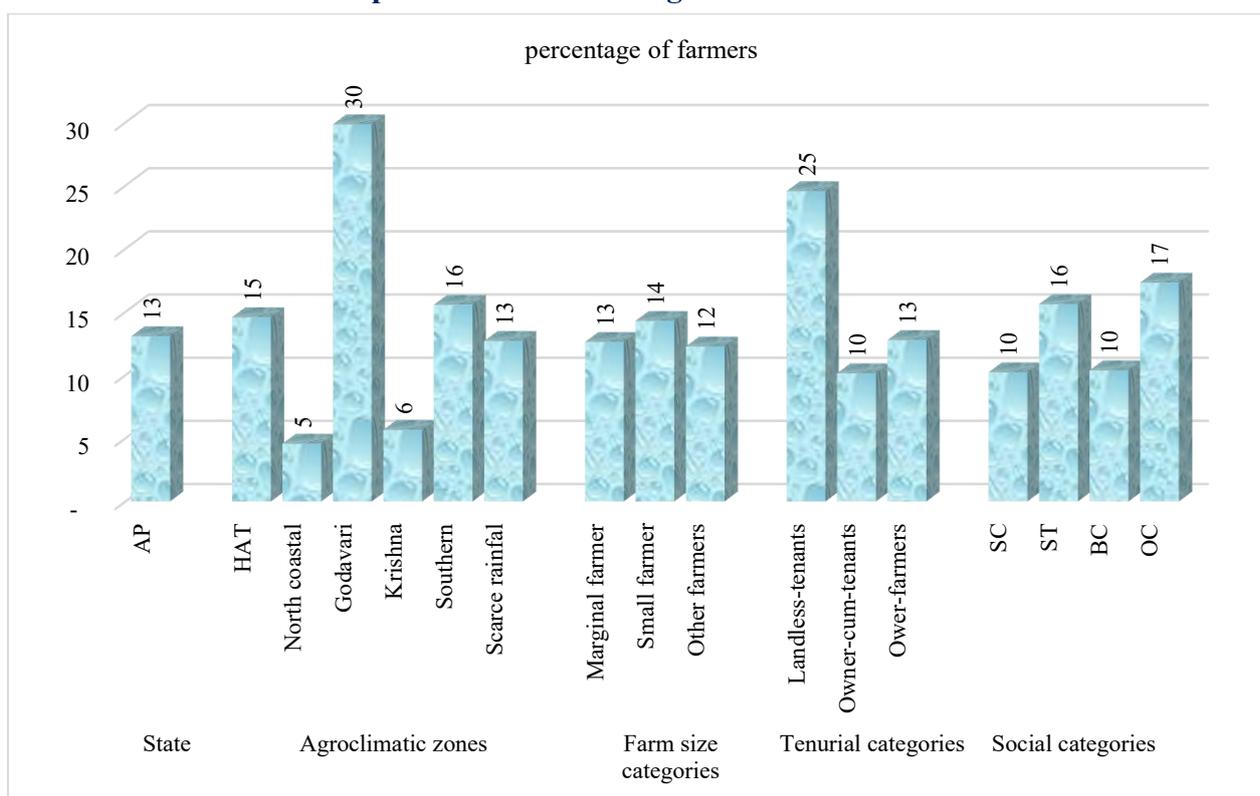
Figure 3.7: Agroclimatic zone wise and farmer's category wise percentage of farmers treated seeds during PMDS 2022



Source: IDSAP, Field Survey 2022

Another protocol suggested for farmers is to **pelletize the seed with Clay, Ghanajeevamrutham and ash**. Seed pelleting is the process of adding inert materials to seeds increasing their weight, size, and shape. This improves planting, allowing for precise metering, spacing and depth of seed in the field. Pelleting is to make small, light, and oddly shaped seeds into bold, heavy, more uniform, and round seeds so that pelleted seeds may be planted in a precise way. In addition, pelleting helps in the seed germination by adding a protective and / or nourishing coating to the seeds. At the state level, 13 percent of the farmers followed seed pelleting, and it was highly practised by the farmers from Godavari zone (30 percent). Farmers, from North coastal and Krishna zones, are far behind in seed pelleting. One fourth of the landless tenants also followed seed pelleting (Figure 3.8).

Figure 3.8: Agroclimatic zone wise and farmer's category wise percentage of farmers pelletized seeds during PMDS 2022

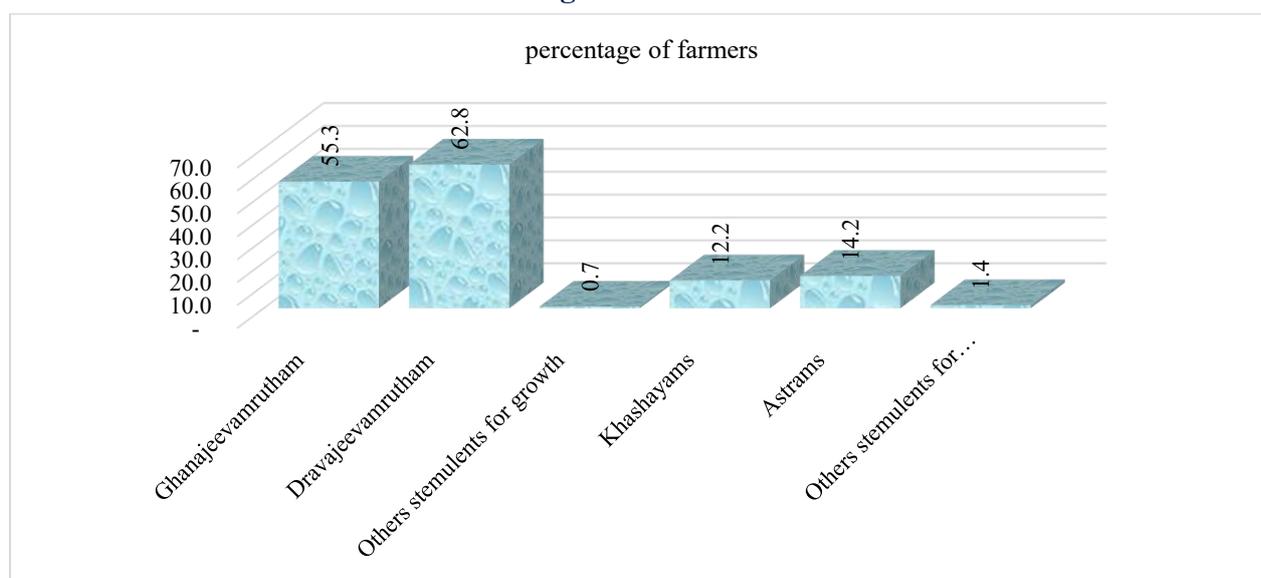


Source: IDSAP, Field Survey 2022

3.6. Use of biological stimulants

Next important protocol is using **Ghanajeevamrutham, Dravajeevamrutham, if needed Kashayams and Asthrams**. In other words, farmers must use biological inputs in place of chemical inputs. On an average, 55 percent of the farmers used Ghanajeevamrutham and 63 percent used Dravajeevamrutham (Figure 3.2). Farmers also used plant protection biological inputs such as Kashayams (12 percent of farmers) and Asthrams (14 percent of farmers). Use of these biological stimulants varied across zones. For instance, farmers from Scarce rainfall zone topped the list with 86 percent farmers using Ghanajeevamrutham and 93 percent using Dravajeevamrutham (Table 3.3). Farmers from Krishna and Southern zones are far behind in using Ghanajeevamrutham and farmers from Godavari and Krishna zones lagged in using the Dravajeevamrutham. Less than one percent of farmers used other growth stimulants other than Ghana and Dravajeevamrutham that too in Scarce rainfall zone. These are locally invented stimulants. Similarly, 1.4 percent of farmers used other than Kashayams and Asthrams towards plant protection and are mainly from Scarce rainfall zone (Figure 3.9 and Table 3.2). Use of growth-related stimulants is negatively related to the farm size. Within the social groups, more percent of STs and BCs used growth-related inputs.

Figure 3.9: Percentage of farmers using different biological stimulants and inputs during PMDS 2022



Source: IDSAP Survey 2022

Table 3.2: Agroclimatic zone and farmers' category wise percentage of farmers using different biological stimulants in PMDS 2022

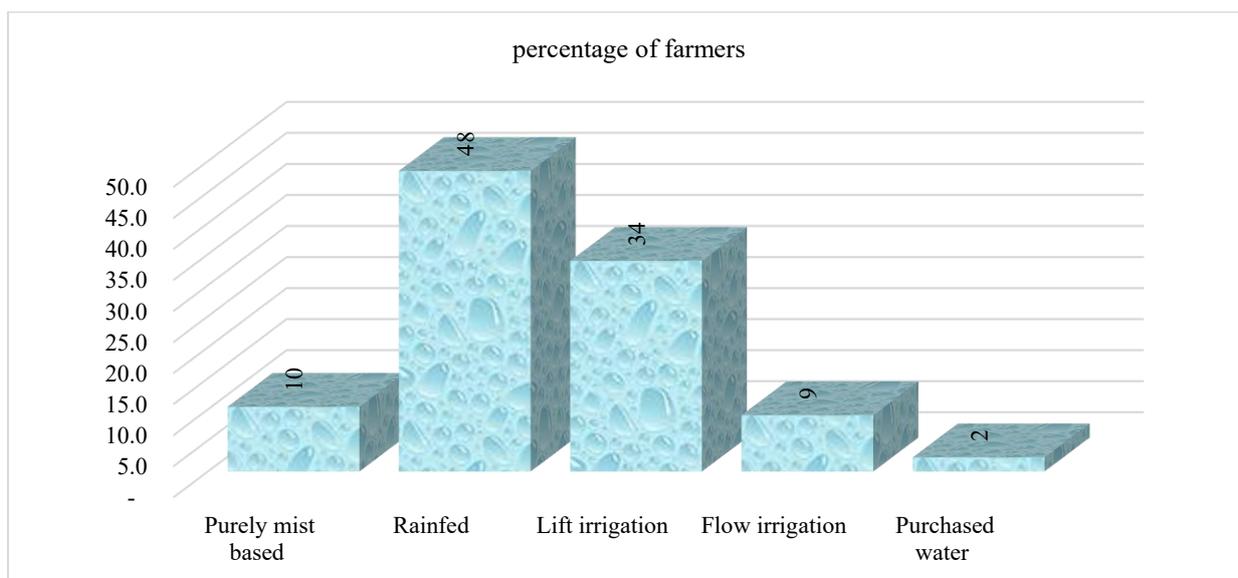
Agroclimatic zones and Farmers categories		Ghanajeevamrutham	Dravajeevamrutham	Others stimulants for growth	Khashayams	Astrams	Others stimulants for protection
Agroclimatic zones	HAT	66.7	66.7	-	38.8	0.4	-
	North Coastal	51.0	45.8	-	18.3	-	-
	Godavari	56.7	25.4	-	-	-	-
	Krishna	33.3	41.7	-	-	1.0	1.0
	Southern	38.9	67.2	-	9.0	11.1	-
	Scarce rainfall	85.9	93.0	3.2	10.5	48.4	5.1
	Andhra Pradesh	55.3	62.8	0.7	12.2	14.2	1.4
Farm size categories	Marginal farmers	54.4	61.7	0.4	11.5	12.8	0.7
	Small farmers	59.8	67.6	0.8	14.9	15.9	2.4
	Other farmers	49.1	56.6	1.9	9.0	16.0	1.9
	All farmers	55.3	62.8	0.7	12.2	14.2	1.4
Tenurial categories	Landless-tenants	38.6	36.8	-	3.5	3.5	-
	Owner-cum-tenants	46.4	44.9	1.4	2.9	18.8	1.4
	Owner-farmers	56.4	64.6	0.7	13.0	14.4	1.4
	All farmers	55.3	62.8	0.7	12.2	14.2	1.4
Social categories	SC	41.6	54.7	-	4.0	17.2	0.7
	ST	64.8	63.5	0.3	31.6	2.3	1.0
	BC	61.2	68.4	1.3	10.4	19.0	1.9
	OC	48.5	59.0	0.7	6.3	13.4	1.2
	All farmers	55.3	62.8	0.7	12.2	14.2	1.4

Source: IDSAP, Field Survey 2022

3.7. Minimum tillage and minimal irrigation

One of the major purposes of PMDS is to provide shade and nourishment to microorganism in the fields. Hence, RySS has recommended for minimum tillage and disturbance to the microbes in the soil. Further, RySS recommended for minimum irrigation or moisture equal to 1-2 millimetres of rainfall. Strictly speaking, PMDS does not need irrigation on a large scale. It is expected to sustain on the odd rainfall during the pre-monsoon months. Further, it is expected to capture the atmospheric moisture through mulching. However, it may need a critical minimum irrigation or moisture, equal to 1-2 millimetres of rainfall during the prolonged moisture-stress periods. About 10 percent farmers have reported that they raised PMDS with mist only. Another 48 percent of the farmers reported that they got PMDS through rainfed only. About 34 percent of farmers reported that they irrigated their crop through lift irrigation, including bore-wells, open-wells, and other lift irrigation sources; and 9 percent utilized flow irrigation which include canal or tanks (Figure 3.10). Nearly 100 percent farmers from HAT zone, 70 percent from Scarce rainfall zone depended upon rainfed or on mist (Table 3.3). More than half of the farmers from Southern and Krishna zones depended upon lift irrigation for PMDS crops. A little over one third of farmers from Godavari zone used flow irrigation. About 2 percent of farmers used purchased water for PMDS. It shows the importance they accord to the PMDS.

