Assessing the Impact of APCNF

Andhra Pradesh Community Managed Natural Farming

A comprehensive Approach Using Crop Cutting Experiments

2021-22

First Interim Report of 2021-22:

Pre-monsoon Dry Sowing

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Project Team

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Visakhapatnam

Contents

List of Boxes

List of Tables

List of Figures

Acronyms

APCNF	:	Andhra Pradesh Community Managed Natural Farming.
APPI	:	Azim Premji Philanthropic Initiatives
CAs	:	Cluster Anchor
CRPs	:	Community Resource Persons
DPMs	:	District Project Managers
FYM	:	Farm Yard Manure
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 Anchor
NGO	:	Non-governmental organization
Non-CNF	:	Non- Community Managed Natural Farming
NPM	:	Non- Pesticide Manage
PKVY	:	Prime Minister Krishi Vikas Yojana
PMDS	:	Pre-Monsoon Dry Sowing
PRDS	:	Pre-Rabi Dry Sowing
RKVY	:	Rastriya Krishi Vikas Yojana
RySS	:	Rythu Sadhikara Samstha
SC	:	Scheduled Caste
SHG	:	Self Help Groups
SIFF	:	Sustainable India Finance Facility
SPSS	:	Statistical Package for the Social Sciences
ST	:	Scheduled Tribe
VO	:	Village Organization
ZBNF	:	Zero Budget Natural Farming

Executive Summary

0.1. Introduction

1. As a part of Andhra Pradesh Community Managed Natural Farming (APCNF), Rythu Sadhikara Samstha (RySS) has developed Pre-monsoon Dry Sowing (PMDS) to protect and enhance the microorganism in the soil, which in turn would enrich the soils. The exact science of PMDS is yet to be determined. The enhancement of soil biology through CNF practices and raising of 8 to 15 diverse crops, as a mixed crops, creates some special conditions for the seed germination and plant survival during the dry seasons. It is expected to ahve far reaching impact and implications.
2. As a part of ***Assessing the impact of APCNF study 2020-21***, RySS asked Institute for Development Studies Andhra Pradesh (IDSAP) to focus on the entire study on PMDS farmers and plots. That is, to compare the outcomes of CNF crops grown on PMDS plots or PMDS+CNF plots with that of non-CNF plots. Further, RySS asked IDSAP to prepare a separate report on the status of PMDS in the state. In this context this report is prepared.
3. The major objectives of this report is to conduct a situational analysis of PMDS farming in the state. Specific objectives of this report are:
    1. To know the status of PMDS adoption by farmers in the state
    2. To assess the adoption of PMDS practices in relations to the protocols suggested by RySS.
    3. To estimate input use, costs, returns and other benefits of PMDS farming in the state.
    4. To identify major challenges faced by farmers in practicing PMDS farming, and
    5. To suggest measures to improve the implementation of PMDS farming in the state for its rapid expansion among the farming community
4. The entire report is based on the result of the primary survey, which is being undertaken by IDSAP during the agriculture year 2021-22.
5. Since this report is a part of a larger study entitled “Assessing the impact of APCNF 2021-22” sample selection was based on the larger study needs. Sample were drawn from the universe of 1.73 lakh CNF farmers who have cultivated PMDS during March to May/ June 2021. Since the study is conducted agroclimatic zone wise, the sample

allocation across the zones was based on the number of PMDS+CNF farmers in each zone and crop diversity in that zone. Total 1,230 PMDS+CNF, also know as cross section sample and 390 panel farmers were surveyed for this report.

6. While all 1,230 (100 percent) cross section farmers cultivated PMDS, 299 (77 percent) of out of total 390 panel farmers cultivated PMDS, during the study period. Total 1,529 sample, vary from 144 in North coastal zone to 351 in Southern zone; from 120 (7.85 percent) of medium and large farmers to 1,031 (64.43 percent) of marginal farmers. The sample include 14.06 percent Scheduled Caste (SC) farmers, 17.4 percent Scheduled Tribes (ST) farmers and 42.9 percent Backward Castes (BS) farmers.

0.2. Status of PMDS in AP

7. The sample farmers have cultivated PMDS in 1,629 plots. Out of total 1,529 total sample, 95 percent, i.e., 1,452 farmers have cultivated PMDS in one plot each. Remaining 77 farmers (5 percent) have cultivated PMDS in more than one plot. On average each sample farmer cultivated 1.07 PMDS plot at the state level.
8. In total, 666.32 hectare was put under PMDS by the sample farmers during the study period. On average each farmer has cultivated 0.44 hectares of PMDS. It varies from 0.28 hectares in North coastal zone and 0.29 hectares in HAT zone to 0.63 hectares in Southern zones and 0.49 hectares in Godavari zone, across agroclimatic zones. Among farm size categories, the average area allocated for PMDS varies from 0.39 hectares for marginal farmers to 0.74 hectares for medium and large farmers.
9. At the state level, 40.6 percent of operational area is allocated for PMDS by the sample farmers. It varies from 27.69 percent in HAT zone to 65.42 percent in Southern zone and from 17.28 percent for medium and large farmers to 64.17 percent for marginal farmers.
10. At the state level, over 57 percent plots were grown on rainfall and nearly 38 percent of plots got irrigation from own or public (free) sources and 1.78 percent plots were irrigated with purchased water, including the water-tankers. Over 3 percent plots were grown on mist only. While 98 percent plots in HAT zone are dependent on rainfall, about 80% of plots in the Southern zone are reliant on irrigation, including purchased water. It appears that irrigation is the major influencing factor in the area allocation for PMDS.

11. As anticipated majority of PMDS plots of marginal and small farmers are based on rainfall and that of medium and large farmers are relied on irrigation. Here also the variations across the agroclimatic zones are larger than that of farmers' categories.
12. Nearly 22 percent of PMDS plots were sown in the month of March 2021. More than 77 percent of PMDS plots were planted by the end of May 2021. About 95 percent plots were sown by the end of June 2021.

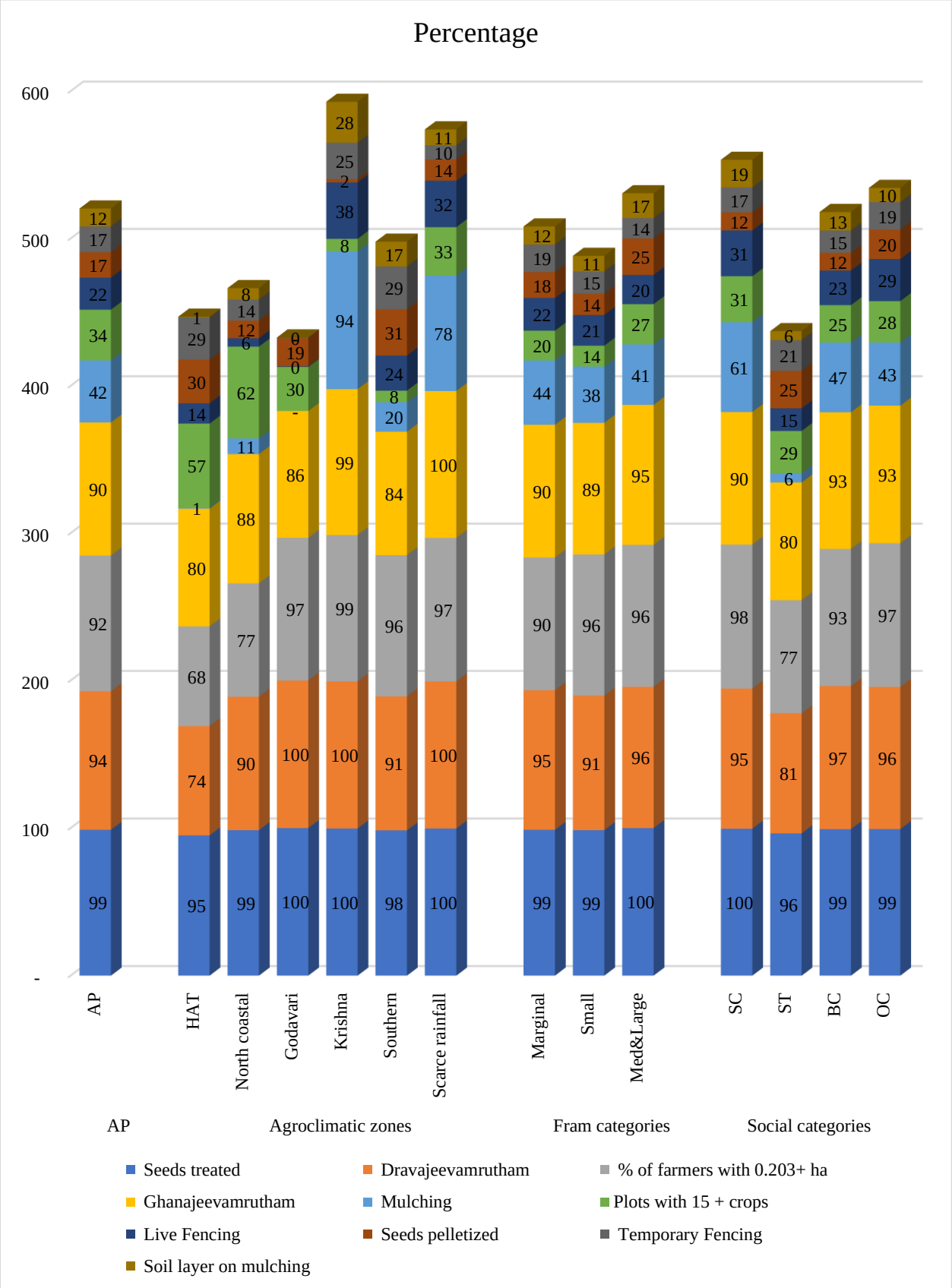
0.3. Adoption of PMDS protocols

13. Over 90 to 99 percent farmers and plots have fulfilled the core protocols such as area allocation, application of Ghanajeevamrutham and/ or Dravajeevamrutham, Seed treatment with Beejamrutham (Figure 0.1). As the adoption is near universal, there are no considerable variations across the zones and cfarmers' ategories.
14. The perfprmance is average with respect to seed rate and number of crops grown. There are structural issues with these indicators, such as availability of seeds, local conditions, crop composition and expection of full crop yields, local survival rates, etc.
15. However, the adoptions rates are considerably below 50 percent in the not so core protocols such as pelletising of seeds, temporary fencing, live-fencing, mulching, soil layer on mulching, and so on. Further, there are considerable variations across the zones and categories in adoption of these protocols. The possible reasons for lower rates of adoption of these protocols could be: (1) farmers might not be convinced about the utility of these protocols, (2) farmers might not have understood and mastered the processes of some of these protocols, and (3) farmers might some challenges such as shortage of materials, not able to afford some these items, in adoption of these protocols. If the first two are the reasons, RySS should strengthen its extension services. If third is the reason, RySS may develop appropriate strategies to overcome those challenges.

0.4. Costs, returns and surpluses/ deficits in PMDS cultivation

16. Though PMDS cultivatin is not competely aimed at the economic returns, over 71 percent of sample farmers have harvested some crop or other. Even after meeting all costs of own inputs used, including the value of own labour and the cost of all purchased inputs, except Krishna zone and SC farmers, all zones and farmers' categories recored surplues (Figure 0.2).

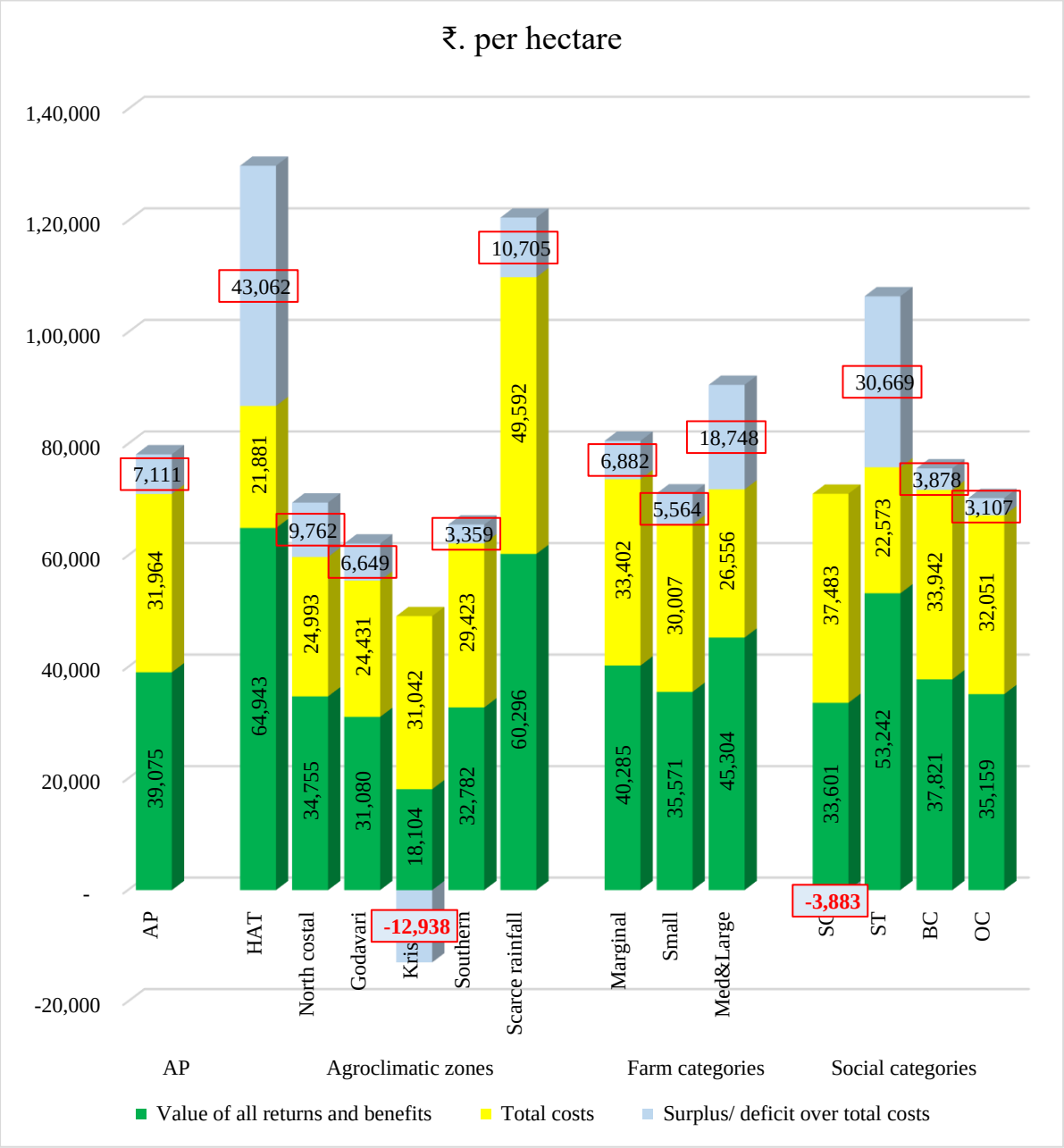
Figure 0.1: Percentage of PMDS plots/ farmers fulfilling protocols



Source: IDSAP Field Survey, 2021-22

It indicates that the PMDS has good potential to generate econommic, if not financial, surpluses over and above the total costs. RySS has to plan to reap these potentials.

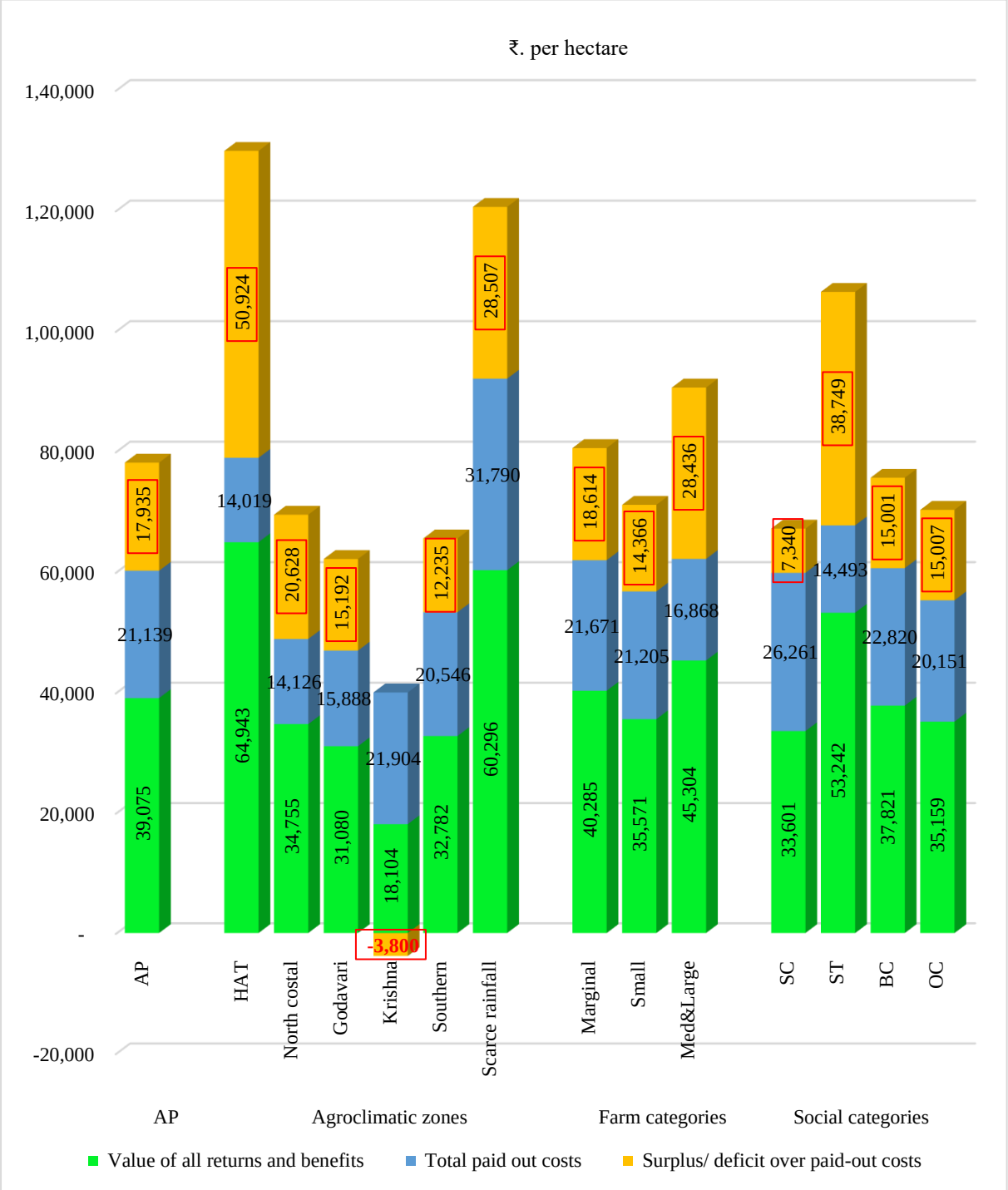
Figure 0.2: Total costs, returns and surpluses/ deficits in PMDS cultivation in 2021



Source: IDSAP Field Survey, 2021-22

17. Compared to the average paid-out cost of ₹.21,139 per hectare, and average returns, of all known benefits, of ₹.39,075 per hectare, the surplused from PMDS cultivation, at the state level, have increased to ₹.17,935 per hectare (Figure 0.3). Further, all, but Krishna zone, agroclimatic zones and all categories of farmers have obtained surpluses.