Figure 3.10: Percentage of farmers using different sources of irrigation to grow PMDS in A P in 2022



Source: IDSAP, Field Survey 2022

Table 3.3: Agroclimatic zone and farmers category wise percentage of farmers using different sources of irrigation for PMDS 2022

Agroclimatic zones and farmers categories		Purely mist	Rainfed	Lift irrigation*	Flow irrigation@	Purchased water
Agroclimatic zones	HAT	0.8	99.2	-	2.1	-
	North coastal	2.6	51.6	26.8	22.2	-
	Godavari	-	53.0	14.2	36.6	0.7
	Krishna	2.0	37.7	47.3	10.3	7.3
	Southern	35.4	7.8	59.4	5.4	0.9
	Scarce rainfall	1.9	67.8	25.9	1.4	2.7
	AP	10.4	48.4	33.9	9.1	2.3
Farm size categories	Marginal farmers	9.0	50.4	27.1	11.4	3.3
	Small farmers	13.9	51.8	35.9	5.5	0.8
	Other farmers#	8.5	32.1	59.0	7.1	1.4
	All farmers	10.4	48.4	33.9	9.1	2.3
Tenorial categories	Landless-tenants	1.8	22.8	38.6	33.3	8.8
	Owner-cum-tenants	8.7	52.2	39.1	14.5	-
	Owner-farmers	10.8	49.2	33.5	7.9	2.1
	All farmers	10.4	48.4	33.9	9.1	2.3
Social categories	SC	5.1	41.2	38.7	8.0	10.2
	ST	2.3	87.7	8.0	4.3	0.3
	BC	13.5	42.9	35.7	11.3	0.9
	OC	15.1	32.9	47.1	9.8	0.5
	All farmers	10.4	48.4	33.9	9.1	2.3

* Include Bore-well, open-well and other lift irrigation sources

@ Include canal and tank irrigation; # Other farmers include medium and large farmers;

Source: IDSAP, Field Survey 2022

3.8. Mulching

It is mandatory for PMDS farmers to do mulching with locally available biomass, though Paddy husk should not be used as mulching material.³ Normal biomass used in mulching is from different sources including, Paddy straw, husks/ biomass waste of different pulses, oilseeds, millets, coarse grains, tree-leaves, twigs, etc. Further, RySS has recommended live mulching also. Under live mulching, planting of wide leaves creepers is used, and creepers are spread across the fields. Quick growing leafy vegetables and other shrubs are also recommended. As against this protocol, 43 percent of farmers at the state level used mulching. About 40 percent of farmers applied biomass (non-live) mulch, 2 percent of farmers used live mulching and one percent used both live and non-live mulching (Figure 3.11). Most of the farmers from Scarce rainfall zone (87 percent), 59 percent from HAT zone

³ Because it generates heat and it may harm the seeds/ seedlings and germination of the seeds.

and 50 percent from North coastal zone used mulching practice. Relatively a fewer number of farmers from Southern zone (9 percent) and Godavari zone (13 percent) have taken up mulching in their PMDS plots (Table 3.4). It may be noted that agroclimatic zones, in which a higher proportion of farmers have irrigation sources, have used mulching sparsely. Comparatively a higher percent of STs, followed by BCs, used mulching in their plots (Table 3.4). Dried leaves, residue of previous crops, Red gram husk and groundnut shells dominate in the mulching material used by the farmers. However, as recommended, none of the farmers used Paddy husk for mulching.

Figure 3.11: Percentage of farmers used mulching in their PMDS plots in 2022

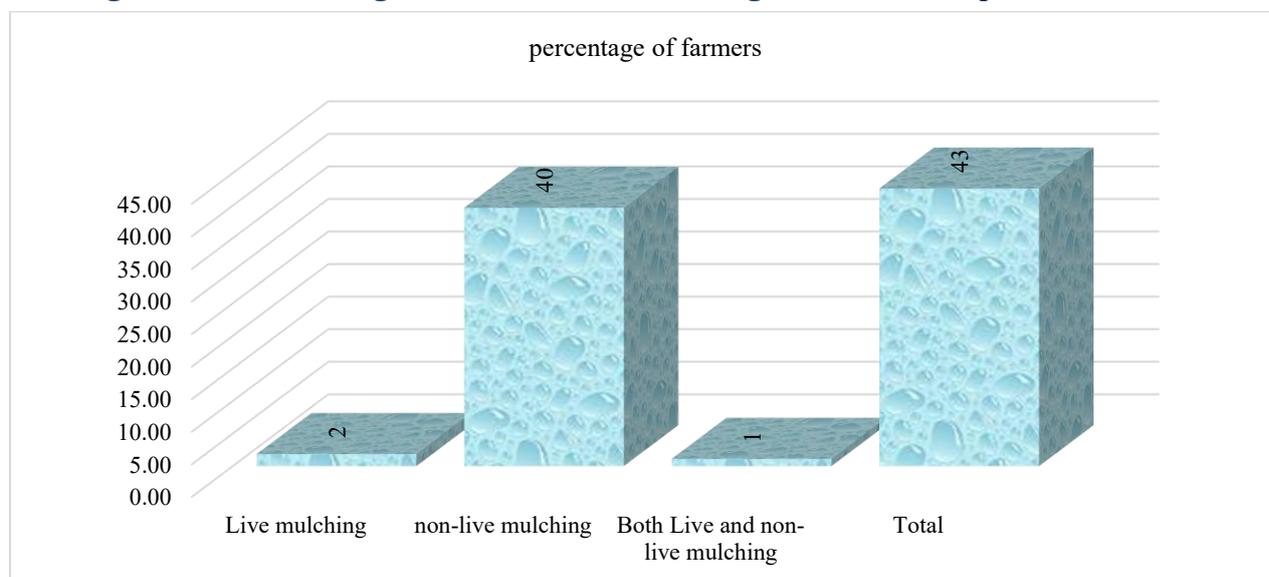


Table 3.4: Agroclimatic zone and farmers' category wise percentage of farmers used mulching in PMDS 2022

Agroclimatic zones and Farmers categories		Live mulching	non-live mulching	Both Live and non-live mulching	Total
Agroclimatic zones	HAT	0.83	57.50	0.83	59.17
	North coastal	0.00	41.83	8.50	50.33
	Godavari	0.00	12.69		12.69
	Krishna	4.00	27.33	0.67	32.00
	Southern	2.59	6.37		8.96
	Scarce rainfall	1.35	85.14	0.27	86.76
	Andhra Pradesh	1.85	39.67	1.11	42.63
Farm size categories	Marginal farmers	1.96	39.93	1.85	43.74
	Small farmers	2.04	40.82	0.20	43.06
	Other farmers	0.94	35.85		36.79
	All farmers	1.85	39.67	1.11	42.63
Tenurial	Landless-tenants	0.00	28.07		28.07

Agroclimatic zones and Farmers categories		Live mulching	non-live mulching	Both Live and non-live mulching	Total
categories	Owner-cum-tenants	4.35	27.54		31.88
	Owner-farmers	1.81	40.67	1.20	43.68
	All farmers	1.85	39.67	1.11	42.63
Social categories	SC	1.09	40.88		41.97
	ST	0.66	51.50	2.66	54.82
	BC	2.67	45.28	1.42	49.37
	OC	1.95	21.46	0.24	23.66
	All farmers	1.85	39.67	1.11	42.63

Source: IDSAP, Field Survey 202

Application of a thin soil layer on the mulch material to prevent the loss of mulch material due to wind is an important protocol, farmers are supposed to follow. It may be noted that soil layer is required for non-live mulching only, to prevent blowing away of the light biomass, which were used for mulching. In total 643 (40 percent of sample farmers) have used non-live materials for mulching. Out of those 643 farmers, 60 percent (384 farmers) followed the protocol (Table 3.5). Almost all the farmers from Godavari and HAT zones followed and one fifth from Krishna zone complied with this protocol, while only 4 percent from Southern zone applied (Table 3.5). Majority of STs (87 percent) and 61 percent of owner-cultivators applied a thin soil layer on the mulch material. But in absolute terms, the Scarce rainfall zone and HAT zone account for the lion's share of farmers, who applied the soil-layer on mulching. BC farmers are larger in number among the social categories of farmers, who applied the soil-layer on mulching (Table 3.5).

Table 3.5: Agroclimatic zone wise and farmers' category wise number and percentage of farmers applied soil-layer on mulching in PMDS 2022

Agroclimatic zones and Farmers categories		Number of farmers used non-live mulching	Number of farmers applied soil layer on mulching material	Percentage of farmers applied soil layer on non-live mulching material
State	AP	643	384	60
Agroclimatic zones	HAT	138	132	96
	North coastal	64	46	72
	Godavari	17	17	100
	Krishna	82	16	20
	Southern	27	1	4
	Scarce rainfall	315	172	55
Farm size categories	Marginal farmers	367	220	60
	Small farmers	200	123	62

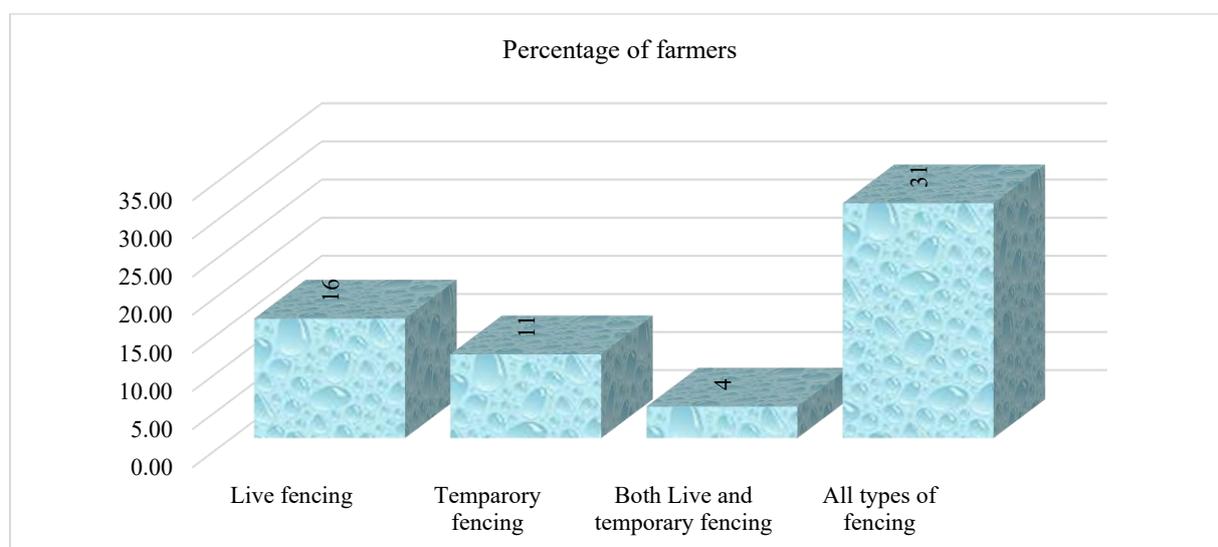
Agroclimatic zones and Farmers categories		Number of farmers used non-live mulching	Number of farmers applied soil layer on mulching material	Percentage of farmers applied soil layer on non-live mulching material
	Other farmers	76	41	54
Tenorial categories	Landless-tenants	16	6	38
	Owner-cum-tenants	19	7	37
	Owner-farmers	608	371	61
Social categories	SC	112	67	60
	ST	155	135	87
	BC	288	153	53
	OC	88	29	33