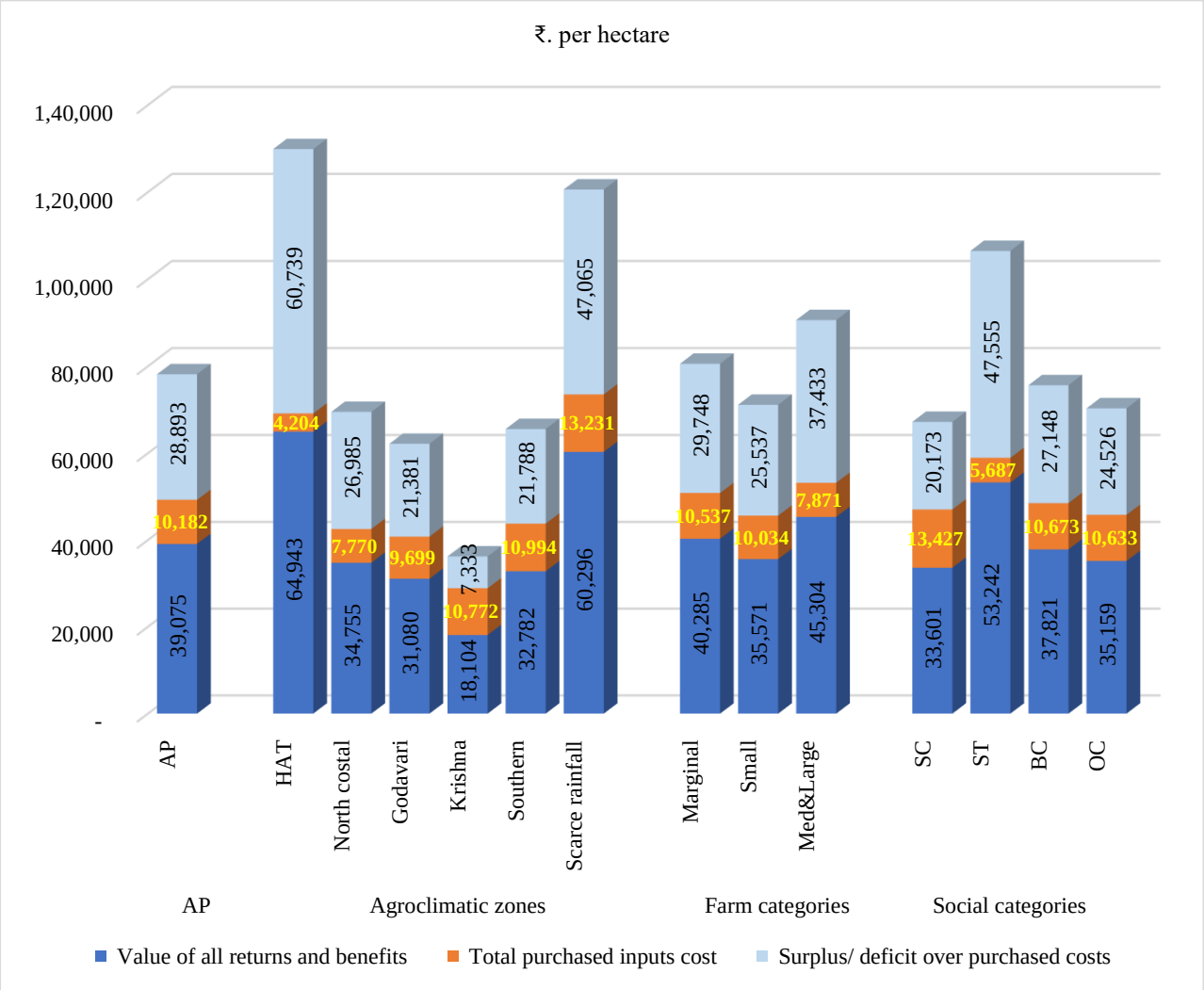
Figure 0.3: Paid-out costs, total returns and surpluse/ deficits in PMDS in 2021



Source: IDSAP Field Survey, 2021-22

18. As anticipated, compared to the average purchased inputs' cost of ₹.10,181 per hectare and the average returns, of all benefits, of ₹.39,075 per hectare, the average surpluses, at the state level, have increased to ₹.28,893 per hectare. Every zone and farmers' category have obtained surpluses from PMDS (Figure 0.4).

Figure 0.4: Cost of all purchases inputs, total returns and surpluse/ deficits in PMDS in 2021



Source: IDSAP Field Survey, 2021-22

19. ***It is well known fact that almost all agriculture machinery, implements, bullocks, etc., particularly land, and most of the family labour remained idle during the summar months. By utilizing the land, agriculture machnery, assets and family labour in the cultivation of PMDS, the farmers can get real economic benefits, along with invaluable environmental services. As some of the agricultural operations such as land preparation, ploughing, application of FYM, Ghanajeevamrutham, etc, are shiftef from Kharif/ Rabi cultivation to PMDS cultivation, it reduces the peak time demand for labour and agriculture machenery and assets. In the process, it reduces stress related to peak time demand of some agriculture operation and optimize the use of cultivators' family labour, agriculture machenary and assets.***

0.5. Non-monetory benefits

20. Incorporation of the multi-crop biomass into the soil to improves soil quality is number one non-financial benefit reported by as many as 90 percent of the farmers. Further, 42.77 percent farmers reported that protection of microorganism as the fourth important benefit from PMDS. Availability of green fodder from PMDS crops to the animals in summer season was the second most important benefit reported by 52.35 percent farmers. Capturing the water vapour from atmosphere is reported as the third important benefit of PMDS by 45.18 percent farmers. Availability of quality and nutritious food to the family consuption is fifth important benefit percieved by 41.43 percent farmers. Additional economic benefits from sale and consumption of PMDS produce are ranked as the sixth important benefits by 30.96 percent farmers.
21. Though formers got good economic returns from PMDS crop cultivation, they have percived that environment services as the major purpose of PMDS. They are in agreement with RySS.
22. About two-thirds of farmers reported one issue or other in adoption of PMDS. Among the issues reported by farmers, protection of PMDS crops from stray aninals is most widely felth challenge by 25.95 per farmers, followed by shortage of seeds (21.19 percent farmers), adverse impact on the timing of Kharif sowing (21.07 percent), shortage of mulching matewrial (20.88 percent), shortage of hired labour (18.91 percent), shortage of fenching material (16.18 percent), shortage of family labour (14.28 percent) and harvesting of mixed crops (9.52 percent) are widely felth problems.
23. Though many farmers reported about inadequate services, over 80 percent information, advices, and services, they get. from multiple sources, are percived mostsly as satisfactory, more satisfactory and highely satisfactory.

0.6. Suggestions

24. The suggestions are devided into two groups, viz., (1) qualitative suggestions given by the farmers directly at the time individual intervies, (2) suggestion given from other sources, which include the literature, research team's interaction with farmers and other stakeholders during the their field visits, field notes of investigators and supervisors, personal knowledge of the project team, etc.

0.6.1. Sugesstions by the farmers

a. Seeds should be supplied by RySS through Rythu Bharosa Kendras at the village level to ensure quality as well as just price of the seeds. They further suggested seeds should be made available at subsidised price.
b. They furthermore suggested that short duration crop should be raised under PMDS so that adequate time will be available for raising Kharif and Rabi crops.
c. Mulching material and fencing material should be supplied through NPM shops in villages.
d. The scarcity of hired labour and family labour can be overcome by linking MGNREGS with Agriculture.
e. Farmers wanted more frequent interactions with ICRPs and CRPs during crop period of PMDS.
f. Success stories of farmers of PMDS crops should be displayed through ***Pico*** Videos in the villages.
g. **Exposure**: Visits to PMDS plots should be arranged for learning about PMDS.

0.6.2. Suggestions from other sources

a. RySS may integrate the PMDS seed supply with the Government's "green manure crops' seed supply" scheme.
b. RySS may facilitate collective/ cooperative cultivation of PMDS to share labour, irrigation water, guarding the fields from stray cattle, etc.
c. Social fencing or social control on free grazing may be facilitated.
d. Whereever, the groundwater and canal water is not avialble, RySS may facilitate development of farm ponds, which can hold water throughout the year.
e. RySS may review the region specific need of certain protocols such as mulching, temporary fenching, pelletizing, etc.
f. Strenthen or improve the extension services

Chapter 1: Context, Objectives and Methodology

1.1. Context

The Government of Andhra Pradesh has introduced Zero Budget Natural Farming (ZBNF) in 2016 as an alternative to chemical-based agriculture. Later, the name was changed to Andhra Pradesh Community Managed Natural Farming (APCNF). APCNF is a paradigm shift in agricultural development. The main objective of APCNF is to make agriculture economically viable, agrarian livelihoods profitable and climate-resilient. APCNF aims to reduce cost of cultivation, enhance yields, increase incomes, reduce risks, and protect agriculture sector from uncertainties of climate change by promoting the adoption of an agroecology framework. APCNF is supported by the Government of India through Rastriya Krishi Vikas Yojana (RKVY) and Prime Minister Krishi Vikas Yojana (PKVY). APCNF is also supported by Azim Premji Philanthropic Initiatives (APPI), Sustainable India Finance Facility (SIFF) – an innovative partnership between UN Environment, BNP Paribas, the World Agro-Forestry Centre and KfW. The State Government proposed to cover all six million farmers and entire eight million hectare cropped area in the state under APCNF. To implement the program effectively and with full focus, a dedicated institution known as Rythu Sadhikara Samstha (RySS) was established. By the March 2021, more than 4.75 lakh farmers, in the state, have been participating in the APCNF project. But majority of them are as partial farmers, i.e., using both the biological and chemical inputs and practices. While there is strong evidence and perceptions about the efficacy of the APCNF in reducing the cost of cultivation and increasing profitability of the farming, but the perceptions are mixed about the crop yields and improvement in the soil quality and productivity. To improve the soil quality and productivity, RySS has introduced Pre-monsoon Dry Sowing (PMDS).

PMDS is an innovation in APCNF. PMDS is a system of sowing, tilling and tending the land wherein the farmer can grow crops in non-farming season or whenever there is no crop cover on the land. This is mostly before the advent of monsoon, during summers, and before beginning of Rabi season. This system believes that land should always be covered 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. The exact science of PMDS is yet to be determined. The enhancement of soil biology through CNF practices and raising of 8 to 15 diverse crops, as a mixed crops, creates some special conditions for the seed germination and plant survival during the dry seasons. The mulching material, which would be spread across the field, as a part of PMDS, 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 mulching material facilitates the percolation of the dew into the soil and prevents its evaporation again. Therefore, farmers grow PMDS during March-May/ June, followed by Kharif crops, Pre-Rabi Dry Sowing (PRDS) and Rabi crops, under the CNF scheme. The crops grown in PMDS and PRDS are used, ultimately, as green manure, after obtaining intermittently some cash income and food items to the farmers and green fodder to animals.

Box 1.1: Universal Principles of Natural Farming

1. Soil to be covered with crops 365 days (living root)
2. Minimal disturbance of soil
3. Bio-stimulants as necessary catalysts
4. Use indigenous seed
5. Diverse crops, including trees; 15 -20 crops
6. Integrate animals into farming
7. Increase organic residues on the soil
8. Pest management through botanical extracts
9. No synthetic fertilizers, pesticides, and herbicides

Source: Compiled from *www.apcnf.in* (on 21.04.2022)

It fulfils many of the universal principles of APCNF (Box 1.1). It ensures the soil cover during the driest period in a year, i.e., during March to May (between Rabi and Kharif crops). If the farmers do not cultivate Kharif crops, in any region, the period would be extended up to the Rabi sowing. The practice would be repeated, in the regions, which take crops during both Kharif and Rabi seasons, during interval period of Kharif and Rabi crops, if feasible. It reduces the need for ploughing and ensure minimum disturbance of soil. It increases organic residues in and on the soil. More importantly, it ensures crop diversity on the soil, thus, contributes significantly to the diversity of the life in the soil (sub-soils).

RySS's facilitation of the PMDS in the Anantapuramu, the driest district in the state and one of the least rainfall districts in the country, is an exemplary. The Anantapuramu experience

indicates that by providing a minimum critical moisture (equal to say 2 mm rainfall to the entire crop period), a good PMDS crop can be grown in any condition and season. PMDS is basically an effective means to enrich the soil through promotion and facilitation of the survival and multiplication of the microorganism in the soils. Firstly, the plants provide the food and nutrients to the microorganism. It is well known that plants prepare their required food and nutrients through photosynthesis and store the same in their roots. A part those food and nutrients ooze into soils, which is used by the microorganisms. Secondly, the plants provide the much-needed shade to the soils and controls the soil temperature, throughout the years, especially, during the extreme hot months. Thirdly, because of PMDS, the soil gets water either through irrigation or moisture conservation. Needless to say, all these factors contribute for the survival and multiplication of the benign microorganisms, which converts different elements and material available in the soils and atmosphere into the nutrients to the plants. To facilitate an effective growing of PMDS, RySS has issued a set of protocols. These protocols are discussed, in details, in chapter 3. As a part of ***Assessing the impact of APCNF study 2020-21***, RySS asked Institute for Development Studies Andhra Pradesh (IDSAP) to focus on the entire study on PMDS farmers and plots. That is, to compare the outcomes of CNF crops grown on PMDS plots or PMDS+CNF plots with that of non-CNF plots.[1] Further, RySS asked IDSAP to prepare a separate report on the status of PMDS in the state. In this context this report is prepared. This report is also known as the "First Interim Report of the ***Assessing the impact of APCNF study 2020-21.***

1.2. Objectives

The broad objective of this report is conducting a situational analysis of PMDS farming in the state. Specific objectives of this report are:

1. To know the status of PMDS adoption by farmers in the state
2. To assess the adoption of PMDS practices in relations to the protocols suggested by RySS
3. To estimate input use, costs, returns and other benefits of PMDS farming in the state
4. To identify major challenges faced by farmers in practicing PMDS farming, and

[1] In this report the word CNF is invariably means CNF cultivated on PMDS plots or PMD+CNF.

5. To suggest measures to improve the implementation of PMDS farming in the state for its rapid expansion among the farming community

1.3. Methodology

The entire report is based on the result of the primary survey, which is being undertaken by IDSAP during the agriculture year 2021-22. As mentioned above, this report is a part of the study entitled "Assessing the impact of APCNF 2021-22" and the survey is being conducted as a part of the entire study. Sample selection was based on the larger study needs. Some salient points of the methodology, especially, the sample selection process and size are discussed below.

1.3.1. Sample selection and size

For the larger study, after considering crop wise required sample observations and other factors total 1,240 CNF sample were selected from the entire state. As mentioned in the beginning of this chapter, the focus of this year (Assessment of the Impact of CNF) study is to assess the impact CNF crops, which are grown on the PMDS plots. Hence, all CNF sample were drawn from the universe of CNF farmers who have cultivated PMDS during March to May/ June 2021. During PMDS season, i.e., March-May/ June in 2021, 1.73 lakh PMDS farmers, across the state, have cultivated PMDS on 1.27 lakh acres. The geographical spread of the farmers and PMDS area is shown at Table 1.1. The number of PMDS farmers vary from 5,707 in Krishna district to 21,359 in Nellore districts. But as the sample was drawn based on agroclimatic zones, the district wise allocated sample GPs do not strictly represent the district wise number of PMDS+CNF farmers.[2]

[2] In this report the district wise analysis is not presented. The district wise tables are provided for the internal use of RySS

Table 1.1: District wise geographical spread of PMDS in Andhra Pradesh as on March/ April 2021

Area in acres and others in numbers

S. No	District	Number of Mandals	Number of Clusters	Number of GPs with PMDS farmers	Number of PMDS Farmers	Extent of PMDS area (in Acres[3])
1	2	3	4	5	6	7
1	Anantapuramu	63	82	208	8,509	6,210
2	Chittoor	65	74	267	14,275	8,686
3	East Godavari	58	94	223	18,245	12,904
4	Guntur	56	69	204	11,695	8,487
5	Krishna	49	58	196	5,707	3,592
6	Kurnool	53	93	307	9,416	7,677
7	Prakasam	59	68	201	9,374	7,943
8	PSR Nellore	47	71	195	21,359	17,592
9	Srikakulam	38	52	181	12,670	6,704
10	Visakhapatnam	39	62	183	9,922	4,028
11	Vizianagaram	34	52	189	18,927	14,719
12	West Godavari	46	57	181	11,880	12,315
13	YSR Kadapa	51	81	281	20,682	16,588
Total		658	913	2,816	1,72,661	1,27,447

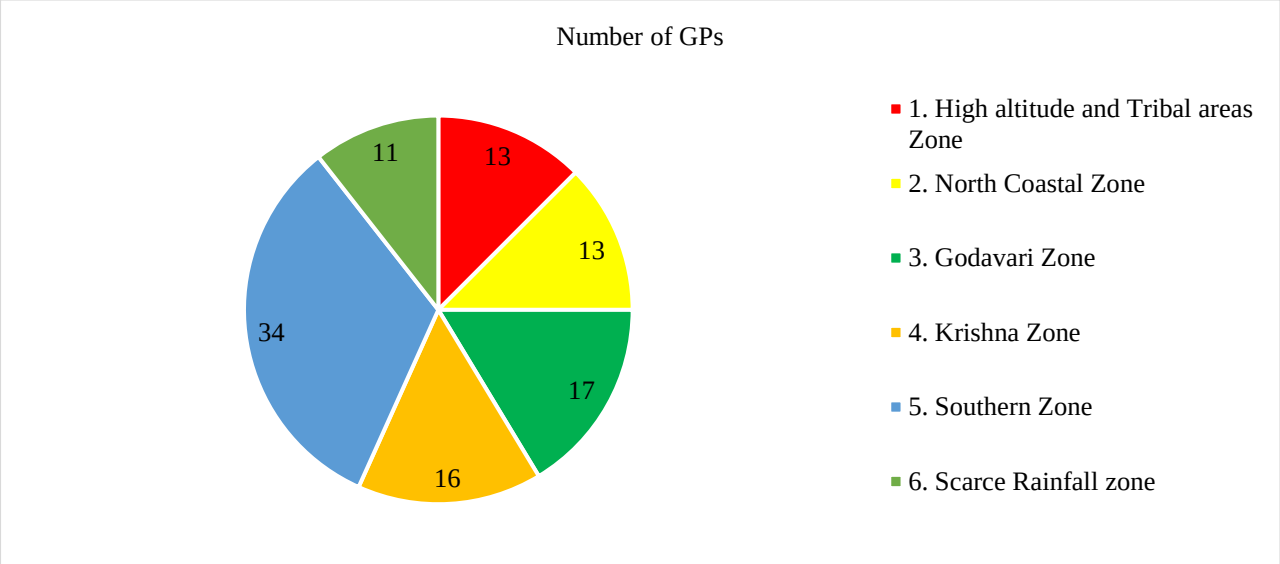
Source: RySS

This year also, the study adopted the agroclimatic zone wise analysis. Hence, the above data was reorganized into the six agroclimatic zones.[4] Then, the agreed number of 104 sample GPs were allocated to the six zones in proportion to the number of PMDS+CNF farmers in that zone. The allocation varies from 11 GPs in the Scarce rainfall zone to 34 in the Southern zone. The High-altitude tribal areas (HAT) zone and Godavari zone got 13 GPs each (Figure 1.1).

[3] One acre is equal to 0.405 hectares. As the PMDS is cultivated on a small piece of lands, normally, the area is discussed in acres.

[4] The agroclimatic zones are described in annexure 1, at the end of this chapter.

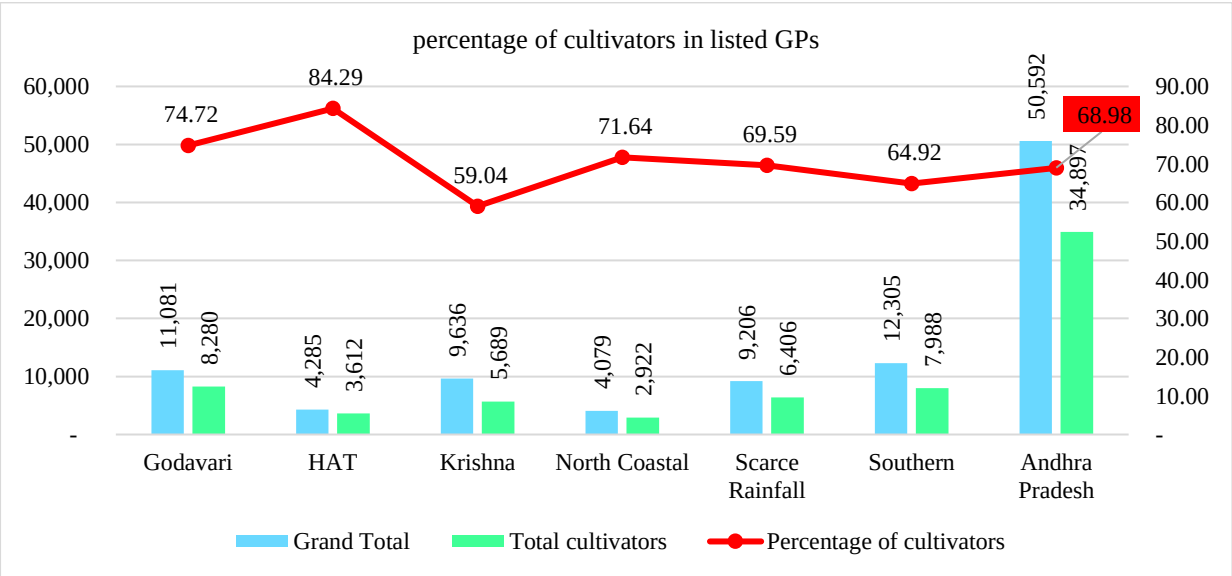
Figure 1.1: Agroclimatic zone wise sample GPs



Sources: IDSAP Fields Survey 2021-22

The household listing was conducted in each of 104 sample CNF GPs. As per the listing there are 50,592 households in 104 Sample CNF GPs. Out of these 68.98 percent (34,897) are cultivators. The percentage of cultivators is highest of 84.29 percent in HAT zone, followed by 74.72 percent in Godavari zone and 71.64 percent in North coastal zone. The same is least of 59.04 percent in Krishna zone (Figure 1.2). More details are discussed in chapter 2.

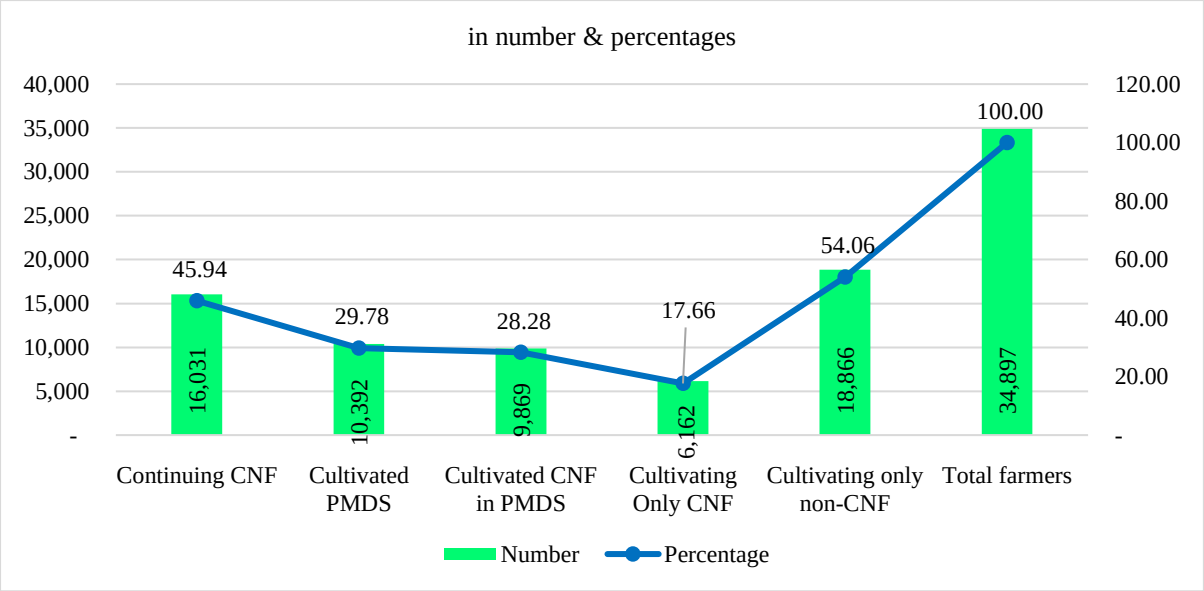
Figure 1.2: Number of households and farmers in the listed sample GPs in 2021-22



Sources: IDSAP Fields Survey 2021-22

Further, the listing data indicates, 16,031farmers out of total 34,897 farmers are CNF (including PMDS+CNF and Only CNF) farmers. It is 45.94 percent of total farmers. Further the data indicates that 10,392 (29.78 percent of all farmers) have cultivated PMDS during the reference period. This turns out to be 64.82 percent of total CNF farmers. Similarly, 9,869 farmers, i.e., 61.56 percent of total CNF farmers have cultivated CNF on PMDS pots. CNF sample was drawn these 9,869 PMDS+CNF farmers.

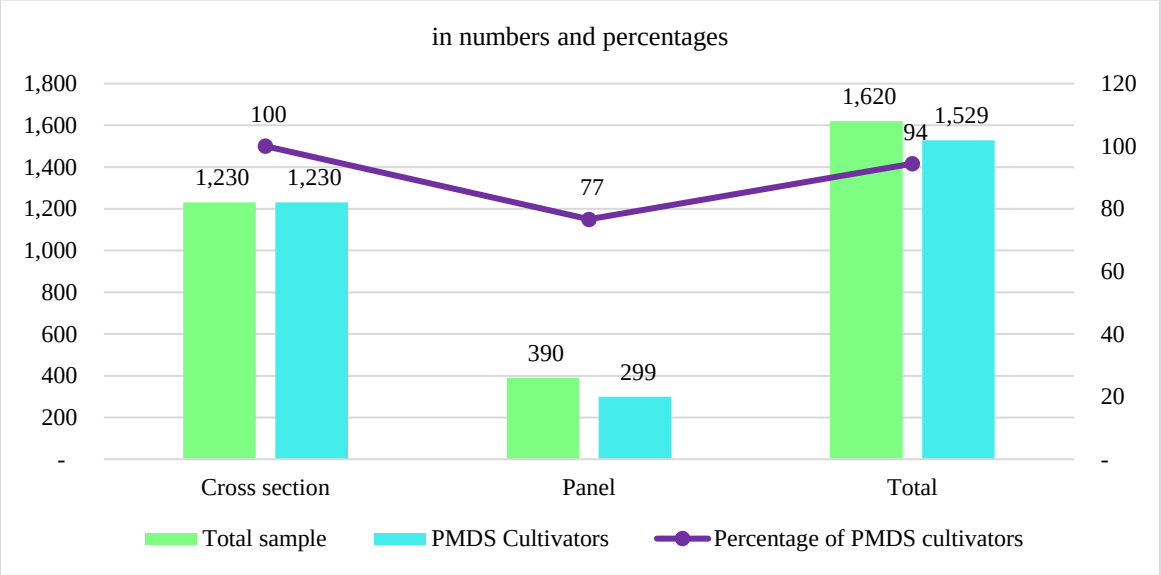
Figure 1.3: Total and different categories of listed farmers in the listed GPs



Sources: IDSAP Fields Survey 2021-22

It was planned to select on average 10 sample households from each sample GP. At that rate, it was planned to select 1,040 CNF cross section sample households. But the sample households were drawn in such a way to get a minimum of 50 observations for each of selected 12 sample crops, for the main Assessing the Impact of CNF reports, at the state level and also in those zones, in which a particular crop is grown by the most of the listed farmers. To get a minimum number of observations, the total number of CNF cross section sample was increased to 1,230; i.e., 18 percent higher sample. All these sample farmers are surveyed for the current report. Further, the study also surveyed all 390 panel farmers fixed in 2018-19 and 2019-20. While each cross-section sample farmer cultivated PMDS during March 2021 onwards, a few panel farmers did not grow the PMDS during the reference period. On the whole, while 1,620 sample farmers were surveyed, 1,529 sample farmers, i.e., 94 percent found to be PMDS cultivators during the study period, these include 100 percent cross section and 77 percent panel farmers (Figure 1.4).

Figure 1.4: Number and percentage of sample farmers cultivating PMDS in 2021



Sources: IDSAP Fields Survey 2021-22

1.4. Data collection and management

About 50-member field team was selected and trained during September and October 2021. Apart from listing in the sample GPs and collecting other data, the data for the present report was collected during November and December 2021. The data was digitalized using an android based Mobile/ Tab application. The digital data was processed using the SPSS and Excel software. Apart from the PMDS data collected from the sample households, the listing data is also utilized in this report. Apart from the descriptive statistics such as averages, percentages, cross tables, rigorous statistical analyses were conducted.

1.5. Structure of the report

In chapter 2, the situation of PMDS cultivation is the state is analysed. The analysis includes a statistical analysis to understand the factors influencing the cultivation of PMDS and also CNF. Chapter 3 analyses how far the protocols of PMDS have been followed at the state level, agroclimatic zone and farm size category levels. The economics of PMDS is examined in chapter 4. The cost of PMDS cultivation and monitory and non-monetary returns from the PMDS are analysed in this chapter. The issues and challenges in the cultivation PMDS and farmers expectations for the expansion of the PMDS are covered in chapter 5.

1.5.1. Appendix 1: List of Agro-climatic zones and their demarcation

S No	Name of the Zone	Districts and Mandals
I	High-altitude and Tribal areas (HAT) Zone	This zone consists of 37 High altitude and Tribal areas mandalas. These include eight Mandals, viz., (1) Hiramandalam, (2) Seethampeta, (3) Kothuru, (4) Bhamini, (5) Meliaputti, (6) Saravakota, (7) Pathapatnam, and (8) Mandasa of Srikakulam district; seven mandals, viz., (9) Gummalakshmipuram, (10) Komarada; (11) Kurupam, (12) Makkuva, (13) Pachipenta, (14) Parvathipuram, and (15) Saluru of 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 Visakhapatnam; 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 East Godavari districts.[5]
II	North Coastal Zone	All mandals of Srikakulam, Vizianagaram, and Visakhapatnam districts, excluding first 26 mandals (i.e., 1 to 26) of HAT zone, mentioned above.
III	Godavari Zone	All mandals of East Godavari, excluding last 11 mandals (i.e., 27 to 37) of HAT zone, mention above and all mandals of West Godavari district
IV	Krishna Zone	All mandals of Krishna, Guntur and Prakasam districts
V	Southern Zone	All mandals of Nellore, Chittoor, and Kadapa districts
VI	Scarce Rainfall Zone	All mandals of Kurnool and Anantapur districts

[5] Information was provided by Associate Director of Research (ADR), Chintapalle.

Chapter 2: Status and trends in adoption of PMDS in Andhra Pradesh

2.1. Introduction

This chapter first discuss the current status of PMDS in the state. Through the sample data, this chapter describe the broad profile of PMDS farmers and spread of PMDS area across the agroclimatic zones. Last year's PMDS Report noticed that some CNF farmers have adopted PMDS in a plot of landholding and have utilised the same PMDS plot for raising CNF crops later; some other CNF farmers have not adopted PMDS but continued to raise CNF crops; and yet other non-CNF farmers have adopted PMDS but utilised the same plot for raising non-CNF crops subsequently. This was the pattern of adoption observed last year by farmers. In this background, this chapter examines the pattern of adoption and utilisation of PMDS with a focus on the farmers shift from CNF to PMDS+CNF and to identify the factors contributing to this shift. Adoption of PMDS was assessed among the category of farmers in terms of small landholders (marginal and small farmers) and large landholders (medium and large farmers); tenurial status of the farmers in terms pure tenants, owner-cum-tenants, and pure owners; and the location of farmers in agro-climatic zones /districts. Further, it is hypothesized that small landholders compared to large landholders; pure owners and owner-cum -tenants vis-a-vis pure tenants; farmers practicing CNF for longer periods; farmers located in rainfall dependent zones compared to assured irrigation zones, do have higher chances of shift from CNF to PMDS+CNF. More specifically, this chapter examines the following issues:

i. What is the present status of PMDS in the state?
ii. What is the pattern of adoption of PMDS by farmers?
iii. What is the pattern of shift from CNF to PMDS+CNF?
iv. How does the category of farmer, and his/her geographical location determine the chances of his/her shift from CNF to PMDS+CNF?

2.2. Current status of PMDS in the state

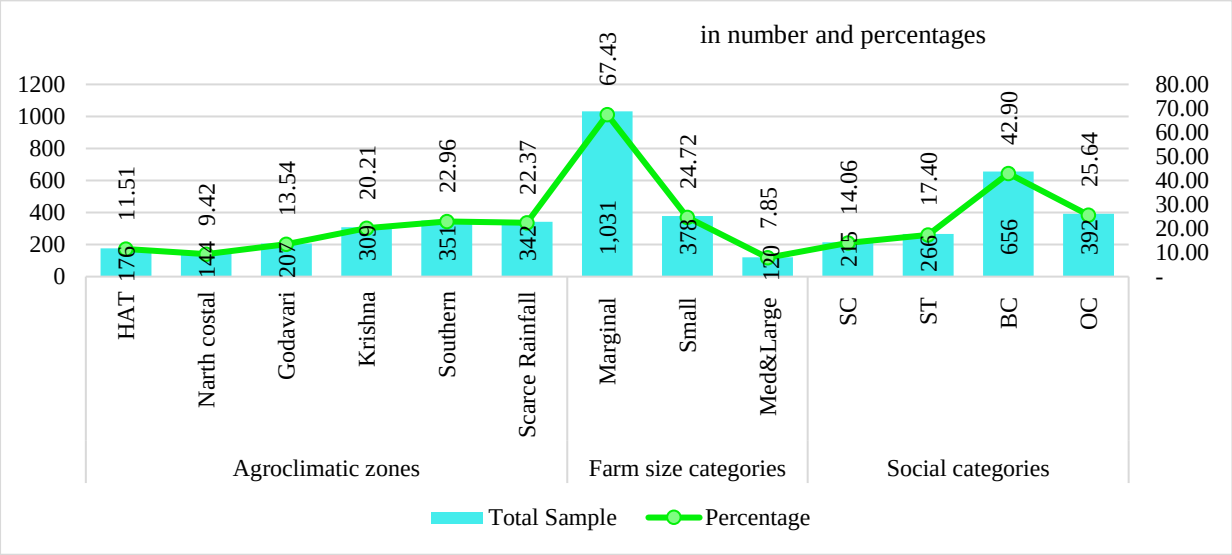
In this section, the locational, farm category and social categories affiliations of PMDS cultivators are discussed.

2.2.1. Sample farmers

As mentioned in the previous chapter PMDS data is collected from 1,529 sample farmers. Their spread across the agroclimatic zones, farm size categories and social categories is shown in Figure 2.1. Out of six zones in the state, the south side zones, Krishna, Southern and Scarce rainfall zones, together, have about two-thirds of total sample farmers. Each of these three zones have 300 plus sample ranging from 309 in Krishna to 351 in Southern zone. On the other hand, the three northern size zone have 144 in North coastal zone to 207 in Godavari zone. Out of total 1,529 sample, 1,031 (67.43 percent) are marginal farmers, 24.72 percent are small farmers and 7.85 percent are medium and large farmers. It may be noted that small and marginal farmers together constitute over 92 percent in the total sample. But their share in the state is about 89 percent[6]. It implies that the small and marginal farmers are over represented in the sample compared to their share in the state. It shows the positive bias of RySS towards the small and marginal farmers[7]. RySS's positive bias towards poor and vulnerable is conspicuous from the social category wise composition of the sample. The share of Scheduled Caste (SC) and Scheduled Tribe (ST) in the sample is 14.06 percent and 17.40 percent respectively (Figure 2.1)[8]. As per 2011 Census, the share of SC's and ST's in total cultivators in the state were 4.7 percent and 7.42 percent respectively[9]. Even if we assume that the share of SC and ST in the total cultivators, in the state, has doubled during last decade, their share in the sample is still higher than that in the state.

[6] See Statistical Abstract Andhra Pradesh 2020; https://des.ap.gov.in/jsp/social/StatisticalAbstrct-2020.pdf
[7] It may be noted that sample is at two stages were drawn randomly. There is every reason to belive that sample truly represents the PMDS population in the state.
[8] All basic and relevant tables, hereafter, are provided at the end of each chapter
[9] See Statistical Abstract Andhra Pradesh 2020; https://des.ap.gov.in/jsp/social/StatisticalAbstrct-2020.pdf

Figure 2.1: Agroclimatic zones, farm size categories and social categories wise distribution of sample farmers

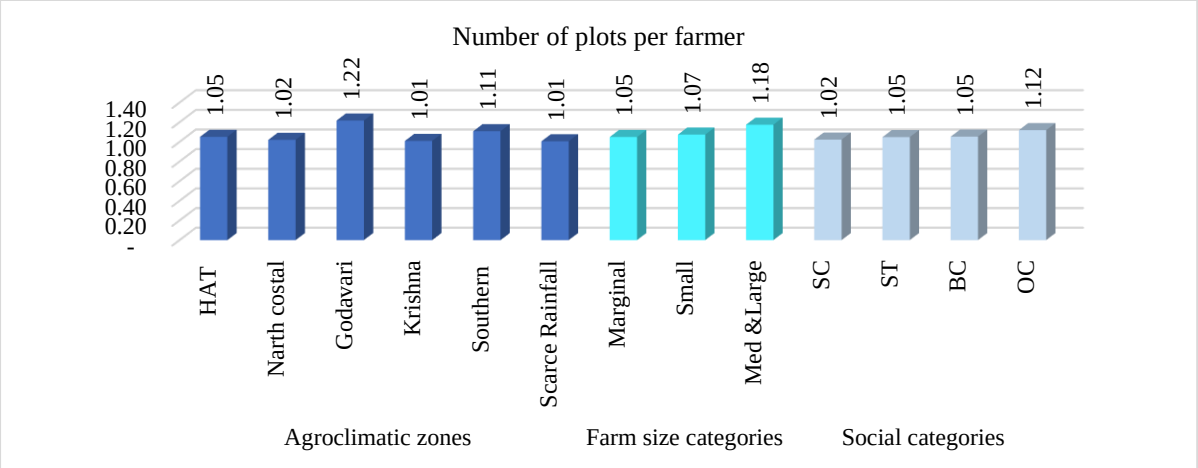


Source: IDSAP Field Survey, 2021-22

2.2.2. PMDS plots and average area

The sample farmers have cultivated PMDS in 1,629 plots. Out of total 1,529 total sample, 95 percent, i.e., 1,452 farmers have cultivated PMDS in plot each. Remaining 77 farmers (5 percent) have cultivated PMDS in more than one plot. On average each sample farmer cultivated 1.07 PMDS plot at the state level. Relatively better off zones (Godavari), farm category (medium and large farmers) and social category (OC) have higher number of PMDS plots per farmer (Figure 2.2).