Source: IDSAP, Field Survey 2022

3.9. Fencing

As per the protocol, fencing is mandatory for all PMDS plots. Temporarily for a short period of time fencing is erected with crops' byproducts such as stalks of Red gram, Cotton, Maize, Jowar, and branches of trees. In Scarce rainfall zone, farmers tie the old sarees, dhotis and other cloths around the PMDS plots. Live fencing with Sesbania, Glyricidia, or Drumstick or any other species is also recommended and adhered in the fields. On an average, 31 percent of the farmers have used one or other type of fencing for their PMDS plots (Figure 3.12). Live fencing and temporary fencing were raised by 16 percent and 11 percent of the farmers. Further, 4 percent of farmers created both live and temporary fencing. Three-fourths of farmers from Scarce rainfall zone and one third from Southern zone have some sort of fencing in their PMDS plots, whereas it is negligible percentage in other zones (Table 3.6). About one-third of different farmers' categories have fencing for their PMDS plots. It may be noted that one of the major objectives of fencing is to break the wind blows and reduce the surface temperature and soil moisture evaporation in the PMDS plots. This is critical in the Scarce rainfall zone and needed in Southern zone, in which moisture stress is severe. Interestingly, sizable number of farmers in these two zones have raised the fencing.

Figure 3.12: Percentage of farmers, who raised different types of fencing to PMDS plots in 2022



Source: IDSAP, Field Survey 2022

Table 3.6: Agroclimatic zone and farmers' category wise percentage of farmers, who have different types of fencing to PMDS plots in 2022

Agroclimatic zones and Farmers categories		Live fencing	Temporary fencing	Both Live and temporary fencing	All types of fencing
Agroclimatic zones	HAT	2.08	5.83	1.67	9.58
	North coastal	1.96	12.42	1.31	15.69
	Godavari	3.73	11.94	2.24	17.91
	Krishna	1.33	0.67	0.33	2.33
	Southern	12.97	14.62	6.37	33.96
	Scarce rainfall	49.19	17.57	8.11	74.86
	Andhra Pradesh	15.67	10.98	4.13	30.78
Farm size categories	Marginal farmers	13.82	9.03	3.26	26.12
	Small farmers	17.35	14.49	5.10	36.94
	Other farmers	19.81	11.32	5.66	36.79
	All farmers	15.67	10.98	4.13	30.78
Tenorial categories	Landless-tenants	7.02	7.02	3.51	17.54
	Owner-cum-tenants	13.04	14.49	7.25	34.78
	Owner-farmers	16.12	10.97	4.01	31.10
	All farmers	15.67	10.98	4.13	30.78
Social categories	SC	21.17	8.03	2.92	32.12
	ST	4.65	8.31	2.33	15.28
	BC	19.03	13.21	4.72	36.95
	OC	14.88	11.46	5.37	31.71
	All farmers	15.67	10.98	4.13	30.78

Note: Other farmers include medium and large farmers

Source: IDSAP, Field Survey 2022

3.10. Conclusions

Overwhelming proportion of farmers are adhering to the most of the protocols prescribed for PMDS. Mostly adhered protocols are - size of area allocated, seed rate, seed treatment, application of biological stimulants, etc. It may be noted that Ghanajeevamrutham and Dravajeevamrutham could be used interchangeably, depending on the local conditions and farmers' resource base. On the other hand, there are marked variations across the agroclimatic zones in adoption of the recommendation of number of crops to be grown. Same is the case in mulching, putting soil-layer on mulched biomass, fencing and seed pelleting. It may be noted that one of the major objectives of mulching and fencing is to break the wind blows and reduce the surface temperature and soil moisture evaporation in the PMDS plots. This is critical in the Scarce rainfall zone and needed in Southern zone, in which moisture stress is severe. Interestingly, sizable number of farmers in these two zones have raised the fencing. There are region specific factors influencing the adoption of the protocols. Thus, it is necessary to issue region specific set of protocols for following the majority of protocols.

Chapter-4: Input use, Costs, Returns and Other Benefits of PMDS Farming.

4.1. Introduction

This chapter discusses the input use, costs incurred to grow, returns from the PMDS cultivation besides other benefits as perceived by the farmers. Any decision on farming depends upon the returns received from it besides perceiving or getting other benefits. Under physical input use, the items covered are seeds, Beejamrutham, Ghanajeevamrutham, Dravajeevamrutham, Kashayams and Asthrams. The other most important input is human labour. After analyzing the physical quantities of input use, the costs and returns of PMDS are analyzed.

4.2. Physical quantities of major inputs used in PMDS

The physical quantities analyzed in this section are seeds, Beejamrutham, Ghanajeevamrutham, Dravajeevamrutham, Kashayams, Asthrams and Human labour.

4.2.1. Seed and Beejamrutham

As mentioned in the previous chapter, on average, 33.20 kgs of seed per hectare is used for PMDS in 2022. However, the seed rate varied across zones. For instance, Scarce rainfall zone, comprising erstwhile Kurnool and Anantapur districts, used the highest seed rate per hectare at 42.06 kgs followed by Krishna zone at 40.49 kgs (Table 4.1). Farmers from HAT zone used the lowest seed rate at 18.51 kgs. Zonal differences in seed rate arise because of differences in crops grown and the number of crops grown under PMDS. For instance, farmers from Southern zone have grown crops like Jowar, vegetables, Maize, and Bajra as major crops along with other crops. Farmers from Scarce rainfall zone have grown Groundnut, Jowar and other pulses as major crop under PMDS. Further, the seed germination and plant survival rate could be different in different agroclimatic conditions. Hence zonal differences in seed rate are bound to happen.

Table 4.1: Agroclimatic zone wise Per hectare use of seeds and Beejamrutham

Agroclimatic zone	Seed (Kgs/ ha)			Beejamrutham (liters/ ha)		
	Own	Purchased	Total	Own	Purchased	Total
HAT	3.75	14.76	18.51	8.50	0.14	8.64
North coastal	8.71	13.38	22.09	15.40	0.12	15.52
Godavari	1.40	27.34	28.74	19.72	0.32	20.05
Krishna	2.46	38.03	40.49	2.71	1.32	4.02
Southern	10.28	31.78	42.06	9.28	0.60	9.89
Scarce rainfall	16.44	15.71	32.14	4.61	0.51	5.11
Andhra Pradesh	8.33	24.87	33.20	8.37	0.58	8.95

Source: IDSAP, Field Survey 2022

Though it is encouraged to use own seed, farmers from Krishna zone, Southern zone and Godavari zone mostly depended upon purchased seed while farmers from Scarce rainfall zone relied on both own and purchased inputs. Overall, 75 percent of the seed used has been purchased from different sources such as RySS, Government, NPM shops and from market. Seed rate differed between farm sizes and between social groups, just as there were differences among zones. Medium and large farmers among farm sizes, and OCs among social groups used comparatively higher seed rate (Annexure-4.1). 94 percent of the seed quantity used by the landless tenants has been purchased from different sources.

At state level, 8.95 litres of Beejamrutham per hectare is used to treat the seed and overwhelmingly (93.5 percent) it is homemade, i.e., own. Godavari followed by North coastal zone used more litres of Beejamrutham to treat the seed (Table 4.1). Irrespective of the zone, most of the quantity of Beejamrutham used has been prepared by the farmers themselves. SCs and Owner-cum-tenants used less quantity of Beejamrutham (Annexure-4.1).

4.2.2. Growth stimulated inputs

Ghana and Dravajeevamrutham are considered as growth stimulating biological inputs. In all, around 405 kgs of Ghanajeevamrutham and 381 litres of Dravajeevamrutham are used per hectare (Table 4.2). Farmers from Scarce rainfall zone have used the highest quantity of Ghana and Dravajeevamrutham (689 kgs and 716 litres respectively) as expected (traditionally farmers in this zone apply farmyard manure during summer), followed by HAT zone farmers (491 kgs) in Ghanajeevamrutham and Southern zone (505 litres) in Dravajeevamrutham. Farmers from north coastal and tribal zones have used only own Ghanajeevamrutham, while Krishna zone used the highest quantity of purchased Ghanajeevamrutham (80.9 kgs). Overall, the proportion of purchased growth stimulating inputs in the total quantity is quite small for both stimulants being 9.3 and 4.5 percent respectively.

Table 4.2: Per hectare use of growth stimulated inputs

Agroclimatic zones	Ghanajeevamrutham (Kgs)			Dravajeevamrutham (liters)		
	Own	Purchased	Total	Own	Purchased	Total
HAT	490.91	0.00	490.91	170.68	0.60	171.27
North Coastal	323.84	0.00	323.84	132.70	0.00	132.70
Godavari zone	312.27	3.51	315.78	128.95	22.48	151.43
Krishna	185.45	80.85	266.30	155.51	41.11	196.62
Southern	255.73	24.92	280.65	492.25	12.88	505.14
Scarce rainfall	618.13	70.47	688.60	698.12	18.17	716.29
Andhra Pradesh	367.22	37.50	404.72	363.66	17.08	380.74

Source: IDSAP Field Survey 2022

Use of Ghanajeevamrutham is inversely related to the farm size, i.e., higher the farm size lesser is the quantity used per hectare. ST farmers used more quantity per hectare compared to others (Annexure-4.2).

4.2.3. Inputs used for plant protection.

Various Kashayams and Asthrams are used towards plant protection. Irrespective of the input, the use is mostly visible in Southern and Scarce rainfall zones (Table 4.3). More quantities of Asthrams compared to Kashayams are used and it is mostly homemade or own. These plant protection inputs are almost absent in north coastal, HAT, Godavari, and Krishna zones. Owner-cum-tenants and BCs are predominant in using Asthrams as a measure to protect the plants (Annexure-4.3).

Table 4.3: Agroclimatic zone wise per hectare use of plant protection inputs

Input/Zone	Kashayams (liters/ ha)			Asthrams (liters/ ha)		
	Own	Purchased	Total	Own	Purchased	Total
HAT zone	2.63	0.18	2.81	0.00	0.02	0.02
North Coastal zone	1.22	0.00	1.22	0.00	0.00	0.00
Godavari zone	0.00	0.00	0.00	0.00	0.00	0.00
Krishna zone	0.00	0.00	0.00	1.11	0.00	1.11
Southern zone	5.32	0.62	5.94	11.38	0.26	11.64
Scarce rainfall zone	4.86	0.82	5.68	87.97	8.01	95.98
Andhra Pradesh	3.01	0.38	3.39	22.51	1.82	24.33

Source: IDSAP, Field Survey 2022

4.2.4. Human labour use in PMDS

Human labour is critical for growing PMDS as some of the inputs must be prepared by the family labour only. Preparation of some inputs requires very short time, and it is not viable to hire human labour. On an average, 42 days of human labour per hectare is required to grow PMDS, of which only 2.4 days is hired labour and the rest is family labour (Table 4.4). Labour requirement varied across zones and farmers from Scarce rainfall zone employed 56 days per hectare followed by Southern zone employing 48 days and HAT zone 46 days respectively. Human labour requirement varied depending upon the major crop grown along with other crops. Crops grown in these zones along with inputs used require a greater number of days compared to the crops and inputs used in other zones. More male labour is engaged compared to female in PMDS cultivation and the involvement of hired labour is negligible. Thus, PMDS practices not only gave additional income to the farmers but also created self-employment to the farmers especially small holders and marginalised groups.