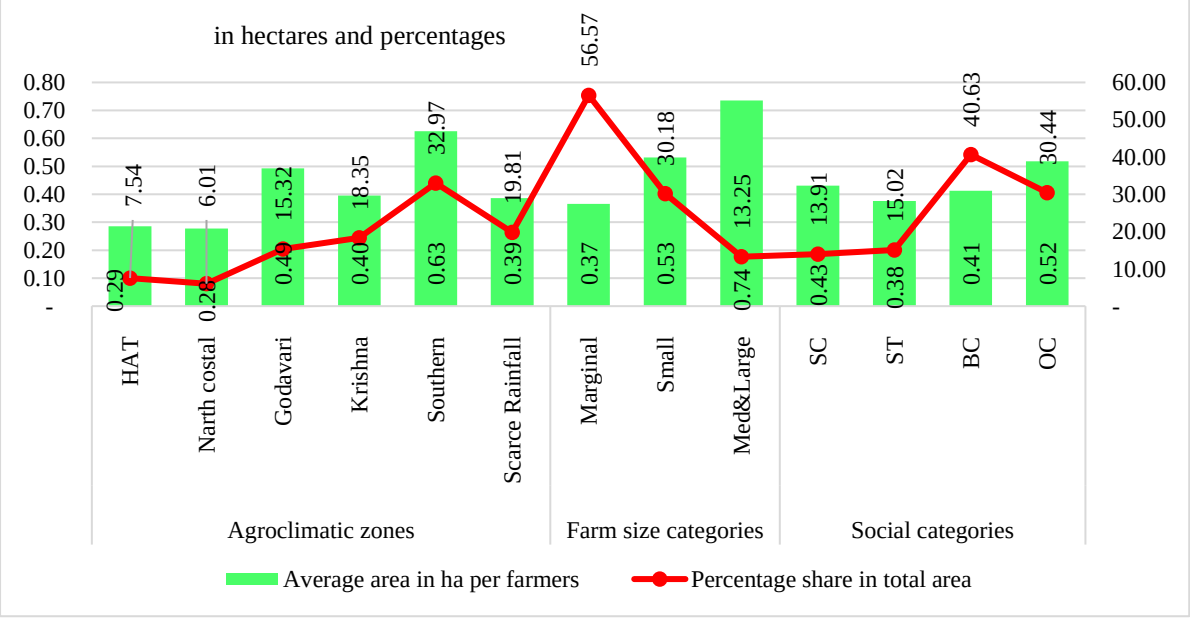
Figure 2.2: Agroclimatic zones, farm size categories and social categories wise average number of PMDS plots per farmer



Source: IDSAP Field Survey, 2021-22

In total, 666.32 hectare was put under PMDS by the sample farmers during the study period. On average each farmer has cultivated 0.44 hectares of PMDS. It varies from 0.28 hectares in North coastal zone and 0.29 hectares in HAT zone to 0.63 hectares in Southern zones and 0.49 hectares in Godavari zone, across agroclimatic zones. Among farm size categories, the average area allocated for PMDS varies from 0.39 hectares for marginal farmers to 0.74 hectares for medium and large farmers. It is interesting to note that average area allocated to PMDS by SC farmers is 0.43 hectares, the second highest among the social groups (Figure 2.3). It indicates RySS focus on SC farmers. It is exciting to note that the average area allocated to PMDS during the study period, in any zone or by any category is higher than the recommended area of 0.203 hectares by RySS. This issue is discussed further in the next chapter. The share of each zone and category in total PMDS area appeared to be partially influenced by the number of sample farmers in that zone or category and economic strength of that zone and category.

Figure 2.3: Agroclimatic zones, farm size categories and social categories wise average area allocated to PMDS and share each zone and category in total PMDS area in 2021



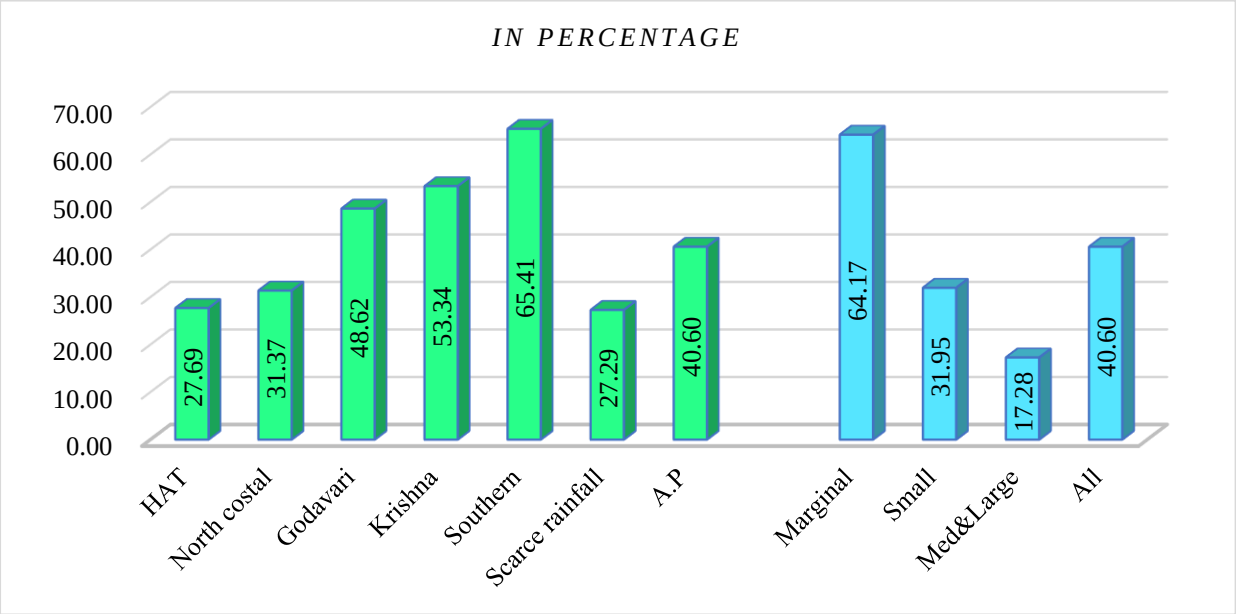
Source: IDSAP Field Survey, 2021-22

Yet another way to understand the farmers interest for PMDS is analyse the percentage of operational area allocated for PMDS. The data is presented at Figure 2.4. Compared to average area allocated to PMDS, the percentage of operational area allocated to PMDS shows some variation across the agroclimatic zones. The Southern zone tops in both absolute and

percentage area allocation for PMDS. Godavari and Krishna zones have around state average values, but in contrasting direction.

While the marginal farmers allocated least absolute area for PMDS among the farm size categories it has highest percentage (64.17 percent) of operational area under PMDS, compared to small farmers (31.95 percent) and medium and large farmers (17.28 percent). The mixed trends in the allocation of absolute and relative area for PMDS across the zones indicates that there are other factors influencing the area allocation for PMDS. Irrigation could be one obvious factor. This is issues is further analysed below.

Figure 2.4: Agroclimatic zone and farm size category wise percentage of operational area allocated to PMDS in 2021



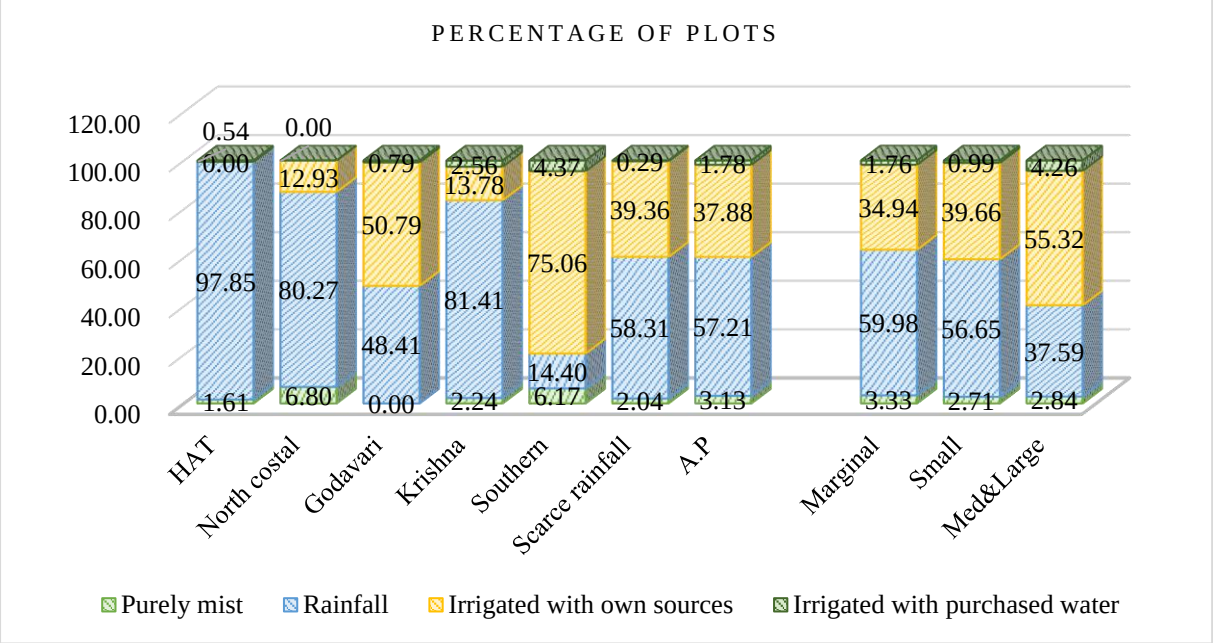
Source: IDSAP Field Survey, 2021-22

2.2.3. Irrigation status of PMDS plots

Though it is called a dry sowing or cultivation during the dry season, some critical soil moisture is required for the seed germination and crop growth. RySS, at least at the local level, is encouraging the farmers to provide critical moisture, equalling to 2 mm rainfall, when necessary. At the state level, over 57 percent plots were grown on rainfall and nearly 38 percent of plots got irrigation from own or public (free) sources and 1.78 percent plots were irrigated with purchased water, including the tankers. Over 3 percent plots were grown on mist only (Figure 2.5). However, there are wide variations across the agroclimatic zones. While 98

percent plots in HAT zone are dependent on rainfall, about 80% of plots in the Southern zone are reliant on irrigation, including purchased water. It appears that irrigation is the major influencing factor in the area allocation for PMDS. The Southern zone with irrigation facility to 80 percent of plots, has highest absolute and relative area allocation for PMDS in the state. Godavari zone with the irrigation provision to majority of PMDS plots has second highest absolute area and third highest percentage area allocation for PMDS among all agroclimatic zones. As anticipated majority of PMDS plots of marginal and small farmers are based on rainfall and that of medium and large farmers are relied on irrigation. Here also the variations across the agroclimatic zones are larger than that of farm size categories. Over 6 percent PMDS plots in the North coastal and Southern zones got the required moistures from the mist only.

Figure 2.5: Sources of water and moisture to the PMDS plots



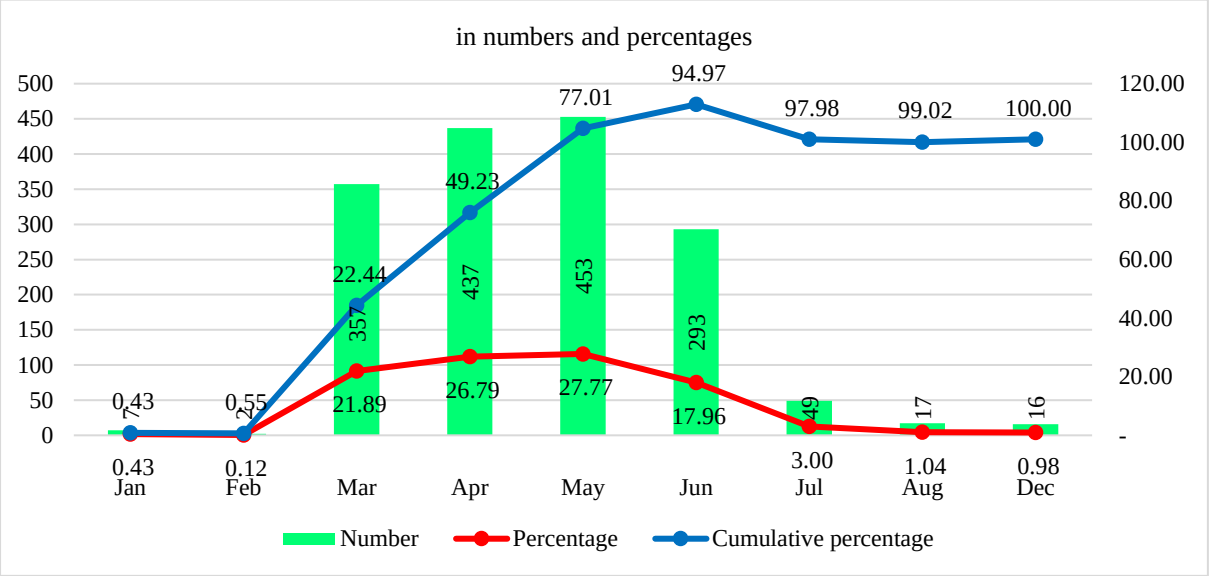
Source: IDSAP Field Survey, 2021-22

2.2.4. Timing of the sowing

Though PMDS is mandated to sow the crops during the pre-monsoon months of March to May, it is really challenging to sow the crops in those driest months in the state. Farmers informed the present study team that some minimum soil moisture is essential for the seeds to germinate. Hence, they sow the PMDS immediately after pre-monsoon showers, which are random phenomenon. Further, some Rabi crops, normally, continue into March, April, and May months. In this context, it is interesting to know the month wise sowing of PMDS. The results

are sown in Figure 2.5. Nearly 22 percent of PMDS plots were sown in the month of March 2021. More than 77 percent of PMDS plots were planted by the end of May 2021. About 95 percent plots were sown by the end of June 2021 (Figure 2.6). There is hardly any pre-Rabi sowing of PMDS. This shows that RySS is successful in getting PMDS in time.

Figure 2.6: Month wise sowing of PMDS plots during 2021



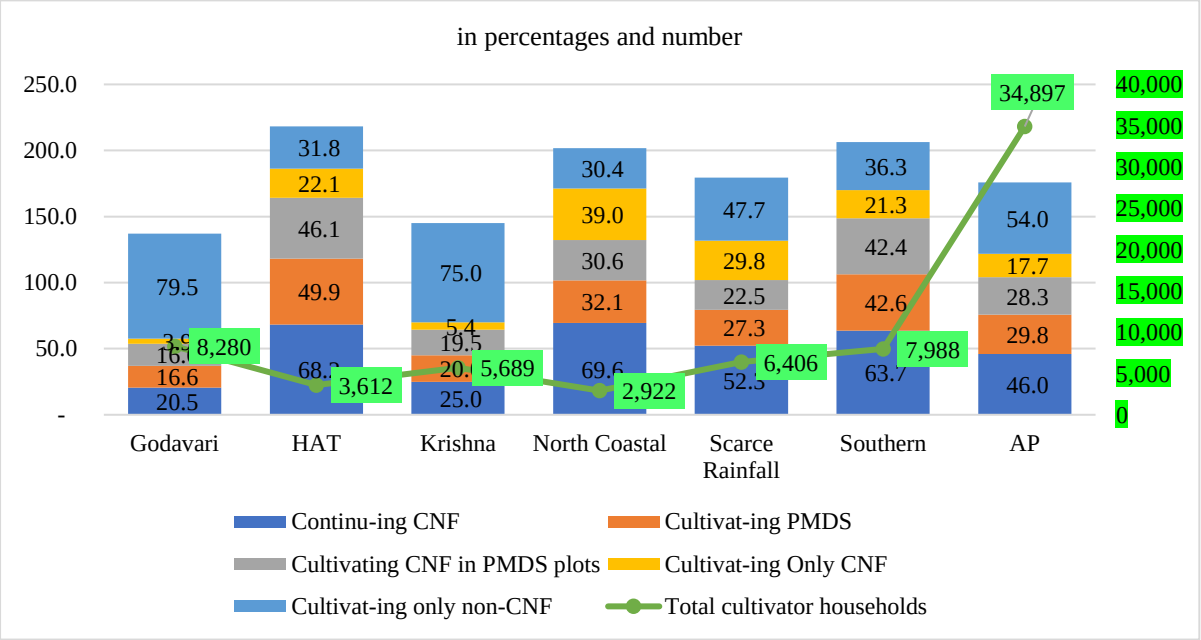
Source: IDSAP Field Survey, 2021-22

2.3. Pattern of Adoption of PMDS

The data collected from the household survey in the APCNF sample villages has been utilised to conduct the analysis**.** It has revealed very interesting insights about the adoption of CNF in the sample villages of project area. Out of 50,592 households listed in the APCNF sample villages, the cultivator households constitute 69 per cent (Figure 1.3 and Table 2.1).