Table 4.4: Per hectare use of human labour in days

Agroclimatic zone	Male			Female			Total		
	Own	Hired	Total	Own	Hired	Total	Own	Hired	Total
HAT	27.12	0.55	28	18.53	0.29	19	45.6	0.8	46
North coastal	22.06	0.21	22	12.65	0.22	13	34.7	0.4	35
Godavari	19.81	0.84	21	8.46	0.21	9	28.3	1.0	29
Krishna	12.85	0.05	13	7.34	0.00	7	20.2	0.1	20
Southern	27.44	0.47	28	19.72	0.66	20	47.2	1.1	48
Scarce rainfall	22.35	2.89	25	25.37	5.63	31	47.7	8.5	56
AP	22.42	0.94	23	16.87	1.49	18	39.3	2.4	42

Source: IDSAP, Field Survey 2022

Farm size wise, and social category wise labour absorption in PMDS cultivation is given in Annexure-4.4.

4.3. Cost of cultivation

Per hectare cost of cultivation is dealt in two ways – total cost that include family labour cost and paid out cost that exclude cost of family (own) labour. At the state level, total cost per hectare to cultivate crops in PMDS method works out to ₹28,637, and there are significant zonal variations in the total cost. For instance, farmers in Scarce rainfall zone incurred an amount of ₹40,258 per hectare while it is ₹16,826 in Krishna zone (Table 4.5). As mentioned earlier, input application, and costs differ based on the crop(s) grown. In Krishna zone, farmers have grown different grams as major crop and that does not require significant expenditure because of very minimal operations while farmers in Scarce rainfall zone have grown Groundnut, Jowar and Maize as main crop along with other crops which are relatively more input intensive based and require a greater number of operations. Overall, in the total cost, own input costs that include labour, seeds, and other materials used for cultivation accounted for 75 percent. In the contribution of own inputs, HAT zone recorded the highest at 82 percent followed by north coastal zone (77 percent) and Scarce rainfall zone (77 percent) respectively.

Cost per hectare is inversely related to the farm size and the cost per hectare is around ₹3,000 while decreasing as the farm size increases (Figure 4.1 and Annexure-4.5). Similar trend is observed in the case of human labour cost.

Table 4.5: Per hectare total cost of cultivation of PMDS (₹)

Agroclimatic zones	Seed	Growth stimulating inputs	Plant protection inputs	Human labour	Machine and Bullock labour	Miscellaneous items	Total cost	Own input costs as % of total cost
High altitude	1004	4738	47	10,512	2,814	273	19,388	82
North coastal	1,119	5,929	22	12,225	3,367	183	22,845	78
Godavari	1,880	4,126	-	12,276	2,770	76	21,128	73
Krishna	2,072	3,172	2	7,105	3,624	852	16,826	64
Southern	1,986	10,510	234	16,410	5,096	511	34,747	72
Scarce rainfall	2,770	11,141	4,617	13,280	5,379	3,072	40,258	77
AP	1,945	7,975	1,083	12,392	4,204	1,037	28,637	75

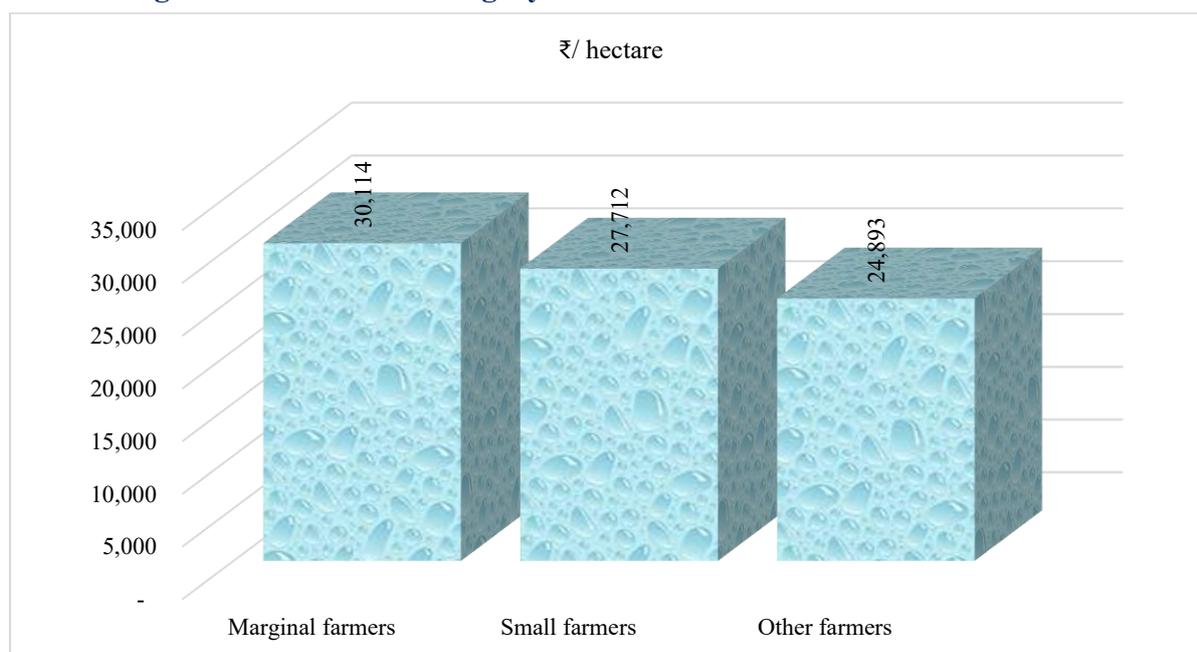
Note: Growth stimulating inputs include Ghanajeevamrutham, Dravajeevamrutham, and Beejamrutham. Plant protection items include different Kashayams and Asthrams; Human labour include Family and hired labour.

Machine and bullock labour include both own and hired.

Miscellaneous items include both own and hired mulching material, fencing material, irrigation expenses, and other costs.

Source: IDSAP, Field Survey 2022

Figure 4.1: Farm size category wise total cost PMDS cultivation in 2022



Source: IDSAP, Field Survey 2022

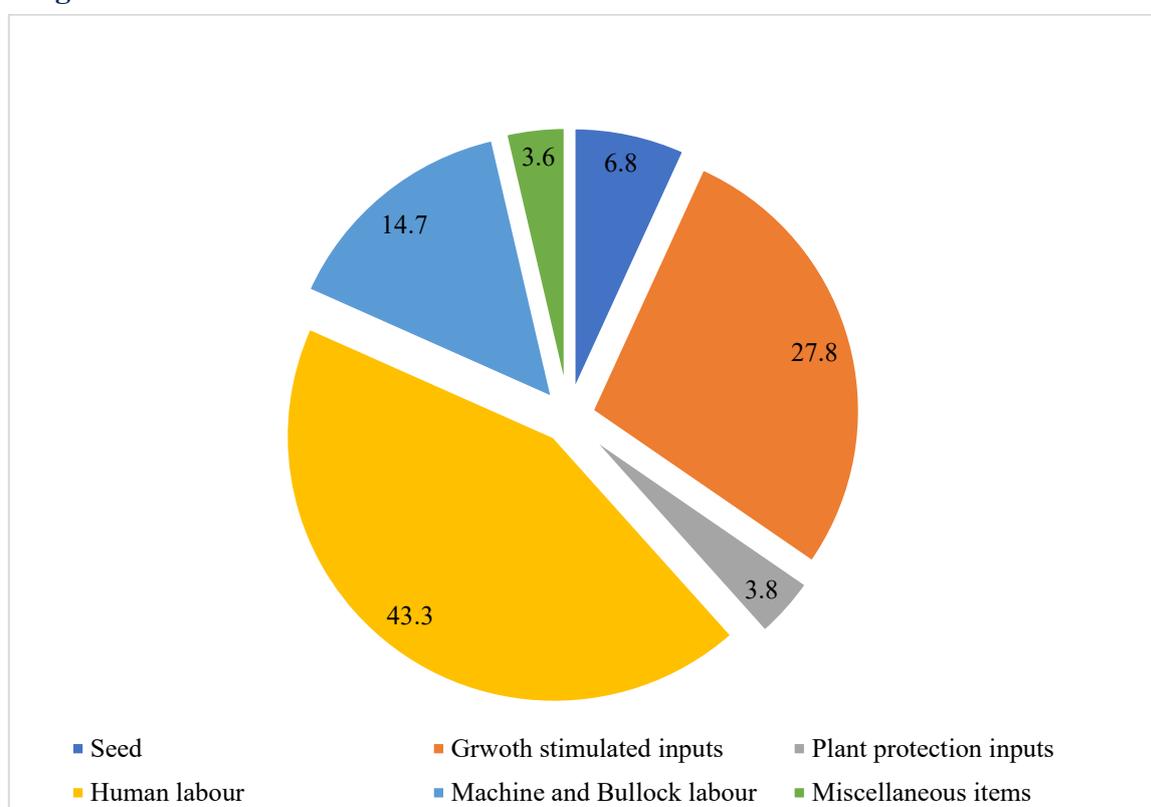
In the total cost, the share of human labour is the highest at 43.3 percent followed by growth stimulating inputs such as Ghanajeevamrutham and Dravajeevamrutham (27.8 percent) and machine and bullock labour at 14.7 percent (Figure 4.2 and Table 4.6). This trend is similar in all the zones except in Krishna zone where machine and bullock labour share became the second highest share followed by growth stimulating inputs. Human labour share is the highest in Godavari zone (58.1 percent) followed by HAT zone (54.2 percent) and north coastal zone (53.5 percent) respectively.

Table 4.6: Share of each item of cost in the total cost of PMDS cultivation in 2022(%)

Inputs/ Zones	Seed	Growth stimulated inputs	Plant protection inputs	Human labour	Machine and Bullock labour	Miscellaneous items	Total Cost
High altitude zone	5.2	24.4	0.2	54.2	14.5	1.4	100
North coastal zone	4.9	26.0	0.1	53.5	14.7	0.8	100
Godavari zone	8.9	19.5	0.0	58.1	13.1	0.4	100
Krishna zone	12.3	18.8	0.0	42.2	21.5	5.1	100
Southern zone	5.7	30.2	0.7	47.2	14.7	1.5	100
Scarce rainfall zone	6.9	27.7	11.5	33.0	13.4	7.6	100
Andhra Pradesh	6.8	27.8	3.8	43.3	14.7	3.6	100

Source: IDSAP, Field Survey

Figure 4.2: Share of each item of cost in the total cost of PMDS cultivation in 2022



Source: IDSAP, Field Survey 2022

As the farm size increases, the share of human labour cost is decreasing, and, among SCs and STs, the share of human labour cost is half of the total cost (Annexure-4.6). The share of plant protection input costs in the case of marginal farmers is the highest and perhaps this is one of the reasons for recording higher share of human labour cost for marginal farmers.

4.4. Value of output obtained from PMDS

Total value of output includes intermittent products obtained such as vegetables, final output, excluding intermittent output already recorded, value fodder harvested, grazed fodder, and value of green manure ploughed back into the soil. Overall, the total value of output from PMDS is recorded at ₹34,932 per hectare. But there are considerable inter-zonal differences in the value of output (Table 4.7). For instance, the highest returns are received from Scarce rainfall zone (₹44,448) and the least returns are from North coastal zone (₹12,521). Among the different forms of returns, the highest returns are from final output in Scarce rainfall zone, value of fodder and intermittent products from Southern zone, green manure ploughed back into the soil in Krishna, HAT zone and North coastal zone respectively. Thus, returns depend upon the crops grown, which are zone specific. However, it is pertinent to note that except in North coastal zone, value of green manure ploughed back into the soil hovered between ₹8,000 to ₹9,000 per hectare in all other zones, showing the importance given by the farmers to enhance their soil fertility/quality through natural farming methods. This has been reiterated in expressing their views on other benefits of PMDS in ensuing paragraphs, wherein farmers overwhelmingly reported that PMDS method is expected to enhance the soil quality.

Table 4.7: Per hectare value of output received in different forms (rupees)

Returns / Zone	Intermittent products obtained e.g., vegetables	Final output (excluding intermittent output)	Value of fodder	Grazed fodder	Green manure ploughed back into soil	Total of all values
High altitude zone	2,365	4,761	949	1,805	7,695	17,575
North coastal zone	2,335	3,441	968	1,094	4,684	12,521
Godavari zone	1,382	3,141	980	1,631	8,213	15,347
Krishna zone	2,355	1,741	4,237	2,800	9,324	20,457
Southern zone	11,054	633	11,195	7,937	8,709	39,529
Scarce rainfall zone	7,742	19,339	7,501	941	8,924	44,448
Andhra Pradesh	6,287	9,558	6,972	3,811	8,304	34,932

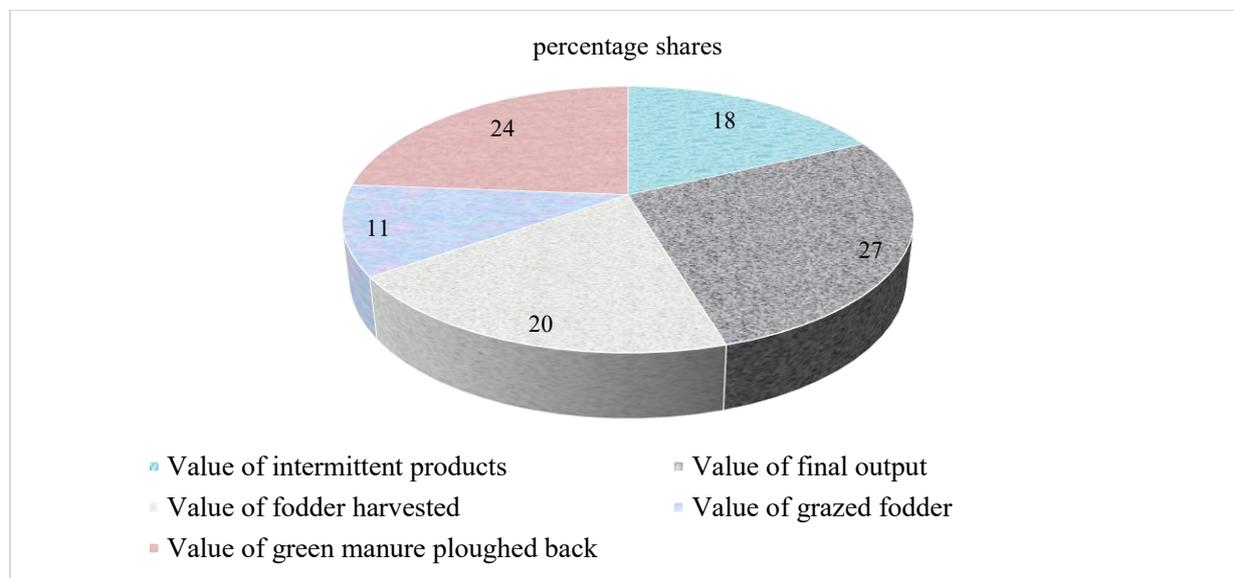
Source: IDSAP, Field Survey 2022

Per hectare total value of output is size neutral. OCs among social groups and owner-cum-tenants received higher returns per hectare (₹41,268 and ₹39,809 respectively) (Annexure-4.7).

Share of different forms of output from total value of output is given in Table 4.8. Final output, green manure ploughed back into the soil and value of fodder harvested are the major contributors in total returns from PMDS (Figure 4.3). Green manure ploughed back into the

soil dominates in North coastal, HAT, Godavari and Krishna zones. Final output in Scarce rainfall zone (43.5 percent), and value of fodder harvested in Southern zone are the major contributors in total returns. Share of different forms of output by category of farmer is given in Annexure-4.8.

Figure 4.3: Percentage share of different forms of output in total value of output from PMDS 2022



Source: IDSAP, Field Survey 2022

Table 4.8: Agroclimatic zone wise share of different forms of returns from total returns from PMDS in 2022 (%)

Agroclimatic zone	Intermittent products obtained e.g., vegetables	Final output (excluding intermittent output)	Value of fodder	Grazed fodder	Green manure ploughed back into the soil	Total of all values obtained
High altitude zone	13.5	27.1	5.4	10.3	43.8	100
North coastal zone	18.6	27.5	7.7	8.7	37.4	100
Godavari zone	9.0	20.5	6.4	10.6	53.5	100
Krishna zone	11.5	8.5	20.7	13.7	45.6	100
Southern zone	28.0	1.6	28.3	20.1	22.0	100
Scarce rainfall zone	17.4	43.5	16.9	2.1	20.1	100
Andhra Pradesh	18.0	27.4	20.0	10.9	23.8	100

Source: IDSAP, Field Survey 2022

4.5. Net returns per hectare over total cost and paid out cost.

Farmer is interested in net returns besides other non-economic benefits. Here we are assessing the net returns - net of total cost that includes own human labour cost and net returns net of paid out costs that exclude own human labour cost. At state level, net returns over total costs are ₹6,295, but it varies substantially across the zones (Table 4.9). Since own

human labour cost in total cost is substantially high in HAT zone, North coastal and Godavari zones, the net returns over total cost are showing minus figures⁴. In natural farming, own human labour component is important, hence net returns over paid-out costs, Fam Business Income (FBI)⁵, is the better option to assess the returns. Paid out costs per hectare is recorded at ₹15,423 and it varied across zones (Table 4.9). It varied from ₹8,552 in Godavari zone to ₹25,143 in Scarce rainfall zone. The net returns over paid-out cost are ₹19,509 per hectare, and it varied from ₹24,99 in North coastal zone to ₹21,186 in Southern zone.

Table 4.9 Agroclimatic zones wise per hectare net returns over total cost and paid-out cost from PMDS in 2022 (₹)

Agroclimatic zones	Total cost (own and purchased inputs)	Paid out cost (excluding own human labour cost)	Gross returns that include all	Surplus over total cost	Surplus over paid-out cost	Benefit-cost ratio (paid-out cost)
HAT	19,388	9,097	17,575	-1,813	8,478	1.93
North coastal	22,845	10,022	12,521	-10,324	2,499	1.25
Godavari	21,128	9,077	15,347	-5,782	6,270	1.69
Krishna	16,826	8,552	20,457	3,631	11,906	2.39
Southern	34,747	18,343	39,529	4,781	21,186	2.15
Scarce rainfall	40,258	25,143	44,448	4,189	19,305	1.77
Andhra Pradesh	28,637	15,423	34,932	6,295	19,509	2.26

Source: IDSAP, Field Survey 2022

The benefit-cost ratio is 2.26. It is implying that every rupee spent, has given an additional ₹1.26 (126 percent). The highest benefit-cost ratio is achieved in Krishna zone (2.39) followed by Southern zone (2.15). Net returns per hectare either over total cost or over paid-out cost is size neutral (Annexure-4.9). Owner-cum-tenants followed by OCs in social groups achieved highest net returns whether over total cost or paid-out cost.

⁴Amartya Sen (1962), "An Aspect of Indian Agriculture", *Economic Weekly*, Annual Number, February 1962. Total costs are treated as Cost-C, in which imputed values of labour, land and management are included. In the data of Farm Management Studies of mid-1950s, Sen computed profit on cultivated land by subtracting Cost-C from the gross value of output and found them to be negative. It is the Cost which Swaminathan Commission recommended to be considered for fixation of the minimum support price (MSP) of Paddy, Wheat etc. This Commission said, "The Minimum Support Price (MSP) should be at least 50% more than the weighted average cost of production." Here Cost-C is equal to weighted average of cost of production (National Commission on Farmers (NCF) (2006), *Serving Farmers and Saving Farming - Towards Faster and More Inclusive Growth of Farmers' Welfare*, Fifth and Final Report, Vol.I, Ministry of Agriculture, Government of India, New Delhi, October 4, p.246).

⁵ Farm Business Income is the net return derived by subtracting all paid out costs including rent on leased-in land (Cost A2) from value of gross output. Cost-A1 does not include rent paid on leased-in land, whereas Cost-A2 is got by adding rent paid on leased-in land. This is got first at individual crop level and then aggregated to arrive at FBI at farm level as a whole. (i) Indian Society of Agricultural Economics (1961), *Cost Studies in Agriculture*, Bombay; (ii) G.D. Agrawal, (1961), "Apportionment, Evaluation and Allocation", p.130, in (i); and (iii) J.K. Pande, "Principles of Evaluation Apportionment of Items of Cost", p.141, in (i).

4.6. Perception of the farmers on other benefits of PMDS

Promotion of PMDS is not only intended for getting additional income to the farmer but also in the larger interest such as rejuvenation of soil fertility, 365 days green cover thereby causing climate protection and providing nutritious food which is chemical free, to the family and society. Thus, other benefits of PMDS cultivation do have importance. Around 80 percent of the farmers perceived that their soil quality is improved due to PMDS (Table 4.10). More than half of the farmers observed that they had quality and nutritious food, availability of green fodder for their livestock, and the improvement in soil moisture thereby protecting micro-organisms which are crop friendly.

Table 4.10: Percentage of farmers perceiving non-monetary benefits from PMDS

Benefit / Zone	Improve the soil quality	Quality and nutritious food for the family	Green fodder for the livestock	Protect the microorganisms/ soil moisture	Capture the atmospheric water vapor	Not aware of any such benefits
HAT	89.2	81.3	80.4	81.7	78.3	1.3
North coastal	75.8	71.9	66.7	68.6	66.0	0.7
Godavari	99.3	64.9	66.4	93.3	86.6	-
Krishna	83.0	65.0	55.7	51.7	39.0	0.7
Southern	71.0	33.3	55.2	29.5	29.2	2.4
Scarce rainfall	75.7	53.5	29.7	49.5	19.7	3.5
Andhra Pradesh	79.8	57.1	55.2	54.8	44.4	1.8

Source: IDSAP, Field Survey 2022

Perception of the farmers varied across zones, but majority of the farmers in Tribal zone observed these benefits compared to the farmers from other zones. Farmers from other zones differed in the extent of some of these benefits. Perceptions by farm size and by social category are presented in Annexure-4.10.

4.7. Conclusions

Though it is suggested to use their own seed, most of the farmers from Godavari and Krishna zones relied on purchased seeds that too from RySS staff. However, farmers from Scarce rainfall zone and Southern zone depended on market and there is need for supply from reliable sources such as RySS staff, NPM shops and government. It is encouraging to note that all the farmers treated their seed with Beejamrutham. Farmers from Southern zone and Scarce rainfall zone not only used more quantities of growth stimulated biological inputs such as Ghana and Dravajeevamrutham but also undertook biological plant protection inputs. PMDS practices created self-employment especially for small holders and socially

marginalised groups and it reflected in human labour absorption. There are huge inter zonal variations in the total cost of cultivation that include own labour cost as well as paid-out cost and the human labour cost has major share in the cost of cultivation. In total value of output, the final output value has the major share followed by green manure ploughing back into the soil, and fodder value respectively. Thus, these three components are the major contributors to total value of output. Farmers from Rayalaseema districts and erstwhile Nellore district earned more net returns compared to other zones. Farmers from Krishna zone earned more on every rupee they spent followed by farmers from Southern zone. More than three fourths of farmers perceived that their soil has been improved due to practice of PMDS and little over half of them have admitted that they are eating quality and nutritious food, getting fodder to the livestock, and noticing enhanced soil moisture.