Among the cultivator households 46 per cent have practiced CNF. Higher percentage of households have practised CNF in the rainfall dependent agroclimatic zones (High Altitude and Tribal, North Coastal, Southern and Scarce Rainfall) compared to assured irrigation agroclimatic zones (Godavari and Krishna Zones) (Table 2.2). This may have an impact on the adoption PMDS. As high as 65 per cent of the farmers among the CNF farmers have grown PMDS crops. The adoption of PMDS is higher in Godavari, Krishna, High Altitude and Tribal, and southern zones compared to the state average of adoption. However, it is lower in rainfall dependent zones (High Altitude and Tribal North Coastal, Southern and Scarce rainfall) than that of in assured irrigation zones (Godavari and Krishna) (Figure 2.7 and Table 2.2)

Figure 2.7: Agroclimatic zone wise total number of farmers and percentages of different types of farmers



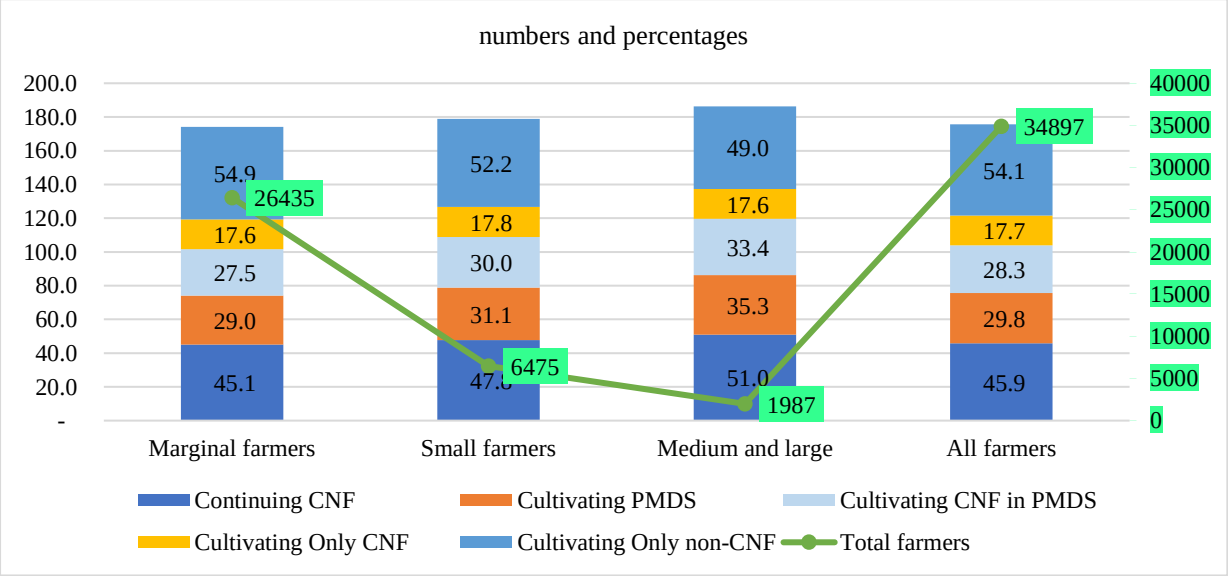
Among the districts, Anantapuramu, Chittoor, Guntur, Prakasam, Visakhapatnam and Vizianagaram have experienced lower adoption of PMDS compared state average of adoption. Further, the adoption varies between 10 per cent in Anantapuramu to 100 per cent in Kurnool (Table 2.3). Large landholders have adopted PMDS in higher percentages than the small landholders (Table 2.4). This is since the small landholders have faced problems viz., shortage of inputs like seeds, mulching material, fencing material etc. Pure tenant farmers have adopted in higher percentage than the pure owners and owner-cum-tenant farmers (Table 2.5). The terms and conditions of tenancy among natural farming cultivators appear to be favourable to both owners and tenants, leading to higher adoption levels among pure tenant farmers.

2.4. Shift from CNF to PMDS+CNF

Among the CNF farmers,62 per cent of farmers have shifted to PMDS+CNF from CNF, while 38 per cent of farmers were cultivating only CNF in the sample villages of Andhra Pradesh. This means that 62 per cent of CNF farmers have grown CNF crops on the PMDS plots (Table 2.2). The assured irrigation zones., viz, Godavari and Krishna compared to the rainfall dependent zones have experienced higher percentage of shift of farmers from CNF to PMDS+CNF. Among the rainfall dependent zones, Scarce rainfall zone and North Coastal zone, lower pace of shift from CNF to PMDS+CNF by CNF farmers was noticed (Figure 2.8 and Table 2.2). Anantapuramu, Vizianagaram, Visakhapatnam Prakasam, Guntur and Chittoor

are the laggard districts among the districts in the pace of shift from CNF to PMDS+CNF (Table 2.3). Small landholders have lagged the large landholders regarding transformation to PMDS+CNF from CNF (Table 2.4).

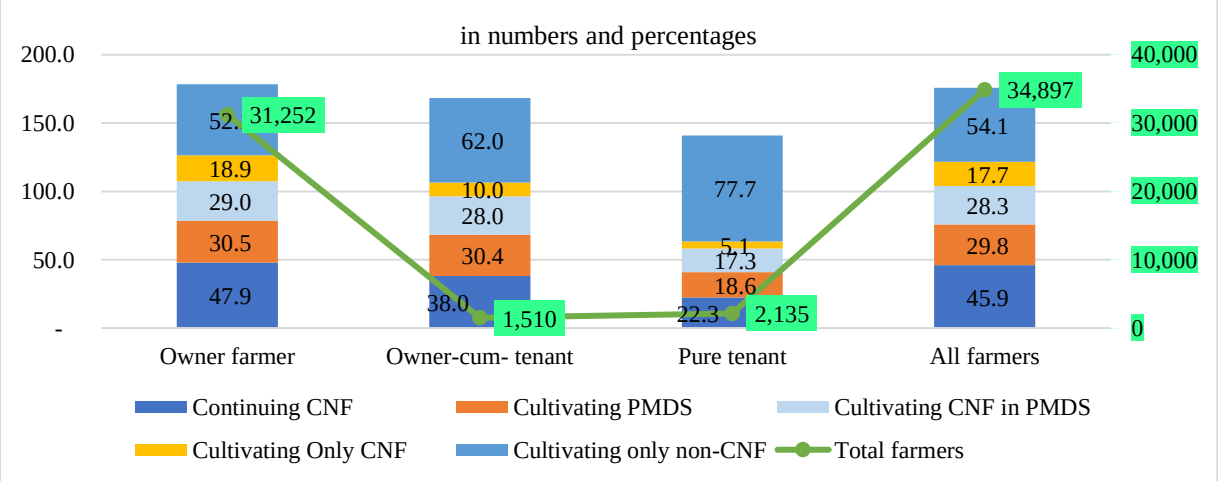
Figure 2.8: Farm category wise total number of farmers and percentage of different types of farmers in CNF listed GPs



Source: IDSAP Survey, 2021-22

It is striking to note that pure tenants, compared to pure owners and owner-cum tenants, have transformed faster from CNF to PMDS+CNF (Figure 2.9 and Table 2.5). This is due to the fact that tenant farmers were comfortable with any innovations in natural farming.

Figure 2.9: Tenurial status wise total number of farmers and percentage of different types of farmers in CNF listed GPs



Source: IDSAP Field Survey, 2021-22

2.4.1. Probit models

In order to understand the factors which contributed to the shift of CNF to PMDS+CNF by CNF farmers, two Probit models have been estimated using information from household data. Two models have been estimated by taking dependent variable, viz., adoption of PMDS by CNF farmer=1 and CNF farmers not adopted PMDS=0.In model I, independent variables considered include operated area of the farmers (in acres); tenurial status in terms of pure owners, owner-cum tenants, and pure tenants; number years of practicing CNF (in years) and agroclimatic zonal dummies. In model 2, instead of agroclimatic zones, district dummies have been considered as independent variables and all other independent variables remain the same as in model 1. The results are presented in Table 2.6. Among the two model, the Model 2 is found to be a good fit. The results in model I reveals that the chances of farmers shifting from CNF to PMDS+CNF has not increased with the increase in the operated cultivate area of farmers. This means all the categories of farmers have equal chance of shifting from CNF to PMDS+CNF. Pure tenants compared to pure owners have higher chance of shifting to PMDS+CNF from CNF. This may be due to the fact the terms and conditions of tenancy are favourable both to owners and tenants in the context of natural farming. But there is not significant difference between owner-cum- tenants and pure tenants in the chance of shifting from CNF to PMDS+CNF. The CNF farmers who have longer association with CNF have higher chance of shifting from CNF to PMDS+CNF. The farmers located in Godavari Zone has higher chance of adopting PMDS+CNF compared to all other zones. Further analysis has been conducted in Model 2 by including district dummies in the place of zonal dummies. Model 2 also has given similar results about category of farmers, and period of practice of CNF. But about tenurial status, the pure tenants have higher chance of shifting from CNF to PMDS+CNF compared to both pure owners and owner-cum-tenant farmers. This contrasts with the equal chance both for pure tenants and owner-cum-tenant farmers in shifting from CNF to PMDS+CNF in Model1.Moreover, the chances of adopting PMDS by CNF farmers is higher in all the districts compared to Anantapuramu district.

2.5. Conclusions

In the APCNF project area, 46 per cent of farmers have practiced CNF in 2021-22 in the sample villages state of Andhra Pradesh. Nearly two-thirds have practiced PMDS among the CNF farmers. As high as 62 per cent of CNF farmers shifted to PMDS+CNF from CNF. All farmers irrespective of operational landholding size have shifted to PMDS+CNF from CNF. Pure tenants compared to pure owner farmers and owner-cum- tenant farmers are likely to shift to PMDS+CNF from CNF. This is due to change in the terms and conditions of tenancy favourable to both owners and tenants in the context of natural farming and or the comfort with the innovations in natural farming. Interestingly, higher percentage of farmers from assured irrigation zone have shifted to PMDS+CNF compared to those from rainfall dependent zones.

Chapter 2 Tables

Table 2.1: Agroclimatic zone wise total listed households and f cultivator households in 2021-22

Agroclimatic zone	Total listed Households	Cultivator Households	Percentage of cultivator Household
Godavari	11,081	8,280	74.72
HAT	4,285	3,612	84.29
Krishna	9,636	5,689	59.04
North Coastal	4,079	2,922	71.64
Scarce Rainfall	9,206	6,406	69.59
Southern	12,305	7,988	64.92
AP	50,592	34,897	68.98

Source: IDSAP Survey,2021-22

Table 2.2: Agroclimatic zone wise different categories of farmers in 2021-22

Agroclimatic zone	Continuing CNF	Cultivating PMDS	Cultivating CNF in PMDS plots	Cultivating Only CNF	Cultivating only non-CNF	Total cultivator Households
Godavari	1,697	1,376	1,378	319	6,583	8,280
HAT	2,463	1,803	1,665	798	1,149	3,612
Krishna	1,420	1,139	1,111	309	4,269	5,689
North Coastal	2,033	937	894	1,139	889	2,922
Scarce Rainfall	3,348	1,746	1,442	1,906	3,058	6,406
Southern	5,090	3,402	3,385	1,705	2,898	7,988
Grand Total	16,051	10,403	9,875	6,176	18,846	34,897
	% of total farmers	% of total CNF farmers			% of total farmers	
Godavari	20.50	81.11	81.23	18.77	79.50	100.00
HAT	68.19	73.37	67.75	32.25	31.81	100.00
Krishna	24.96	80.13	78.50	21.50	75.04	100.00
North Coastal	69.58	46.09	43.97	56.03	30.42	100.00
Scarce Rainfall	52.26	52.15	43.07	56.93	47.74	100.00
Southern	63.72	66.85	66.52	33.48	36.28	100.00
AP	46.00	64.82	61.56	38.44	54.00	100.00

Source: IDSAP Survey,2021-22

Table 2.3: District wise different categories of farmers in listing in 2021-22

District	Continuing CNF	Cultivated PMDS	Cultivated CNF in PMDS	Cultivating Only CNF	Cultivating only non-CNF	Total farmers
Anantapuramu	442	42	40	402	818	1,260
Chittoor	899	373	372	527	1,404	2,303
East Godavari	986	704	717	269	2,072	3,058
Guntur	388	195	181	207	2,292	2,680
Krishna	130	130	130	-	977	1,107
Kurnool	1,839	907	902	937	1,628	3,467
Prakasam	957	869	860	97	1,191	2,148
PSR Nellore	3,081	2,286	1,983	1,098	320	3,401
Srikakulam	1,432	378	379	1,053	358	1,790
Visakhapatnam	753	141	138	615	64	817
Vizianagaram	2,145	2,099	1,920	225	1,416	3,561
West Godavari	806	730	719	87	4,536	5,342
YSR Kadapa	2,173	1,538	1,528	645	1,790	3,963
AP	**16,031**	**10,392**	**9,869**	**6,162**	**18,866**	**34,897**
	% of total farmers	**% of total CNF farmers**			**% of total farmers**	
Anantapuramu	35.08	9.50	9.05	90.95	64.92	100.00
Chittoor	39.04	41.49	41.38	58.62	60.96	100.00
East Godavari	32.24	71.40	72.72	27.28	67.76	100.00
Guntur	14.48	50.26	46.65	53.35	85.52	100.00
Krishna	11.74	70.78	70.32	29.68	88.26	100.00
Kurnool	53.04	100.00	100.00	-	46.96	100.00
Prakasam	44.55	49.32	49.05	50.95	55.45	100.00
PSR Nellore	90.59	74.20	64.36	35.64	9.41	100.00
Srikakulam	80.00	90.80	89.86	10.14	20.00	100.00
Visakhapatnam	92.17	26.40	26.47	73.53	7.83	100.00
Vizianagaram	60.24	18.73	18.33	81.67	39.76	100.00
West Godavari	15.09	97.86	89.51	10.49	84.91	100.00
YSR Kadapa	54.83	90.57	89.21	10.79	45.17	100.00
AP	**45.94**	**64.82**	**61.56**	**38.44**	**54.06**	**100.00**

Source: IDSAP Survey,2021-22

Table 2.4: Farm size category wise different categories of farmers in 2021-22

Farm size category	Continuing CNF	Cultivating PMDS	Cultivating CNF in PMDS	Cultivating Only CNF	Cultivating Only non-CNF	Total farmers
Marginal farmers	11,924	7,677	7,264	4,660	14,511	26435
Small farmers	3,094	2,013	1,942	1,152	3,381	6475
Medium and large	1,013	702	663	350	974	1987
Grand Total	16,031	10,392	9,869	6,162	18,866	34897
	% of total farmers	**% of total CNF farmers**			**% of total farmers**	
Marginal Farmers	45.11	64.38	60.92	39.08	54.89	100.00
Small Farmers	47.78	65.06	62.77	37.23	52.22	100.00
Medium and Large	50.98	69.30	65.45	34.55	49.02	100.00
Grand Total	45.94	64.82	61.56	38.44	54.06	100.00

Source: IDSAP Survey,2021-22

Table 2.5: Tenurial status wise different categories of farmers in 2021-22

Tenurial status	Continuing CNF	Cultivating PMDS	Cultivating CNF in PMDS	Cultivating Only CNF	Cultivating only non-CNF	Total farmers
Owner farmer	14,980	9,535	9,077	5903	16272	31,252
Owner-cum-tenant	574	459	423	151	936	1,510
Pure tenant	477	398	369	108	1658	2,135
All farmers	16,031	10,392	9,869	6,162	18,866	34,897
	% of total farmers	**% of total CNF farmers**			**% of total farmers**	
Owner farmer	47.93	63.65	60.59	39.41	52.07	100.00
Owner-cum-tenant	38.01	79.97	73.69	26.31	61.99	100.00
Pure tenant	22.34	83.44	77.36	22.64	77.66	100.00
All farmers	45.94	64.82	61.56	38.44	54.06	100.00

Source: IDSAP Survey,2021-22

Table 2.6: Factors influencing shift from CNF to PMDS +CNF

S. No	Description of independent Variables	Model-1		Model-2	
		df/dx (Probability)	p>z	df/dx (Probability)	p>z
1	Operational land holding (In Acres)	0.0008*	0.4920	0.0005	0.7150
2	Tenurial Status				
	Pure Tenant (Control Group)				
	Pure Owner	-0.0807*	-0.0010	-0.1071*	0.0000
	Owner-cum-Tenant	-0.0389	0.1660	-0.0724*	0.0130
3	Experience in CNF (in Years)	0.0561*	0.0000	0.0858*	0.0000
4	Agro Climatic Zones				
	Godavari Zone (Control Zone)				
	High Altitude & Tribal			-0.1969*	0.0000
	North Coastal			-0.3729*	0.0000
	Krishna			-0.0646*	0.0010
	Southern			-0.1894*	0.0000
	Scarce rainfall			-0.4129*	0.0000
5	Districts				
	Anantapuramu (Control District)				
	Srikakulam			0.2609*	0.0000
	Vizianagaram			0.5107*	0.0000
	Visakhapatnam			0.1474*	0.0000
	East Godavari			0.4131*	0.0000
	West Godavari			0.4283*	0.0000
	Krishna			0.3909*	0.0080
	Guntur			0.3379*	0.0000
	Prakasam			0.4379*	0.0000
	SPS Nellore			0.4917*	0.0000
	Chittoor			0.2925*	0.0000
	YSR Kadapa			0.4643*	0.0000
	Kurnool			0.3725*	0.0000
	Number of Observations	16465		16465	
	Pseudo R^2	0.0637		0.1986	
	Log likelihood	-10380.3520		-08884.2701	

Note1: Dependent Variable: adoption of PMDS by CNF farmer=1 and CNF farmer not adopted PMDS=0

Note 2:* denotes significant at 1 per cent level

Source: IDSAP Survey, 2021-22

Chapter 3: Adoption of PMDS protocols

3.1. Introduction

As mentioned in chapter 1, RySS has provided guidelines, referred as protocols, for fruitful cultivation of PMDS. These include plot size, number of crops to be grown in a plot, seed rate, treating seeds, application of biological inputs, mulching, fencing, etc. These are described in details in Box 3.1. This chapter explores farmers' adoption rates with respect to each of the recommended practice in the cultivation of PMDS across the agroclimatic zones and farm size categories. This analysis enables to identify constraints, if any, for better intervention by the project authorities to follow the procedures. The Protocols issued by RySS about PMDS practices are presented in Box 3.1.

Box 3.1: 1Protocols 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 optimize based on the local farming situation
4. Seeds should be treated with Bheejamrutham
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 local availability of 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

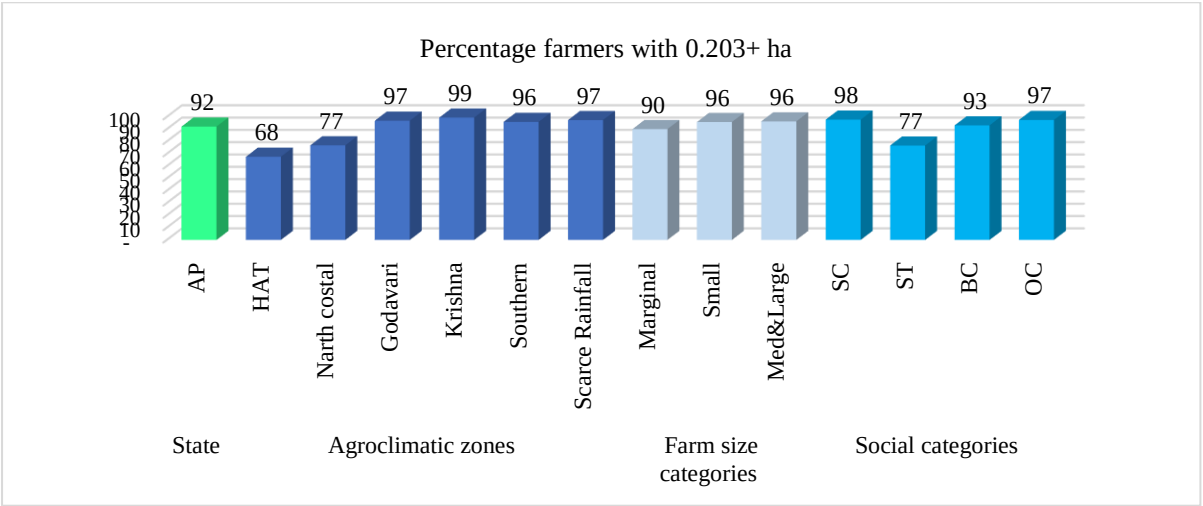
3.2. Adoption levels of different PMDS protocols

In this section, the rate of adoption of important protocols such as number of crops, seed rating, seed treatments, palletisation of the seeds, etc are analysed. As mentioned in the previous chapter, in total the sample farmers have planted PMDS in 1,629 plots during 2021. In this section the analysis is, moslty, carried out plot wise.