Annexure Tables of Chapter 4: Farmers category wise tables

Annexure-4.1: Per hectare use of seeds and Beejamrutham

Farmers categories	Seed (Kgs)			Beejamrutham (liters)		
	Own	Purchased	Total	Own	Purchased	Total
Marginal farmers	7.26	24.08	31.34	8.33	0.76	9.09
Small farmers	9.87	21.55	31.42	8.78	0.30	9.07
Other farmers	9.16	35.78	44.94	7.58	0.47	8.05
Landless tenants	1.80	28.35	30.15	8.66	0.79	9.45
Owner-cum-tenants	3.87	26.18	30.05	7.35	0.51	7.85
Owner-farmers	8.81	24.67	33.48	8.41	0.57	8.98
SC	5.89	24.35	30.23	5.49	0.82	6.31
ST	5.18	16.97	22.15	8.31	0.11	8.42
BC	11.10	22.61	33.71	9.63	0.56	10.19
OC	7.93	34.33	42.25	8.32	0.79	9.11
All farmers	8.33	24.87	33.20	8.37	0.58	8.95

Source: IDSAP, Field Survey 2022

Annexure-4.2: Per hectare use of growth stimulated inputs

Input/Type of farmer	Ghanajeevamrutham (Kgs)			Dravajeevamrutham (liters)		
	Own	Purchased	Total	Own	Purchased	Total
Marginal farmers	386.26	42.84	429.10	364.37	18.16	382.53
Small farmers	358.95	34.04	392.99	376.44	11.02	387.46
Other farmers	308.08	23.57	331.65	331.03	26.72	357.74
Landless tenants	187.92	40.51	228.44	161.50	40.51	202.01
Owner-cum-tenants	253.71	25.67	279.39	273.29	19.26	292.55
Owner-farmers	379.83	37.97	417.80	376.03	16.06	392.08
SC	267.10	52.43	319.54	337.98	22.81	360.79
ST	477.66	0.00	477.66	208.26	8.20	216.46
BC	387.85	48.41	436.26	448.22	19.03	467.25
OC	320.97	37.98	358.96	362.28	16.75	379.03
All farmers	367.22	37.50	404.72	363.66	17.08	380.74

Source: IDSAP, Field Survey 2022

Annexure-4.3: Per hectare use of plant protection inputs

Input/Type of farmer	Kashayams (Liters)			Asthrams (Liters)		
	Own	Purchased	Total	Own	Purchased	Total
Marginal farmers	3.44	0.42	3.86	19.90	2.01	21.91
Small farmers	2.42	0.30	2.73	27.79	1.56	29.36
Other farmers	2.63	0.34	2.97	20.99	1.65	22.63
Landless tenants	1.09	0.65	1.74	4.29	0.00	4.29
Owner-cum-tenants	0.56	0.00	0.56	43.92	0.00	43.92
Owner-farmers	3.21	0.38	3.59	22.17	1.98	24.15
SC	2.62	0.23	2.85	13.43	0.49	13.92
ST	3.98	0.14	4.12	6.63	0.06	6.68
BC	3.36	0.46	3.82	35.10	3.11	38.21
OC	2.03	0.51	2.54	20.49	1.98	22.47
All farmers	3.01	0.38	3.39	22.51	1.82	24.33

Source: IDSAP, Field Survey 2022

Annexure-4.4: Per hectare use of human labour in days

Input/ Type of farmer	Male			Female			Total		
	Own	Hired	Total	Own	Hired	Total	Own	Hired	Total
Marginal farmers	25.24	1.28	27	19.36	1.83	21	44.6	3.1	48
Small farmers	19.75	0.55	20	14.87	0.98	16	34.6	1.5	36
Other farmers	17.12	0.47	18	11.32	1.27	13	28.4	1.7	30
Landless tenants	16.10	0.12	16	8.01	0.45	8	24.1	0.6	25
Owner-cum-tenants	18.55	0.67	19	11.96	1.27	13	30.5	1.9	32
Owner-farmers	22.87	0.99	24	17.46	1.54	19	40.3	2.5	43
SC	23.07	3.08	26	16.88	3.93	21	40.0	7.0	47
ST	24.93	0.54	25	17.24	0.52	18	42.2	1.1	43
BC	23.41	0.55	24	18.31	1.29	20	41.7	1.8	44
OC	18.70	0.44	19	14.40	0.91	15	33.1	1.4	34
All farmers	22.42	0.94	23	16.87	1.49	18	39.3	2.4	42

Source: IDSAP, Field Survey 2022

Annexure-4.5: Total cost of cultivation per hectare in rupees

Inputs / Type of farmer	Seed	Growth stimulating inputs	Plant protection inputs	Human labour	Machine and bullock labour	Miscellaneous items	Total Cost	(%) of own inputs in total cost
Marginal farmers	1,770	7,478	1,786	13,907	4,178	994	30,114	77
Small farmers	1,927	8,981	220	11,173	4,369	1,042	27,712	74
Other farmers	2,668	7,720	223	9,146	3,944	1,192	24,893	69
Landless tenants	1,603	4,033	87	9,402	3,277	975	19,377	68
Owner-cum-tenants	1,837	5,469	247	11,046	4,162	1,157	23,918	70
Owner-farmers	1,964	8,249	1,162	12,573	4,242	1,033	29,223	75
SC	1,835	6,164	103	13,874	4,097	1,034	27,107	72
ST	1,263	5,518	123	10,646	2,923	467	20,940	81
BC	1,956	8,517	1,267	13,139	4,760	1,452	31,091	75
OC	2,471	8,185	2,103	11,485	4,304	794	29,342	72
All farmers	1,945	7,975	1,083	12,392	4,204	1,037	28,637	75

Note: Growth stimulated inputs include Ghanajeevamrutham, Dravajeevamrutham, and Beejamrutham; Plant protection items include different Kashayams and Asthrams; Human labour include Family and hired labour; Machine and bullock labour include both own and hired. Miscellaneous items include both own and hired mulching material, fencing material, irrigation expenses, and other costs.

Source: IDSAP, Field Survey 2022

Annexure-4.6: Share of each input in total cost (%)

Farmer categories	Seed	Growth stimulated inputs	Plant protection inputs	Human labour	Machine and Bullock labour	Miscellaneous items	Total Cost
Marginal farmers	5.9	24.8	5.9	46.2	13.9	3.3	100.0
Small farmers	7.0	32.4	0.8	40.3	15.8	3.8	100.0
Other farmers	10.7	31.0	0.9	36.7	15.8	4.8	100.0
Landless tenants	8.3	20.8	0.4	48.5	16.9	5.0	100.0
Owner-cum-tenants	7.7	22.9	1.0	46.2	17.4	4.8	100.0
Owner-farmers	6.7	28.2	4.0	43.0	14.5	3.5	100.0
SC	6.8	22.7	0.4	51.2	15.1	3.8	100.0
ST	6.0	26.4	0.6	50.8	14.0	2.2	100.0
BC	6.3	27.4	4.1	42.3	15.3	4.7	100.0
OC	8.4	27.9	7.2	39.1	14.7	2.7	100.0
Andhra Pradesh	6.8	27.8	3.8	43.3	14.7	3.6	100.0

Note: Other farmers include medium and large farmers

Source: IDSAP, Field Survey 2022

Annexure-4.7: Per hectare value of output received in different forms (rupees)

Returns / Type of farmer	Intermittent products obtained e.g., vegetables	Final output (excluding intermittent output)	Fodder harvested	Grazed fodder	Green manure ploughed back into the soil	Total of all values obtained
Marginal farmers	8,008	9,426	7,739	3,845	7,705	36,722
Small farmers	4,113	9,366	6,690	3,507	8,182	31,859
Other farmers	3,757	10,659	4,790	4,424	11,027	34,657
Landless tenants	2,672	3,858	3,983	2,534	9,304	22,350
Owner-cum-tenants	2,043	16,039	3,783	3,224	14,720	39,809
Owner-farmers	6,551	9,450	7,175	3,865	7,949	34,989
SC	4,318	8,265	6,281	3,030	8,705	30,600
ST	2,545	7,276	1,831	1,878	7,442	20,972
BC	4,342	11,788	8,269	4,593	8,741	37,733
OC	13,191	7,748	7,533	4,805	7,991	41,268
All farmers	6,287	9,558	6,972	3,811	8,304	34,932

Note: Other farmers include medium and large farmers

Source: IDSAP, Field Survey 2022

Annexure-4.8: Share of different forms of returns from total returns (%)

Item / Type of farmer	Intermittent products obtained e.g., vegetables	Final output (excluding intermittent output)	Value of fodder	Grazed fodder	Green manure ploughed back into the soil	Total of all values obtained
Marginal farmers	21.8	25.7	21.1	10.5	21.0	100.0
Small farmers	12.9	29.4	21.0	11.0	25.7	100.0
Other farmers	10.8	30.8	13.8	12.8	31.8	100.0
Landless tenants	12.0	17.3	17.8	11.3	41.6	100.0
Owner-cum-tenants	5.1	40.3	9.5	8.1	37.0	100.0
Owner-farmers	18.7	27.0	20.5	11.0	22.7	100.0
SC	14.1	27.0	20.5	9.9	28.4	100.0
ST	12.1	34.7	8.7	9.0	35.5	100.0
BC	11.5	31.2	21.9	12.2	23.2	100.0
OC	32.0	18.8	18.3	11.6	19.4	100.0
Andhra Pradesh	18.0	27.4	20.0	10.9	23.8	100.0

Note: Other farmers include medium and large farmers

Source: IDSAP, Field Survey 2022

Annexure-4.9: Per Hectare net returns over total cost and paid-out cost (Rupees)

Farmers categories	Total cost (own and purchased inputs)	Paid out cost (excluding own human labour cost)	Gross returns that include all	Surplus / deficit over total cost	Surplus / deficit over paid-out cost	Marginal returns over paid-out cost
Marginal farmers	30,114	15,459	36,722	6,608	21,264	2.38
Small farmers	27,712	15,623	31,859	4,147	16,236	2.04
Other farmers	24,893	14,848	34,657	9,765	19,809	2.33
Landless tenants	19,377	9,050	22,350	2,973	13,299	2.47
Owner-cum-tenants	23,918	12,389	39,809	15,891	27,420	3.21
Owner-farmers	29,223	15,816	34,989	5,767	19,174	2.21
SC	27,107	12,513	30,600	3,493	18,088	2.45
ST	20,972	11,945	20,972	-0	9,026	1.76
BC	31,091	16,944	37,733	6,642	20,789	2.23
OC	29,342	17,383	41,268	11,926	23,885	2.37
Andhra Pradesh	28,637	15,423	34,932	6,295	19,509	2.26

Source: IDSAP, Field Survey 2022

Annexure-4.10: Percentage of farmers perceiving other benefits through PMDS cultivation.

Benefit / Type of farmer	Improve the soil quality	Quality and nutritious food for the family	Green fodder for the livestock	Protect the microbes/ soil moisture	Capture the atmospheric water vapor	Not aware of any such benefits
Marginal farmers	78.8	56.9	58.2	54.2	43.6	1.1
Small farmers	79.8	55.3	53.1	58.0	44.7	2.4
Other farmers	84.0	62.3	47.2	50.5	46.7	3.3
Landless tenants	84.2	73.7	54.4	75.4	45.6	1.8
Owner-cum-tenants	88.4	56.5	52.2	63.8	55.1	-
Owner-farmers	79.2	56.5	55.4	53.6	43.8	1.9
SC	78.5	56.6	48.5	54.0	36.9	-
ST	89.0	73.1	74.8	75.1	74.1	1.3
BC	77.2	52.5	49.4	50.5	36.9	2.5
OC	77.8	52.9	54.4	47.3	39.0	2.2
Andhra Pradesh	79.8	57.1	55.2	54.8	44.4	1.8

Note: Other farmers include medium and large farmers

Source: IDSAP, Field Survey 2022

Chapter-5: Issues, challenges and way forward

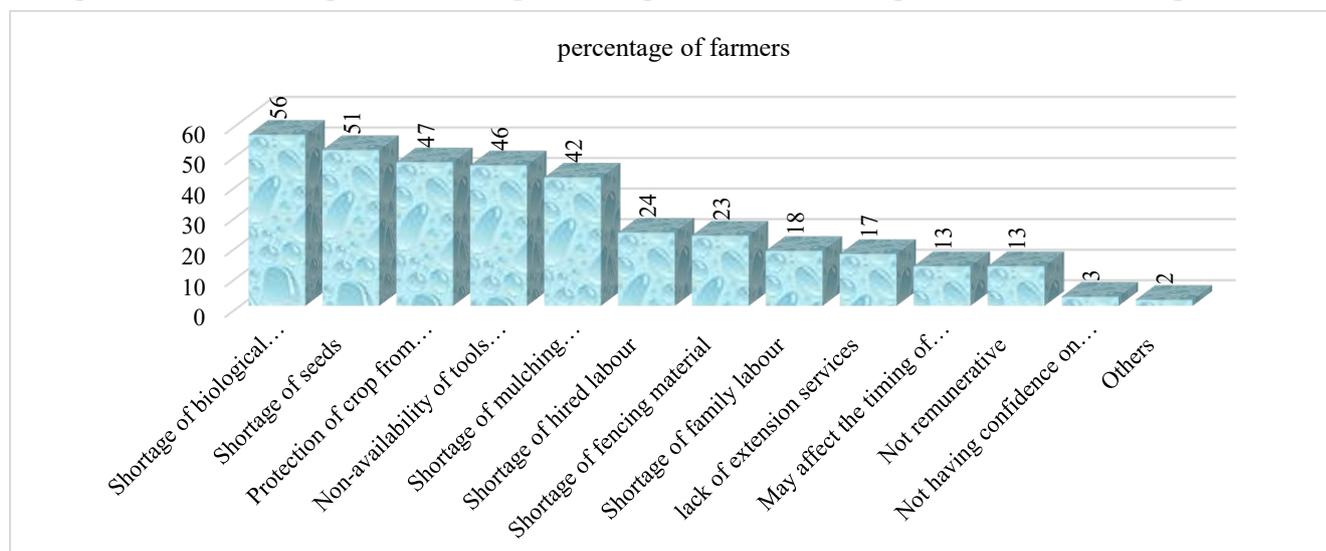
5.1. Introduction

In this chapter, three issues and challenges in adoption of PMDS and strategies required for expansion of PMDS are discussed. Firstly, major challenges faced by the farmers in practicing PMDS are discussed, followed by extension services received by the farmers for practicing PMDS and finally suggestions emanated from the analysis and results for expansion of PMDS are deliberated.

5.2. Challenges in practicing PMDS

Agroclimatic zone wise major challenges faced by the farmers for practicing PMDS are presented in Table 5.1. In all, farmers reported 13 challenges. Among all, the most important challenge is shortage of biological stimulants, faced by the highest proportion of farmers (56 percent). The other dominant challenges in descending order are: shortage of seeds (51 percent), protection of the crop from grazing animals during summer (47 percent), non-availability of tools and instruments required for preparation of required inputs as well as for practicing PMDS (46 percent), and shortage of mulching materials (42 percent) (Figure 5.1 & Table 5.1). Nearly one fourth of the farmers faced constraint due to shortage of hired labour and shortage of fencing material. Some of the farmers also reported lack of family labour and lack of extension services. Within Andhra Pradesh, majority of the farmers from tribal zone reported a greater number of challenges in practicing PMDS followed by farmers from north coastal zone. There are zone specific challenges. For instance, more than three fourths of the farmers from Godavari zone reported non-availability of hired labour.

Figure 5.1: Percentage of farmers perceiving different challenges in PMDS farming



Source: IDSAP, Field Survey 2022

Vast majority of farmers from HAT zone perceived the shortage of biological stimulants for PMDS. In general, availability of raw material such as different leaves, animal dung and urine may not be a scarce resource in this zone, but farmers may not be aware of the method to prepare the stimulants required. It is evident that half of the farmers in this zone reported lack of extension services (Table 5.1). It is encouraging to note that 97 percent expressed confidence on PMDS and 87 percent did not agree that PMDS practices are non-remunerative. However, nearly half of the farmers from Godavari zone expressed that practicing PMDS will affect the timing of growing Kharif and Rabi crops. Challenges expressed by the farmers are size neutral, but most of the landless tenants are constrained with shortage of seeds and non-availability of required tools and instruments for practicing PMDS (Annexure-5.1). Within the social groups, considerable proportion of ST farmers faced many challenges.

Table 5.1: Percentage of farmers perceiving challenges in PMDS farming

Agroclimatic zones	Shortage of biological	Shortage of seeds	Protection of crop from grazing animals	Non-availability of tools and instruments	Shortage of mulching materials	Shortage of hired labour	Shortage of fencing material	Shortage of family labour	Lack of extension services	May affect the timing of Kharif and Rabi crops	Not remunerative	Not having confidence on PMDS	Others
High altitude	85	74	58	76	77	25	37	53	49	24	6	-	-
North coastal	69	67	37	63	60	25	35	35	30	16	20	1	-
Godavari	28	65	51	63	-	77	6	6	8	43	3	-	-
Krishna	66	59	55	47	29	33	9	13	16	10	22	0	2
Southern	43	34	35	31	28	7	23	10	9	8	14	3	4
Scarce rainfall	50	36	48	29	52	14	24	6	6	4	9	10	1
Andhra Pradesh	56	51	47	46	42	24	23	18	17	13	13	3	2

Source: IDSAP, Field Survey 2022

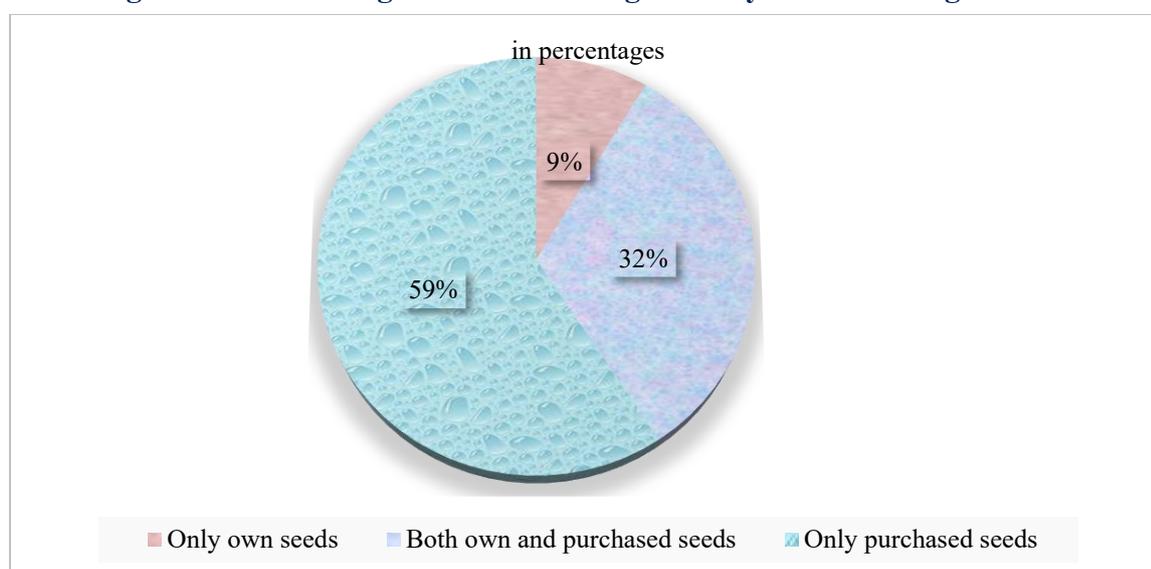
5.2.1. Non-availability of certain seeds

From the above table 5.1, it is clear that shortage of seeds is one of the major challenges faced by majority of farmers. It may be recalled from chapter 3, though the farmers maintained the recommended seed rate (number of kgs/ hectare), they could not sow number of crops as recommended. Non-availability of certain seeds could be one of the reasons. Against recommendation of 15-20 crops in a plot, the farmers in Southern zone could sow less than 10 crops and the farmers of Krishna and Scarce rainfall zone could plant 13 crops

only. It is well known that the crop diversity has been declining significantly in recent years. Some of the traditional crops and seeds are endangered. Special efforts are needed to revive and propagate those crops. The RySS' field staff are doing commendable work in procuring and distributing the seeds of different crops, especially the seeds of endangered crops.

Another issue with respect to seeds is over dependence on purchased or procured seeds. Only 9 percent of the farmers used their own seed for PMDS farming, while 32 percent used both own and purchased seeds (Figure 5.2). Nearly three-fifths of the farmers (59 percent) used purchased seed only.

Figure 5.2: Percentage of farmers using seeds by source during PMDS 2022



Source: IDSAP, Field Survey 2022

Substantial percentage of farmers from Godavari and Krishna zones used purchased seeds only, while 86 percent of farmers from Scarce rainfall zone used both purchased and own seeds. Thus, percentage of farmers using seed by source varied across agroclimatic zones (Table 5.2). Landless tenants followed by owner-cum-tenants are heavily depended on purchased seeds (Annexure-5.2).

Table 5.2: Zone wise percent of farmers using seed by source for PMDS

Agroclimatic zones	Only own seeds	Both own and purchased seeds	Only purchased seeds
High altitude zone	2.1	31.3	66.7
North coastal zone	18.3	24.8	56.9
Godavari zone	3.7	5.2	91.0
Krishna zone	2.3	9.7	88.3
Southern zone	17.9	13.0	69.1
Scarce rainfall zone	4.9	85.9	8.9
Andhra Pradesh	8.6	32.2	59.2

Source: IDSAP, Field Survey 2022

Major sources of purchased seeds include market (41 percent of farmers), followed by RySS staff (30 percent of farmers); and 15 percent of farmers bought from NPM shops (Annexure-3.3). Around 8 percent of the farmers purchased from government, 3 percent from fellow farmers, and 2 percent of farmers purchased seed from NGOs. In all, only 3 percent of farmers depended upon fellow farmers for seed; most of those are from Southern zone and Scarce rainfall zone. It means buying from fellow farmers is totally absent in other zones. Nearly half of the farmers from Krishna zone depended upon NPM shops; and 100 percent of farmers from Godavari zone, three-fourths of farmers from HAT zone, two-thirds from North coastal zone purchased from RySS staff. It is presumed that quality seed is being supplied by RySS staff, government and NPM shops.

Table 5.3: Agroclimatic zone wise percentage of farmers procured PMDS seeds from different sources in 2022

Agroclimatic zones	Fellow farmers	NPM shop	RySS (staff)	Govt.	NGOs	Market	Others
HAT	0.00	0.00	77.08	20.00	1.67	2.92	0.00
North coastal	1.31	5.88	67.97	19.61	0.00	0.65	3.27
Godavari	0.00	1.49	100.00	0.00	0.75	0.00	0.00
Krishna	1.33	44.67	9.67	3.00	0.00	43.33	0.33
Southern	6.13	22.64	6.13	8.96	5.66	51.18	0.71
Scarce rainfall	4.86	1.89	2.16	0.00	1.08	85.14	0.00
Andhra Pradesh	3.08	15.30	29.98	7.71	2.04	41.33	0.56

Note: Other farmers include medium and large farmers;

Source: IDSAP, Field Survey 2022

5.3. Extension services availed by the farmers

Different sources of extension services availed by the farmers are given in the Table 5.4. Master farmer or ICRP is the dominant source for extension services to the (95 percent) farmers irrespective of the zone. Only in Southern zone, the least share of 89 percent availed the services from Master farmer/ICRP while in all other zones it was almost all the farmers, 96-100 percent. CRP, CA, MA, MT, and fellow farmers are the other dominant extension sources farmers availed. Nearly one fourth of the farmers also availed SHGs/VO/electronic media such as TV and videos, and the highest share of 45 percent farmers have availed these sources in North coastal zone. The role of NGOs is meagre, as only 2 percent of the farmers have benefited. A higher percent of farmers from HAT zone and North coastal zone have undergone formal training by RySS. About 11 percent each from Krishna and Godavari zones reported availing the benefit from the booklets distributed by RySS and others. Farm

size wise as well as social category wise farmers reporting on the availing of extension services is given in Annexure-5.4.