3.2.1. Average area allocated for PMDS

PMDS is predominantly a soil quality enhancement method, to get higher yields in the subsequent Kharif and Rabi seasons. Hence, some minimum area must be allocated for PMDS to get the optimum benefits. RySS has recommended to allocate 0.5 acre, i.e., 0.203 hectare. As seen in the previous chapter each of agroclimatic zone, farm size category and social category on average allocated more area for PMDS than recommended by RySS. On average each farmer has allocated 0.44 hectare for PMDS in 2021. In fact, 92 percent sample farmers in the state have allocated over 0.203 hectare to PMDS. This percentage varies from 68 percent in HAT zone and 99 percent in Krishna (Figure 3.1). While 90 percent marginal farmers allocated more than 0.203 hectares for PMDS, 96 percent of remaining farm categories have allocated more than recommended area of 0.203 hectare. Among the four social categories, surprisingly highest percentage (98 percent) of SC farmers allocated recommended land size for PMDS, followed by OCs (97 percent). About a quarter of sample ST farmers and HAT zone farmers and North coastal zone farmers have allocated less than recommended size area of 0.203 hectares. RySS may focus on these categories and zones.

Figure 3.1: Agroclimatic zone, farm category and social category wise percentage of sample farmers, who allocated more than recommended area for PMDS in 2021

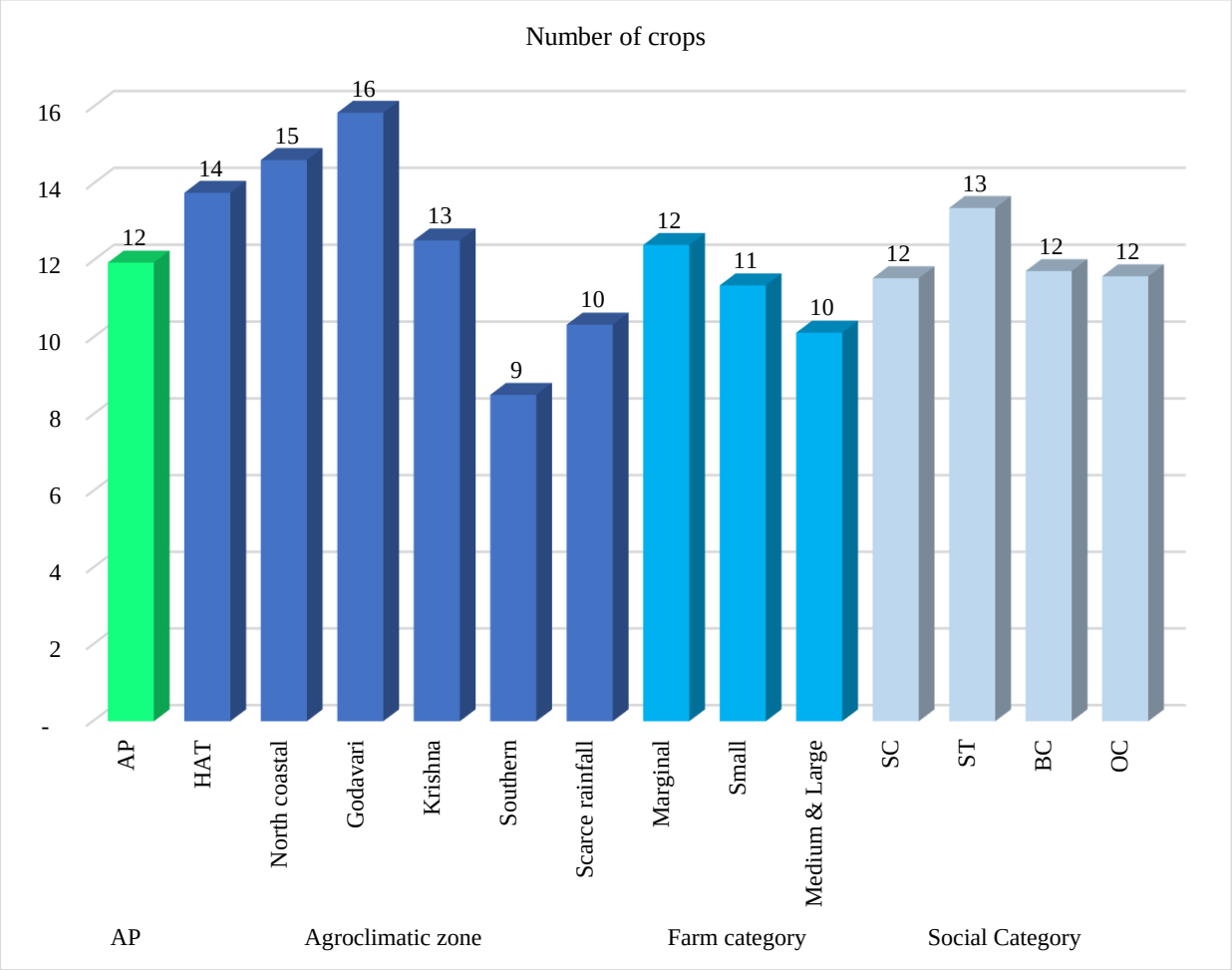


Source: IDSAP Survey,2021-22

3.2.2. Number of crops grown

Cultivation of as many crops as possible under PMDS is very important, under PMDS design, to promote the diversity of lifeforms, especially the benign and useful microorganism in the soils. Hence, RySS recommended to cultivate a mix of 15-20 crops under PMDS. The crops include green manure, fodder, food (including cereals, pulses, and oilseeds), vegetables, leafy-vegetables, roots, tubers, etc. They include shrubs, herbs, and creepers. On average 12 crops have been cultivated under PMDS plots by all farmers in the state in 2021. This is somewhat lower than the recommended number. There could be three possible reasons for this. Firstly, non-availability of seeds of many crops could be one major reason. Monocropping is one of major characteristics of chemical-based agriculture. Under that model, there has been significant reduction in the diversity of crops cultivated. The seeds of many traditional crops are not available in many places. Special efforts are needed to make available the seeds of many crops across the state. Second reason could be that some farmers may be focusing on one or two major crops, which allow them to reap better monetary returns. Thirdly, some crops need more conducive conditions, especially, soil moisture for germination and growth. It is interesting to note that northern zones, which receive relatively higher rainfall and bestowed with good irrigation infrastructure have cultivated higher number of crops compared to the state average and southern zones (Figure 3.2). Among the farm categories, it appears that there is an inverse correlation, but not significant, between the farm size and number of crops grown under PMDS. It may also a reflection of zonal patter observed above. It may be noted that the land-man ratio is relative higher in the southern part and concentration farmers with higher holding size. Among the social groups, the plots of ST farmers, who are mostly concentrated in the northern part, have cultivated relatively higher number of crops under PMDS, compared to other social categories (Figure 3.2)

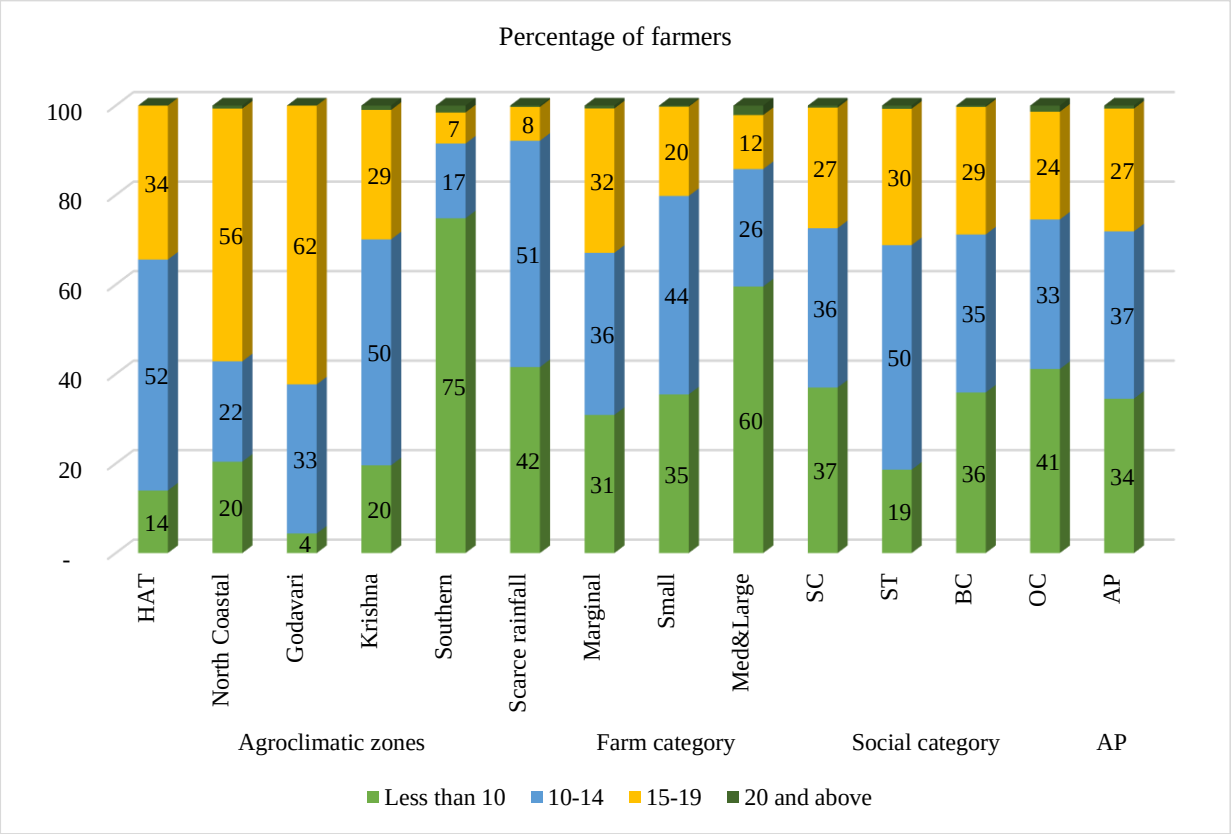
Figure 3.2: Agroclimatic zone, farm category and social category wise average number of crops grown in PMDS plots during 2021



Source: IDSAP Survey,2021-22

For the deeper understanding of the pattern of number crops grown across the agroclimatic zones and categories of farmers, the distribution of PMDS plots as per the number of crops grown is worked out and presented at Figure 3.3. At the state level 34 percent of plots have less than 10 crops. The same are as high as 75 percent in Southern zone and 42 percent in Scarce rainfall zone; 60 percent for medium and large farmers; and 41 percent for OC, among social categories. About 27 percent plots in the states have over 15 crops. The same is as high as 62 percent in Godavari zone and 56 percent in North coastal zone; 32 percent for Marginal farmers and 30 percent for ST farmers. Broadly the trends observed and reasons cited, above with respect to the number of crops grown, holds good in this context also.

Figure 3.3: Agroclimatic zone, farm category, social category, and number of crops' range wise distribution PMDS plots in 2021



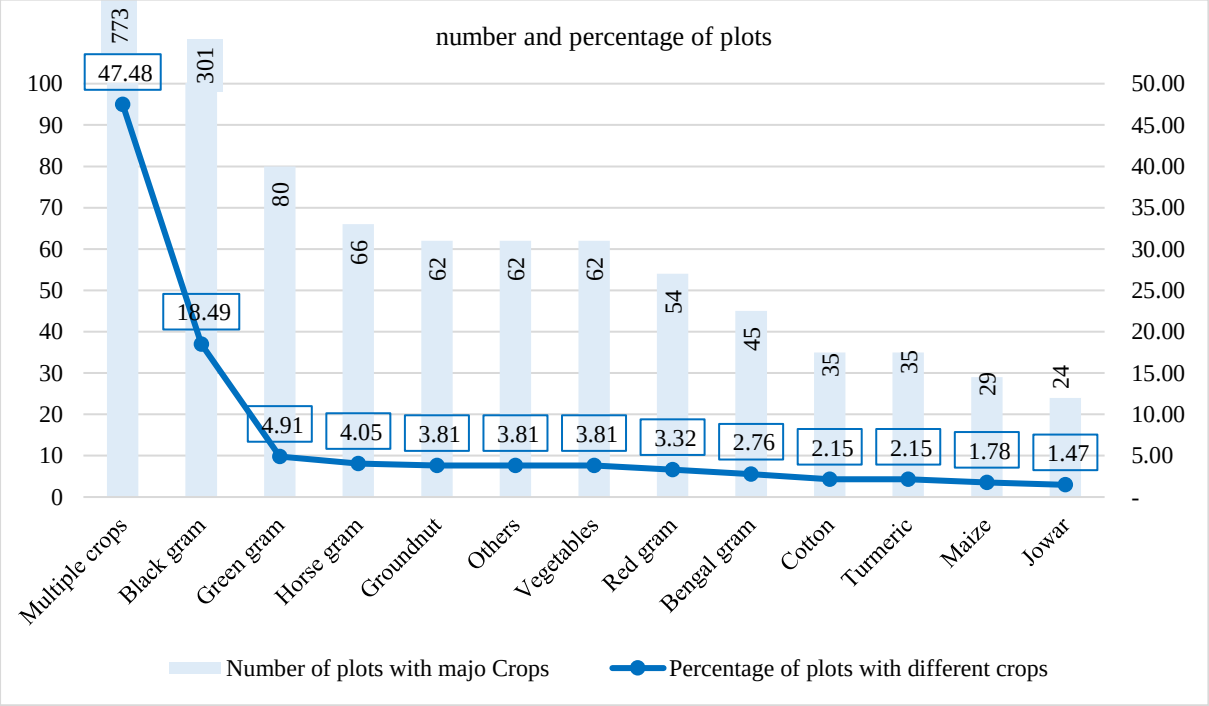
Source: IDSAP Survey,2021-22

3.2.3. Major crops

Traditionally green manure crops were grown during the pre-monsoon period for green manure and fodder purposes. But in the PMDS, majority plots, over 52 percent plots, are grown with some main crops. Main crop here means, sowing one crop, wither higher percentage of seeds, compared to other crops sown in the plot. The major purpose of main crop is to harvest the yields for the sale and/ or consumption. These are not meant for just fodder and manure purposed. Most prominent main crops are pulses crops grown, during 2021 are Black gram (18.49 percent), Green gram (4.91 percent), Horse gram (4.05 percent), Red gram (3.32 percent) and Bengal gram (2.75 percent) plots. Groundnut is cultivated on 62 (3.81 percent) of total plots. Other crops, which are cultivated less than 20 plots, include Paddy, Ragi, Bajra, Sesamum, Banana, other fruits, etc., add to 62 (3.81 percent) plots. Maize and Jowar are cultivated on 1.78 percent and 1.47 percent plots respectively (Figure 3,4). It may be noted that PMDS is also cultivated in the horticulture crops/ plots, which used to be left vacant for most part of the year, especially, during the pre-monsoon months. Further, it should be kept in mind

that each main crop is not necessarily harvested for the grains and products. Even if crop failed to mature and yield any tangible, they could be used as manure, fodder, and other purposes. Out of total 850 plots with main crop, about 550 plots were with pulses, which are nitrogen fixing crops. In any case some are long duration/ horticultural crops.

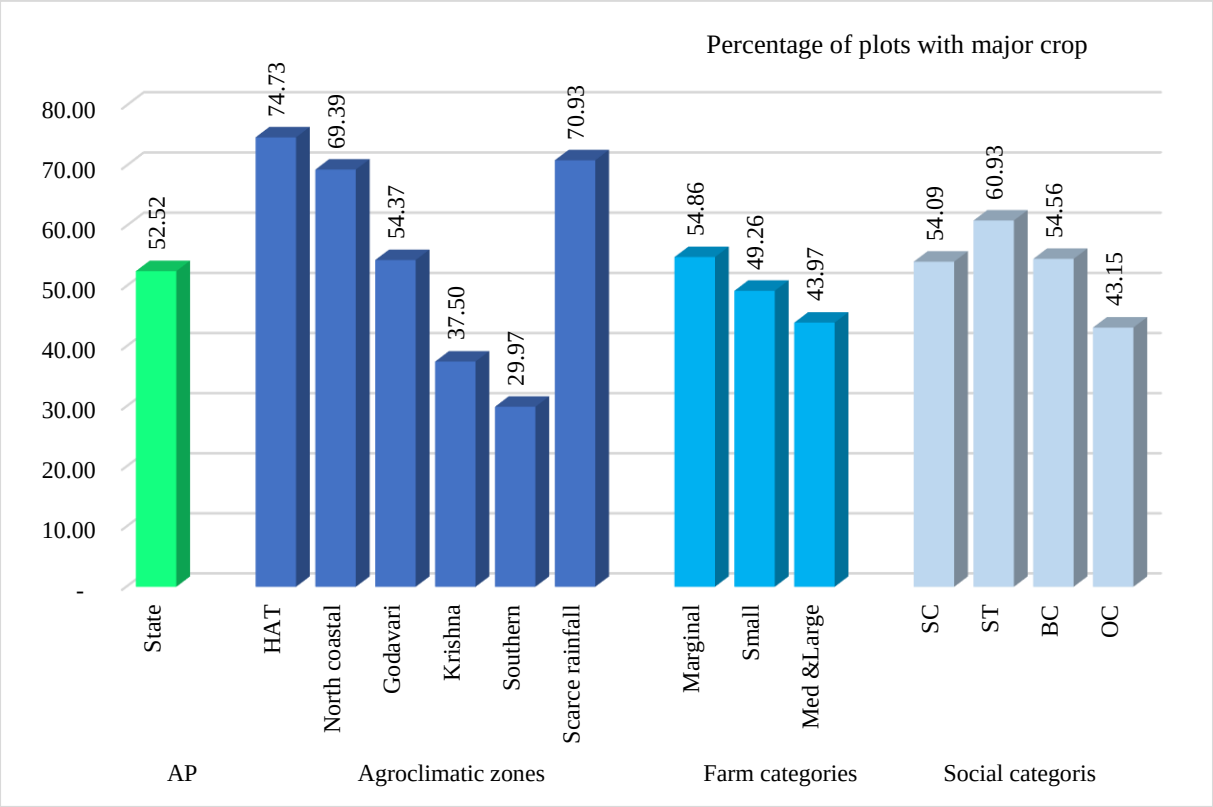
Figure 3.4: Number of percentages of PMDS plots with different main crops during 2021



Source: IDSAP Survey,2021-22

Percentage of plots with 'main crop' in different zones, and, of categories are shown in the Figure 3.5. At the state level, 52.22 percent plots have main crop. The same is over 74 percent in HAT zone, about 71 percent in Scarce rainfall zone and about 70 percent in North coastal zone. Marginal and small farmers have higher percentage of plots with main crop. It is surprising that Southern zone with highest percentage of irrigated plots, has least percentage (30%) of plots with a main crop and the ***Scarce rainfall zone with lowest rainfall in the state and less irrigation facilities have higher (71) percentage of plots with the main crop. It once again confirms the RySS assertion that a decent PMDS crops can be grown with minimum soil moisture equal to 2 mm rainfall.*** Among social categories, ST have highest (60.93) percentage plots with main crops followed by BC and SC with over 54 percent plots (Figure 3.5).

Figure 3.5: Agroclimatic zone, farm category, social category wise percentage of PMDS plots with main crop in 2021

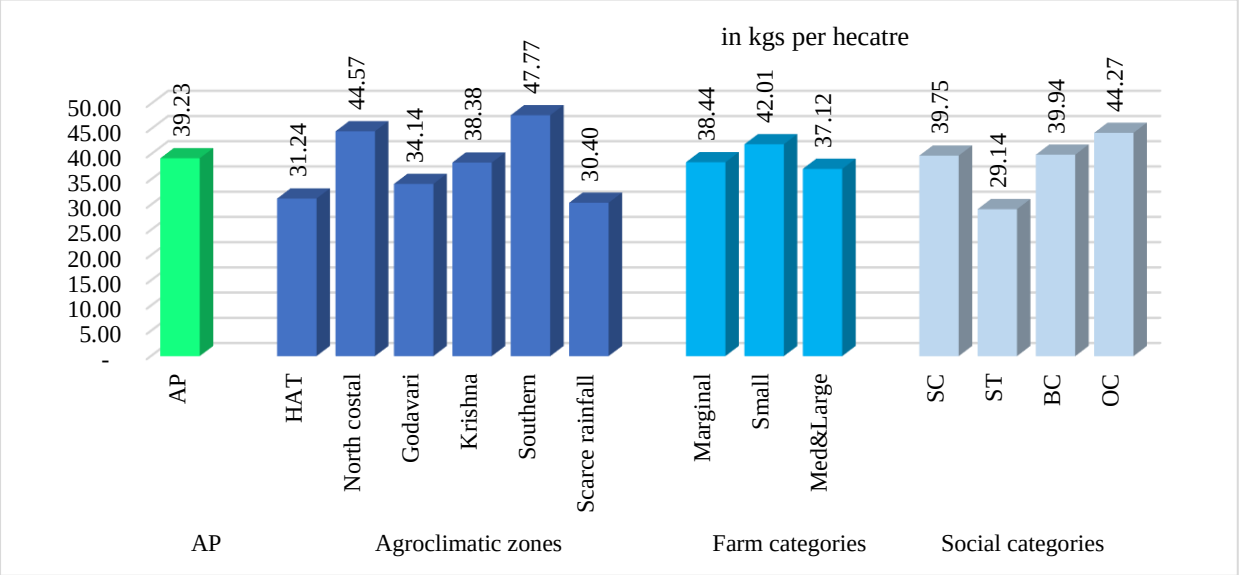


Source: IDSAP Survey,2021-22

3.2.4. Seed rate

For optimum benefits, RySS has suggested seed rate in the range of 12-15 kgs per acre or 30 to 37 kgs per hectare. Given various heterogenous influencing factors across the agroclimatic zones such as crop varieties, soil type, local weather, soil moisture levels, germination rates, the protocol of a uniform seed rate across the zones and crops may be reviewed. On average 39.23 kgs of seeds were used in the state. It is higher than the highest value of the range suggested by RySS. But there are wide fluctuations across the zones, varying from 30.40 kgs per hectare in Scarce rainfall zone and 31.24 kgs per hectare in HAT zone to 47.77 kgs per hectare in Southern zone. Though fluctuations are moderate across the farm size categories, there are wider variations in the seed rate across the social categories. It varies from 29.14 kgs per hectare for ST farmers to 44.27 kgs per hectare for OC farmers (Figure 3.6).

Figure 3.6: Agroclimatic zone, farm category, social category wise seeds rate in 2021



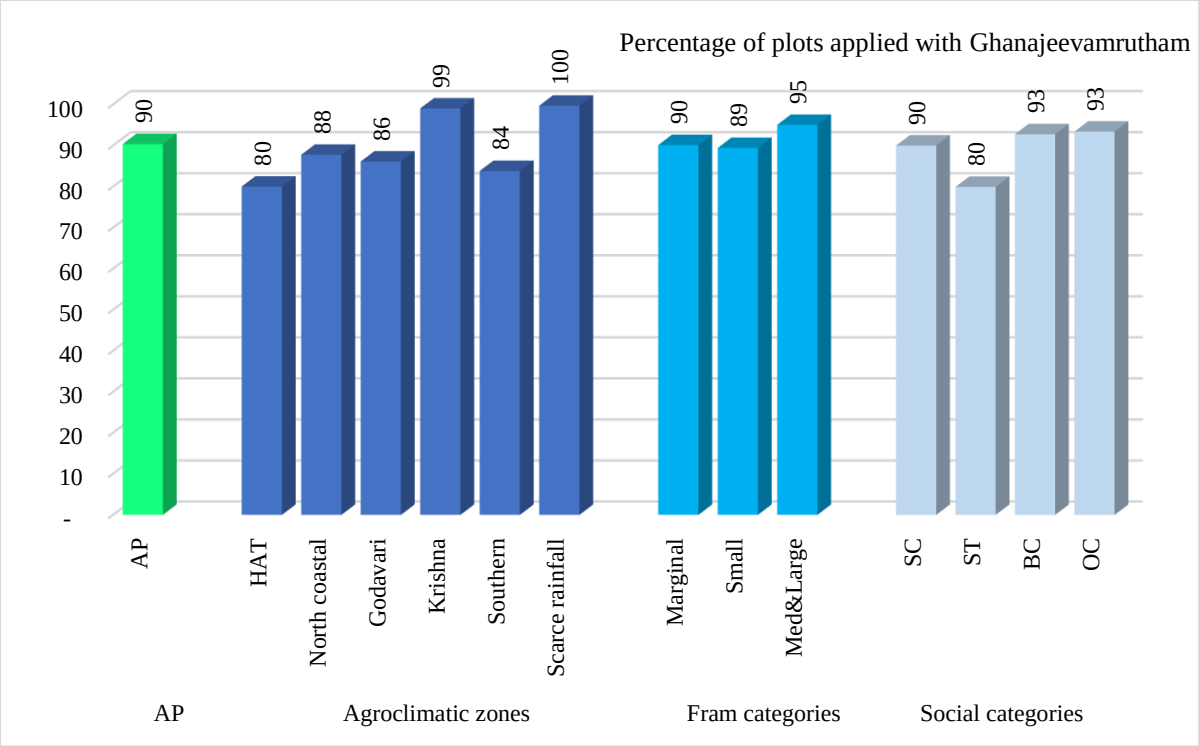
Source: IDSAP Survey,2021-22

3.2.5. Application of Ghanajeevamrutham

Culturing and application of microbial or microbes is the most important part of the APCNF. After culturing the microbial, it will be applied in the field in the form of either Ghanajeevamrutham (dry form) or Dravajeevamrutham (liquid form). Ghanajeevamrutham is applied usually as a part of the preparation of the land for sowing. The microorganism will convert the variety elements and material available in the soil and atmosphere into plant nutrients. These nutrients contribute for the healthy growth of the crops. Application of Ghanajeevamrutham one of mandatory recommendation. However, there is no mentioned about the quantity to be applied and number of times it must be applied. Ghanajeevamrutham was applied one time in about 60 plots, two times in 25 percent plots and more than two times in the remaining plots. Ghanajeevamrutham was applied in 90 percent of sample PMDS plots in the state. The same varied from 80 percent in HAT zone and 84 percent in the Southern zone to 99 percent in Krishna zone and 100 percent in the Scarce rainfall zone. Among farm categories 95 percent plots of medium and large farmers, got Ghanajeevamrutham, and among the social categories, highest (93) percent plots of BC and OC were applied with Ghanajeevamrutham (Figure 3.7). This data indicates that about 10 percent plots did not get Ghanajeevamrutham. It does not imply that those plots did not get microbial/ microorganism. They might have got microorganism through Dravajeevamrutham. Needless to say, that the Ghanajeevamrutham and Dravajeevamrutham are perfect substitutes. Farmers can apply either

one as per their convenience and other conditions. The microbes would be preserved and multiplied for many months in the form of Ghanajeevamrutham.

Figure 3.7: Agroclimatic zone, farm category, social category wise percentage of PMDS plots applied with Ghanajeevamrutham in 2021

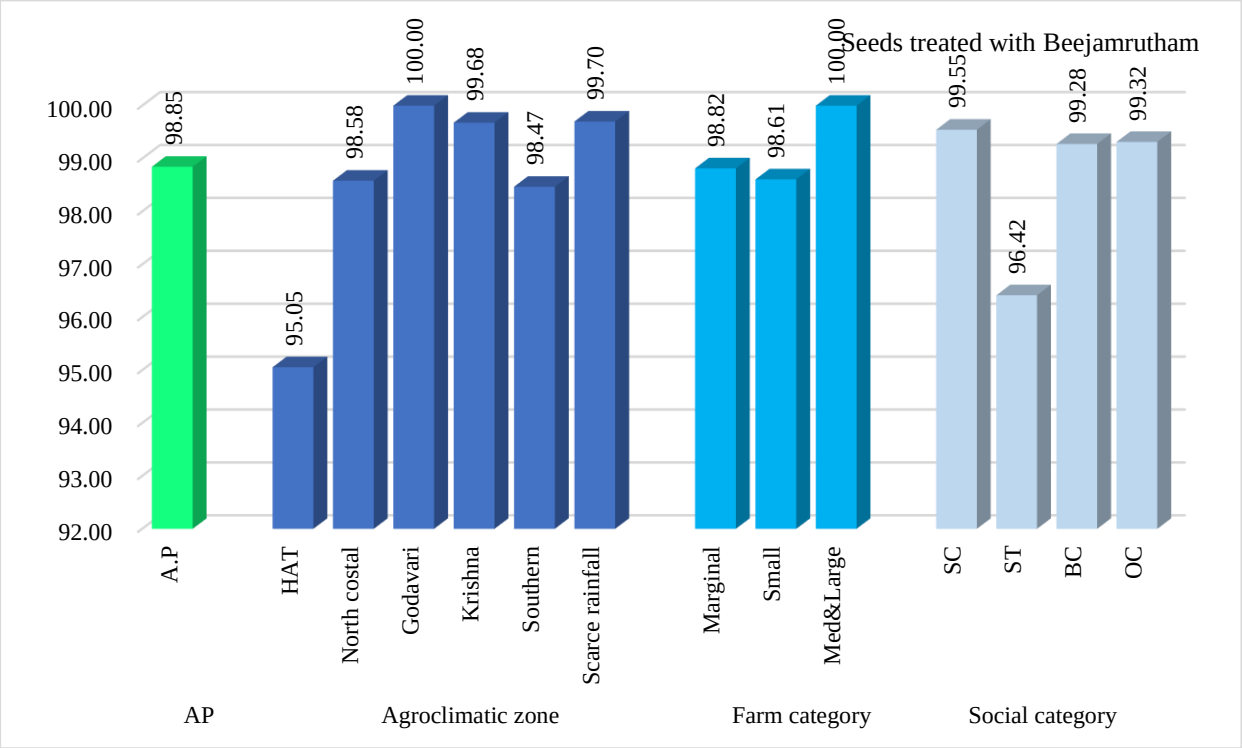


Source: IDSAP Survey,2021-22

3.2.6. Seed treatment with Beejamrutham

Another protocol in the chronological order to be adopted is the seed treatment. Seed treatment is common operation in every model of agriculture. The major and commonly known purpose of seed treatment is to protect the seed from deceases and viruses and to prevent insects from eating away the seeds. In APNCF, a special material knows as Beejamrutham has been developed for seed treatment. It shows the importance of seed treatment in APCNF. Further, in the PMDS context, the seed treatment is even more important. As the crop is sown in not so conducive conditions, the seed treatment must stimulate the germination. Given its criticality, the seeds in 99 percent plots were treated with Beejamrutham before sowing (Figure 3.8). Even the lowest percentage of plots with seed treatment was 95.05 percent in HAT zone and 96.42 percent for ST farmers. Needless to say, these two are overlapped.

Figure 3.8: Agroclimatic zone, farm category, social category wise percentage of PMDS plots with seeds treatment with Bheejamrutham in 2021

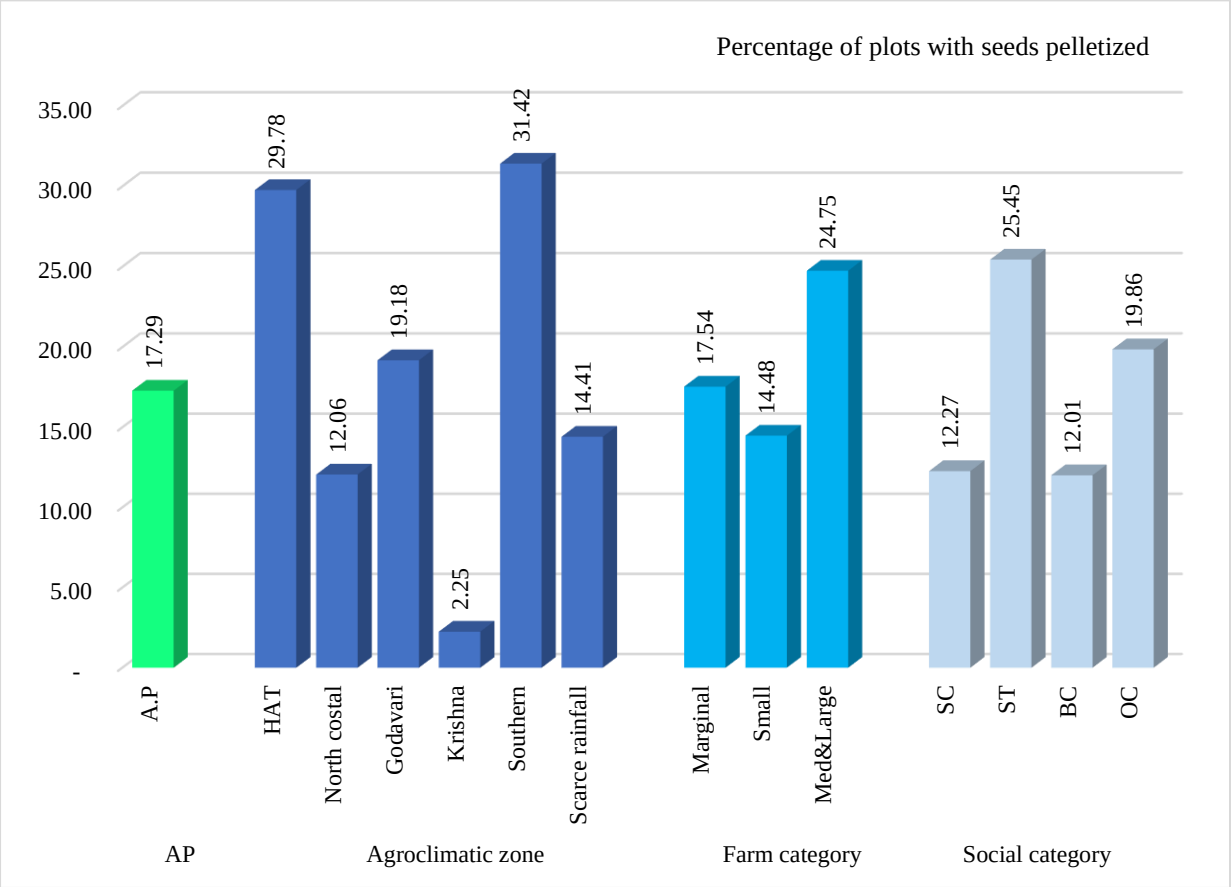


Source: IDSAP Survey,2021-22

3.2.7. Pelletize seeds

Pelletizing, i.e., coating seeds with with clay, Ghanajeevamrutham and ash, is one of the protocols given by RySS. It enables the handling of seeds easy. It provides conducive conditions for the germination and protect the seeds from wind blows and birds and pests, etc. However, only 17.29 percent plots were sown with pelletized seeds at the state level. The same varies from 2.25 percent in the Krishna zone to 31.42 percent in the Southern zone. Among the farm categories it varies from 14.48 percent plots of small farmers to 24.75 percent plots of medium and large farmers. Among the social categories, seeds were pelletized in the range of 12.01 percent plots of BC farmers to 25.45 percent plots of ST farmers (Figure 3.9). The possible reasons for lower rate of palletization could be: (1) farmers might not be convinced about the utility of the palletization, (2) farmers might not have understood and mastered the process, and (3) farmers might think that the palletization is not required. If the first two are the reasons, RySS should strengthen its extension service. If farmers think, that there is no need for palletization, RySS may reflect on this issue. This issue is further discussed in chapter five.

Figure 3.9: Agroclimatic zone, farm category, social category wise percentage of PMDS plots with seeds pelletized in 2021

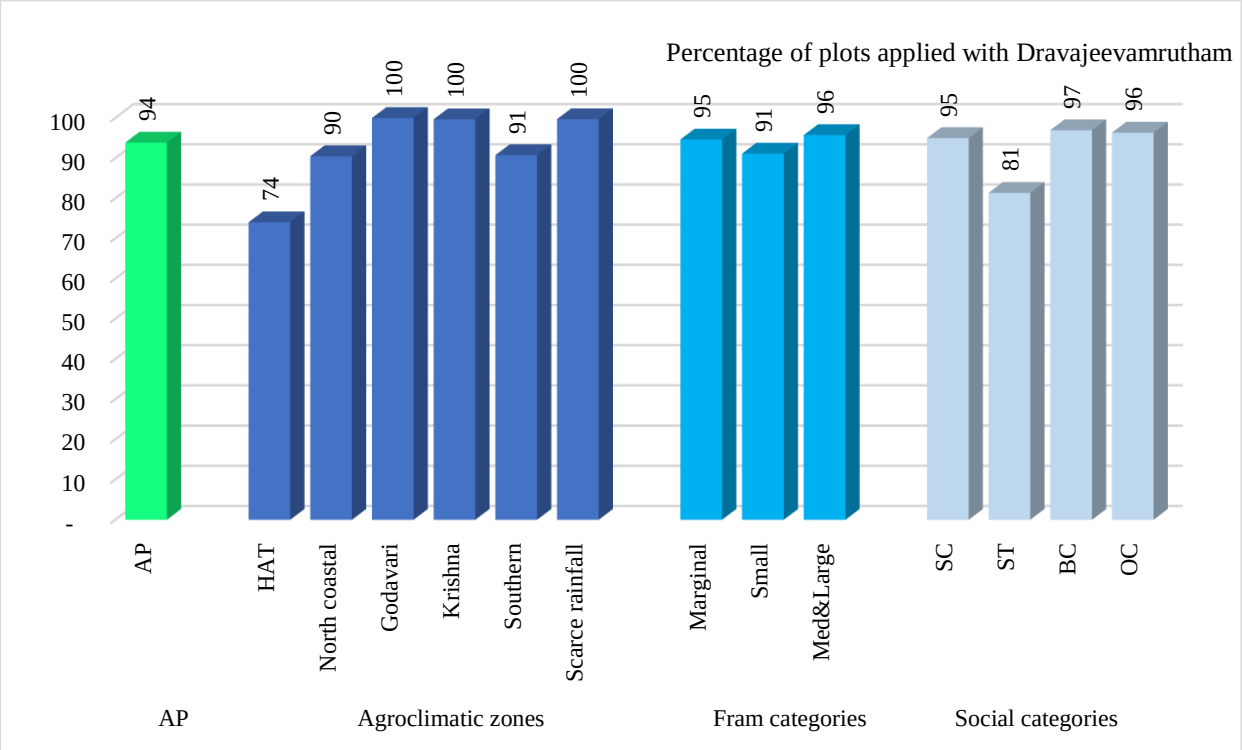


Source: IDSAP Survey,2021-22

3.2.8. Application of Dravajeevamrutham

As mentioned above, that application of Dravajeevamrutham is another method, along with Ghanajeevamrutham, of incorporating the microorganism into the soil. It would be either sprayed directly on the crops or soil or mixed with water while irrigating the plot. It is one of the principal protocols for PMDS. At the state level, 94 percent PMDS plots were applied with Dravajeevamrutham. It varies from 74 percent in HAT zone to 100 percent Godavari, Krishna, and Scarce rainfall zone. Over 90 percent of PMDS plots of each of farm size category haven applied with Dravajeevamrutham. Among social categories, 81 percent plots of ST farmers and over 95 percent plots of other three categories were applied with Dravajeevamrutham (Figure 3.10). The ST farmers and HAT zones have relatively lower-level application of both Ghanajeevamrutham and Dravajeevamrutham. The possible reason could be those farmers are traditionally natural farmers and their lands must be already enriched with microorganism.