Table 5.4: Agroclimatic zone wise percentage of farmers availing extension services from different sources (%)

Agroclimatic zones	Master farmer/ ICRP	CRP, CA, MA, MT etc.	Fellow farmers	SHG/VO members	Electronic media TV & Videos	Formal training by RySS.	Exposure visits by RySS	Newspapers and magazines	Booklets from RySS and others	Others	NGO
HAT	100	91	93	53	38	58	34	16	0	19	2
North coastal	100	76	94	34	45	39	22	18	6	1	1
Godavari	99	85	57	17	16	1	1	6	11	-	1
Krishna	96	96	79	29	16	6	1	5	11	-	-
Southern	89	78	68	10	22	8	4	2	2	1	5
Scarce rainfall	96	91	44	15	18	26	19	3	1	-	2
Andhra Pradesh	95	87	70	24	24	21	13	7	4	3	2

Source: IDSAP, Field Survey 2022

5.3.1. Farmers' satisfaction on the extension services

As explained above farmers have interacted with several sources for the extension services for PMDS and the level of satisfaction on their interaction has been captured with a scale 1 to 5. If the farmer is highly satisfied with the interaction of a particular source, it is recorded as 5, if more satisfied it is recorded as 4 and if the interaction is of no use, then it is recorded as 1. The average level of satisfaction is presented in the Table 5.5. Farmers are happy with the interaction with others and master farmers/ICRPs. Farmers are more than satisfied with the formal training from RySS and with the interactions of CRPs, CAs, MAs, MTs, fellow farmers, and exposure visits by RySS. By and large, farmers from HAT zone, north coastal zone and Godavari zone are happy with the interactions irrespective of the source of interaction compared to the farmers from other zones. Satisfaction levels by category of farmers are given in Annexure-5.5.

Table 5.5: Average satisfaction level* of interactions reported by the farmers on each of the extension service availed (number)

Agroclimatic zone	Others	Master farmer/ICRP	Formal training from RySS	CRP, CA, MA, MT etc.	Fellow farmers	Exposure visits by RySS	NGO	SHG/VO members	Newspapers and magazines	Elect. media TV/Videos	Booklets from RySS and others
HAT	5	4	4	4	4	4	4	4	4	4	4
North coastal	5	4	4	4	4	3	4	4	3	4	3
Godavari	.	5	4	4	4	4	3	3	3	3	3
Krishna	.	4	4	3	3	4	.	3	3	3	3
Southern	5	4	3	4	3	2	3	3	3	3	2
Scarce rainfall	.	4	3	4	3	3	3	3	3	3	3
AP	5	4	4	4	4	3	3	3	3	3	3

*Given 1 to 5 numbers 1=No use, 2=Less satisfied, 3=Satisfied, 4=More satisfied and 5=Highly satisfied

Source: IDSAP, Field Survey 2022

5.4. Suggestions for expansion of PMDS.

Suggestions for expansion of PMDS is based on the results of the present survey. As of now, one third of the farmer households are practicing PMDS in CNF promoted gram panchayats which in fact is no small achievement. However, there is a large scope for expansion in Krishna zone and Scarce rainfall zone where only 12 and 14 percent of farmer households respectively are following the PMDS. There is need to activate ground level staff in the CNF gram panchayats in these zones. More attention is needed to involve small, medium, and large farmers as their participation is comparatively low compared to marginal farmers. Cross section and panel farmers from Scarce rainfall zone have allocated only one plot for PMDS and strategies need to be explored for increasing the number of PMDS plots per farmer as well as area under PMDS. Even in HAT zone, less than 10 percent of farmers are practicing PMDS in their entire operational area which need attention of grassroot level functionaries.

Farmers from Southern zone need to be educated to go for a greater number of crops in a PMDS plot, with the slogan “*higher the number of crops in a plot higher the benefits from it*”. Farmers are heavily depending upon purchased seed though it is safer to use own seed. Most of the farmers from North coastal and Godavari districts are depending upon RySS staff and government for seed which are reliable. Farmers from other zones especially Scarce rainfall zone are depending upon the market and thus, the quality of seed they are receiving

must be certified by authorised personnel. Zone specific requirement of seeds needs to be identified and arrangements must be made to supply seed through reliable sources such as RySS staff, Government and NPM shops. The State Agriculture Department supplies, every year, the kits, with the seeds of 3-5 green manure crops to be raised before Kharif or main crop. RySS may collaborate with the Department to supply PMDS seeds kits, in place of green manure crops' seeds kits.

Farmers from Southern zone and Godavari zone have not taken up mulching in their PMDS plots seriously. On assessing the situation, farmers from these zones need to be educated to follow the protocols of PMDS for better results. Fencing is important to protect the crop but a little less than one third of the farmers alone had fencing to their plots. Farmers from Krishna, HAT, and Godavari zones must be informed on the importance and usefulness of fencing and ensure that they will follow the protocol. Similarly, there is need to explain the farmers on the importance of application of soil layer on non-live mulching material. Most of the PMDS practitioners of Scarce rainfall zone, Southern zone, and Krishna zone are not aware about the practice of PMDS that will capture the atmospheric water vapor and will protect the microorganisms and soil moisture. Hence attention of the extension personnel is needed to propagate these benefits, so that other farmers also fall in line to practice PMDS.

Overall, nearly half of the farmers who are practicing PMDS reported that shortage of biological inputs and seeds has to be tackled. The difficulty to protect the crop from grazing animals, and non-availability of suitable instruments are the major challenges to practice PMDS. It is much more in the North coastal and Godavari districts including tribal areas. It is therefore necessary to explore the possibility of handholding the PMDS farmers by the Government to counter these challenges in the larger interest of climate protection and health of the people. Around one fifth and half of the farmers in HAT zone reported lack of extension services which need to be strengthened. More SHG and VO members and fellow farmers need to be trained by RySS to advise the PMDS farmers.

If these steps are taken, and by making the grassroot level functionaries more responsible, in identifying and addressing zone specific challenges, there is a large scope for expanding the PMDS both in terms of number of farmers following the PMDS as well as area under PMDS. It is evident from the views of the farmers on allocating their entire operational area to PMDS.

Annexure Tables of Chapter 5: Farmers category wise tables

Annexure-5.1: Percentage of farmers perceiving challenges in PMDS 2022

Farmers categories	Shortage of biological stimulants	Shortage of seeds	Protection of crop from grazing animals	Non-availability of tools and instruments	Shortage of mulching materials	Shortage of hired labour	Shortage of fencing material	Shortage of family labour	lack of extension services	May affect the timing of Kharif and Rabi crops	Not remunerative	Not having confidence on PMDS	Others
Marginal farmers	56	51	49	45	42	23	23	18	17	14	10	1	1
Small farmers	58	53	43	46	44	23	22	19	19	11	14	4	2
Other farmers	53	43	47	49	35	25	21	16	16	17	21	11	4
Landless tenants	49	67	51	63	21	54	9	11	14	32	25	2	-
Owner-cum-tenants	43	62	57	51	29	45	14	16	12	19	19	3	-
Owner-farmers	57	49	46	45	43	21	23	18	18	13	12	3	2
SC	50	54	58	45	23	30	15	8	10	13	16	1	1
ST	76	67	56	68	68	25	34	44	42	21	5	1	1
BC	53	48	42	40	46	20	25	15	13	10	15	6	1
OC	51	40	39	39	27	22	16	10	11	14	11	2	3
Andhra Pradesh	56	51	47	46	42	24	23	18	17	13	13	3	2

Note: Other farmers include medium and large farmers

Source: IDSAP, Field Survey 2022

Annexure – 5.2: Farmers category wise percentage farmers used own and purchased seeds in PMDS plot in 2022

Farmers categories	Only own seeds	Both own and purchased seeds	Only purchased seeds
Marginal farmers	7.5	30.4	62.1
Small farmers	10.6	34.9	54.5
Other farmers	8.5	34.0	57.5
Landless-tenants	1.8	12.3	87.7
Owner-cum-tenants	2.9	27.5	69.6
Owner-farmers	9.1	33.2	57.7
SC	3.6	29.6	66.4
ST	3.7	31.9	64.5
BC	12.3	39.0	48.9
OC	9.8	23.7	66.6
All farmers	8.6	32.2	59.2

Source: IDSAP, Field Survey 2022

Annexure 5.3: Farmers category wise percentage of farmers procured seeds from different sources for PMDS 2022

Farmers categories	Fellow farmers	NPM shop	RySS (staff)	Govt.	NGOs	Market	Others
Marginal farmers	2.94	15.67	31.88	5.98	1.85	39.93	0.33
Small farmers	3.27	13.06	30.41	11.84	2.65	40.61	0.82
Other farmers	3.30	18.87	20.75	5.66	1.42	49.06	0.94
Landless-tenants	1.75	38.60	26.32	1.75	1.75	29.82	0.00
Owner-cum-tenants	1.45	26.09	40.58	1.45	0.00	43.48	1.45
Owner-farmers	3.21	13.91	29.63	8.23	2.14	41.67	0.54
SC	2.55	36.13	14.96	4.38	1.82	40.88	0.00
ST	0.33	1.66	69.10	17.61	1.99	9.63	0.33
BC	3.93	11.48	25.63	6.76	1.73	47.96	1.26
OC	4.15	17.32	18.05	4.15	2.68	54.63	0.00
All farmers	3.08	15.30	29.98	7.71	2.04	41.33	0.56

Source: IDSAP, Field Survey 2022

Annexure-5.4: Farmers categories wise percentage of farmers availing different extension services during PMDS 2022 (%)

Farmers categories	Master farmer/ ICRP	CRP, CA, MA, MT etc.	Fellow farmers	SHG/ VO members	Electronic media TV, Videos	Formal training from RySS.	Exposure visits by RySS	Newspapers and magazines	Booklets from RySS and others	Others	NGO
Marginal farmers	95	88	70	23	21	23	12	7	5	3	1
Small farmers	95	85	69	26	25	22	15	6	4	4	3
Other farmers	94	88	73	25	32	14	8	8	2	3	4
Landless tenants	98	95	77	32	21	5	-	7	4	-	2
Owner-cum-tenants	96	96	67	25	23	6	7	-	9	1	-
Owner-farmers	95	86	70	23	24	23	13	7	4	3	2
SC	97	92	72	27	18	17	8	4	5	1	1
ST	98	90	86	44	34	49	27	14	2	14	2
BC	96	86	62	20	24	18	13	6	5	1	3
OC	90	84	69	13	19	10	5	5	3	1	3
Andhra Pradesh	95	87	70	24	24	21	13	7	4	3	2

Note: Other farmers include medium and large farmers

Source: IDSAP, Field Survey 2022

Annexure-5.5: Average satisfaction level* of interactions reported by the farmers on each of the extension service availed (number)

Service / Type of farmer	Others	Master farmer/ICRP	Formal training from RySS	CRP, CA, MA, MT etc.	Fellow farmers	Exposure visits by RySS	NGO	SHG/ VO members	Newspapers and magazines	Elect. media TV/ Videos	Booklets from RySS and others
Marginal farmers	5	4	4	4	4	3	4	3	3	3	3
Small farmers	5	4	4	4	4	4	3	3	3	3	3
Other farmers	5	4	4	4	3	3	3	3	3	3	4
Landless tenants	.	4	4	4	3	.	4	3	4	3	4
Owner-cum-tenants	4	4	4	4	4	4	.	3	.	3	3
Owner-farmers	5	4	4	4	4	3	3	3	3	3	3
SC	5	4	3	4	3	3	4	3	3	3	3
ST	5	4	4	4	4	4	4	4	4	4	3
BC	5	4	4	4	3	3	3	3	3	3	3
OC	4	4	3	4	4	3	3	3	3	3	3
Andhra Pradesh	5	4	4	4	4	3	3	3	3	3	3

*Given 1 to 5 numbers 1=No use, 2=Less satisfied, 3=Satisfied, 4=More satisfied and 5=Highly satisfied

Note: Other farmers include medium and large farmers

Source: IDSAP, Field Survey 2022

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