Figure 3.10: Agroclimatic zone, farm category, social category wise percentage of PMDS plots applied with Dravajeevamrutham in 2021

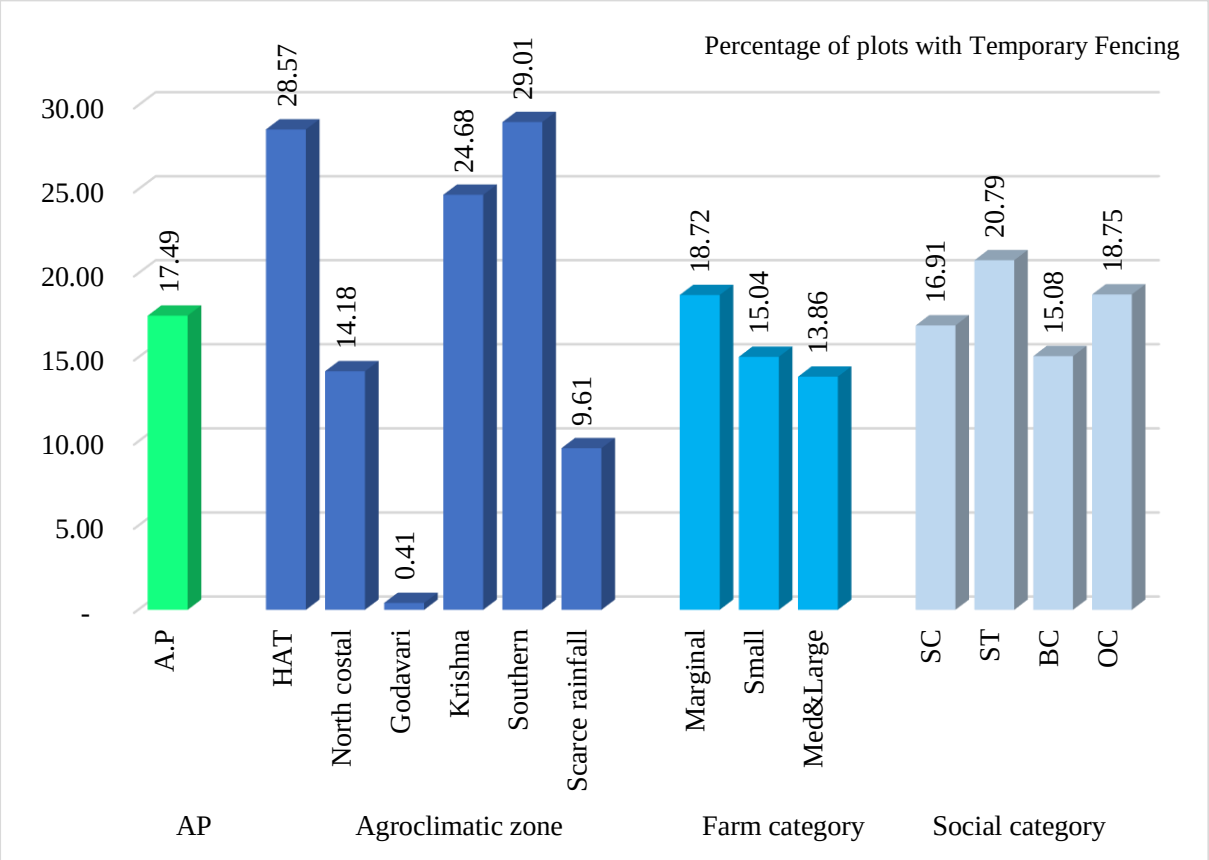


Source: IDSAP Survey,2021-22

3.2.9. Temporary fencing

Putting up of fence around the PMDS plots, with branches, crop residues, other biomass, Gunny bags, plastic bags, sheets, etc., are known as temporary fencing. It will degrade on its own or removed if not needs. It has several advantages. It protects the crop from stray animals. It reduces the wind velocity in the fields reduce the moisture evaporation and protect the seeds and mulching material from blowing away. It can be erected immediately when needed. Hence, it is one of the protocols of PMDS. However, only 17.49 percent plots at the state lever provided with the temporary fencing. Further, there are wider fluctuations across the zones, varying from 0.41 percent plots in the Godavari zone to 29.01 percent plots in the Southern zone. In the Scarce rainfall zones, where it is expected to be very useful, only 9.61 percent plots got temporary fencing. The variations across farm size and social categories are much less compared to that of agroclimatic zones (Figure 3.11). Though very low percentage of plots were provided with the temporary fencing, many more plots have been provided with live and permanent fencing. This is heartening. This issue is discussed in the next section.

Figure 3.11: Agroclimatic zone, farm category, social category wise percentage of PMDS plots with temporary fencing in 2021

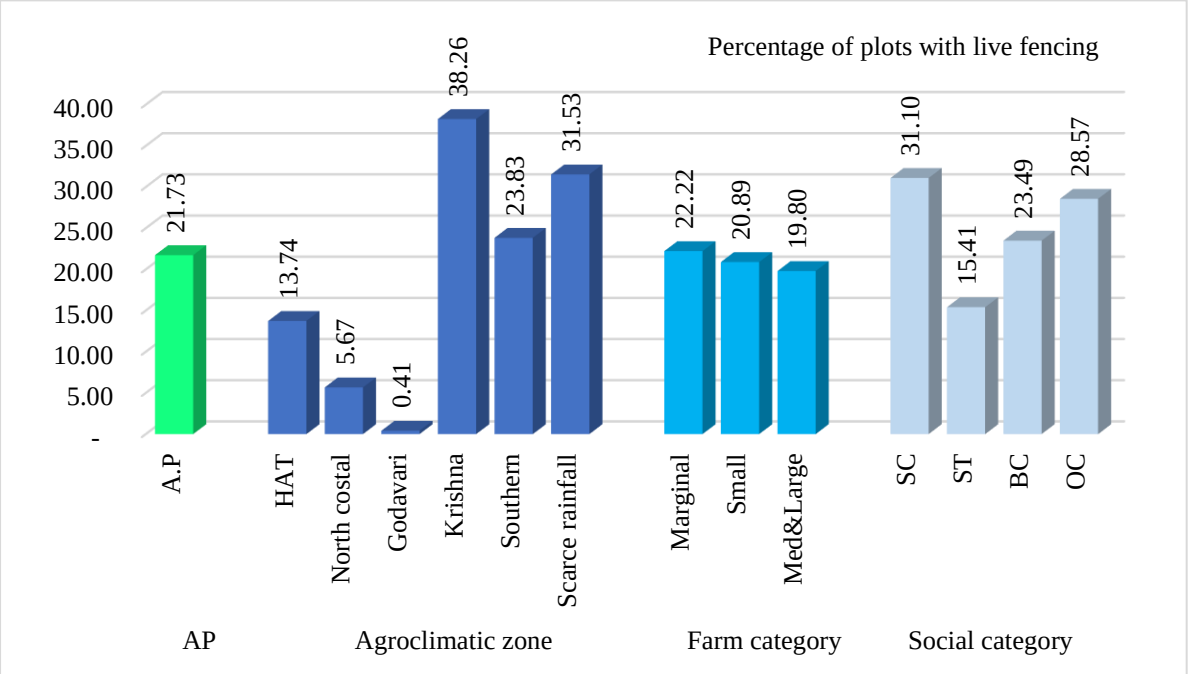


Source: IDSAP Survey,2021-22

3.2.10. Live fencing

Live fencing with pole kinds trees such as Bamboo, Casuarina, Subabul, Drumstick, etc., which has minim shade effect and busy plans, which reduce the wind velocity in the fields and protect crops from invading stray animals, is one of the recommended protocols of PMDS. Apart from providing all services provided by the temporary fencing, live fencing provides addition biomass and related benefits. It is also helpful in repelling in the insects. Live fencing is one of most beneficial constituents of natural farming. It enhances the ecological services to the fields and crops. It is inexpensive and maintenance free. But it needs time to establish and also needs initial protection. At the state level, 21.73 percent plots got live fencing. It is hearting to note that the spread of live fencing is higher than the temporary fencing. Here also the variations are quite high across the agroclimatic zones compared to that across the farm and social categories (Figure 3.12).

Figure 3.12: Agroclimatic zone, farm category, and social category wise percentage of PMDS plots with live fencing in 2021

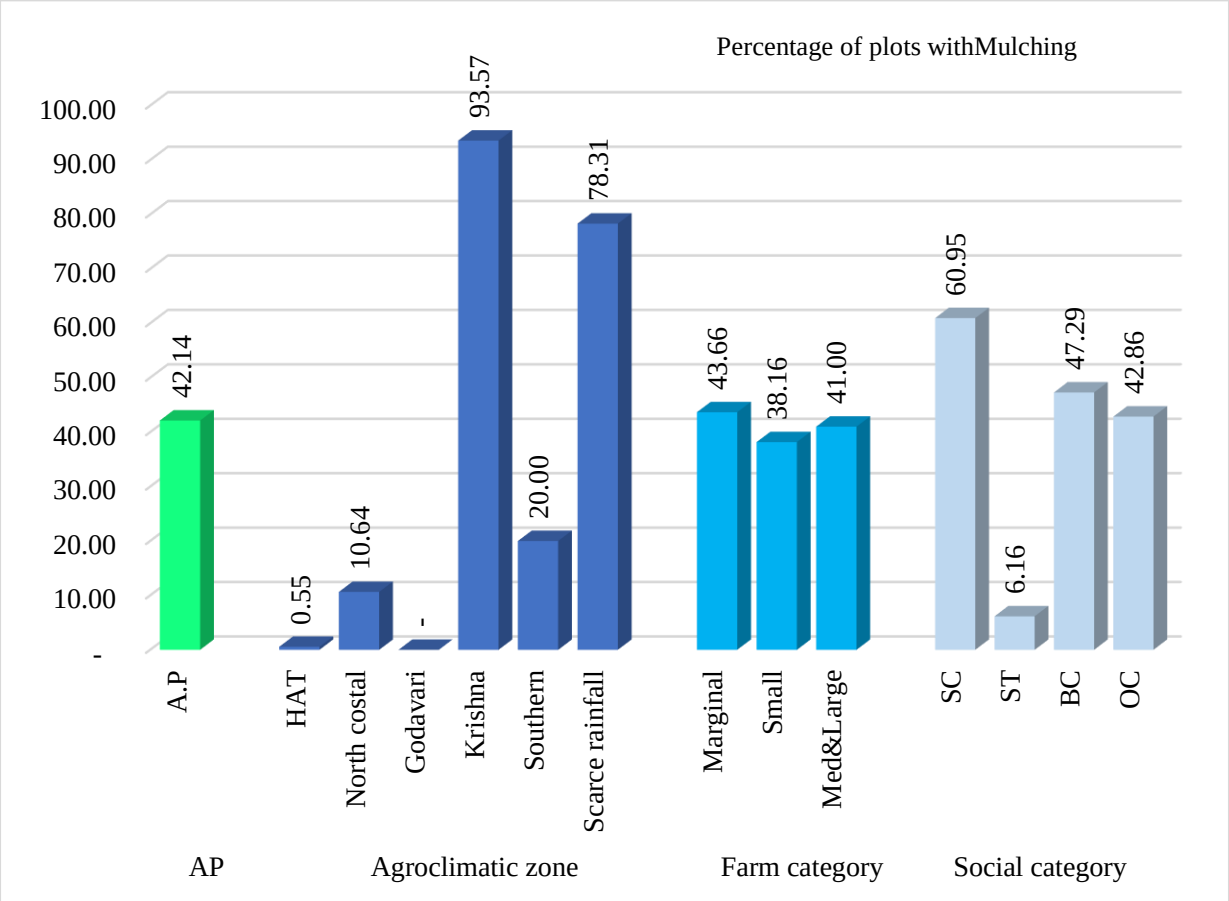


Source: IDSAP Survey,2021-22

3.2.11. Mulching

Mulching is yet another protocol of PMDS. Mulching is expected to protects the seeds from wind blows, keep the land covered. Thus, conserve the soil moisture and protects the microorganism for heat. As per the recent research, it enables the fields to capture the atmospheric moisture. At the state level 42.14 percent plots were provided with mulching. But there are wider variations across the agroclimatic zones. While there is no mulching in Godavari and HAT zone, as many as 93.57 percent plots in the Krishna zone and 78.31 percent plots in Scarce rainfall zone. ***One possible reason for low prevalence of mulching in the northern zones could be higher rainfall and good irrigation and water resources. The soils might have higher moisture levels and the easy irrigation facilities. Further, the farmers might be thinking that the crop itself would acts as the soil cover and protect the microorganism from the heat.*** There are less variations among the plots of different farm categories. While 60.95 percent plots of SC farmers have mulching, only 6.16 percent plots of ST farmers have mulching (Figure 3.13).

Figure 3.13: Agroclimatic zone, farm category, social category wise percentage of PMDS plots with mulching in 2021

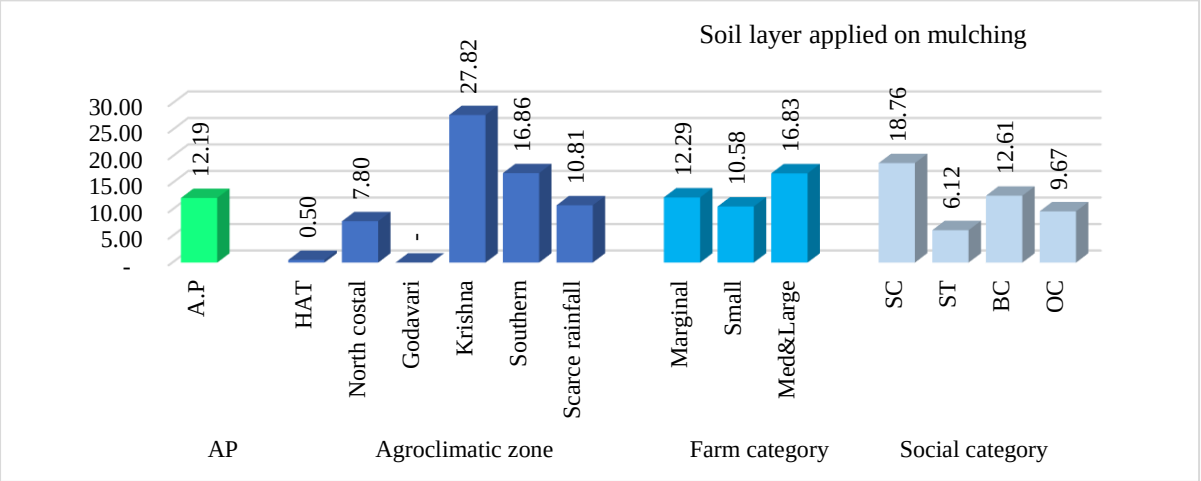


Source: IDSAP Survey,2021-22

3.2.12. Thin Soil layer on mulching

It may be noted that the material used in mulching, is mostly agriculture by-products/ waste include Paddy straw, Groundnut shells, husk of the pulses, leaves of Maize, Jowar, and Sugarcane, and collected wild biomass. Most of these materials is light in weight and can be easily blown away by the wind. To protect the mulching material from blowing away, RySS suggested to put a thin layer of soil on the mulching. In last year PMDS report it was pointed out that "***It may be noted that putting soil layer on mulching may be counter-productive. The soil normally absorbs moisture from mist in the morning and allow it to evaporate during the day time, leaving less or no moisture to percolate down***". At the state level only 12.19 percent plots were provided with thin soil layer on the mulching (Figure 3.14). The distribution across the zones and categories broadly reflects the distribution of mulching.

Figure 3.14: Agroclimatic zone, farm category, social category wise percentage of PMDS plots with thin soil layer on mulching in 2021



Source: IDSAP Survey,2021-22

3.3. Conclusion

Over 90 to 99 percent farmers and plots are fulfilling the core protocols such as area allocation, application Ghanajeevamrutham and/ or Dravajeevamrutham, Seed treatment with Beejamrutham, seed rate, number of crops. As the adoption is near universal, there are no considerable variations across the zones and categories. However, the adoptions rates below 50 percent in the not so core protocols such as pelletising of seeds, temporary fencing, live-fencing, mulching, soil layer on mulching, and so on. Further, there considerable variations across the zones and categories in adoption of these protocols. The possible reasons for lower rates of adoption of these protocols could be: (1) farmers might not be convinced about the utility of these protocols, (2) farmers might not have understood and mastered the processes of some of these protocols, and (3) farmers might some challenges such as shortage of materials, not able to afford some these items, in adoption of these protocols. If the first two are the reasons, RySS should strengthen its extension services. If third is the reason, RySS may develop appropriate strategies to overcome those challenges.

Another, possibly more important, reason could be that the farmers might be thinking that those protocols are not required in their context. As can be seen in chapter 5, very few farmers said that these protocols are not needed. Still, RySS may reflect on this issue. It is important to note that the variations across the zones are larger than categories. It implies, region specific issues have to be addressed, on priority.

Chapter 3 Tables

Table 3.1: Agro climatic, farm size categories and social categories wise avergae number of PMDS crops grown in the plots in 2021-22

Agroclimatic zone	**Number of crops**	**District**	**Number of crops**
HAT	14	Srikakulam	11
North costal	15	Vizianagaram	15
Godavari	16	Visakhapatnam	13
Krishna	13	East Godavari	18
Southern	9	West Godavari	15
Scarce rainfall		Krishna	16
A.P	**12**	Guntur	13
		Prakasam	11
Farm size zones		SPS Nellore	10
Marginal	12	YSR Kadapa	8
Small	11	Kurnool	10
Medium &Large	10	Anantapuramu	10
All	**12**	Chittoor	9
		A.P	**12**

Table 3.2: Agro climatic, farm size categories and social categories wise number and percentage of plots with main crop

Agroclimatic zone	Number of plots with main crop	Number of plots with Multiple crops	Total plots	Percentage of plots with main crop
HAT	139	47	186	74.73
North coastal	102	45	147	69.39
Godavari	137	115	252	54.37
Krishna	117	195	312	37.50
Southern	116	271	387	29.97
Scarce rainfall	244	100	344	70.93
Farm categories				
Marginal	593	488	1081	54.86
Small	200	206	406	49.26
Med &Large	62	79	141	43.97
Social categories				
SC	119	101	220	54.09
ST	170	109	279	60.93
BC	377	314	691	54.56
OC	189	249	438	43.15
Districts				
Srikakulam	2	50	52	3.85
Vizianagaram	169	9	178	94.94
Visakhapatnam	57	24	81	70.37
East Godavari	68	50	118	57.63
West Godavari	82	74	156	52.56
Krishna	69	2	71	97.18
Guntur	28	46	74	37.84
Prakasam	20	147	167	11.98
SPS Nellore	12	80	92	13.04
YSR Kadapa	68	165	233	29.18
Kurnool	229	98	327	70.03
Anantapuramu	15	2	17	88.24
Chittoor	36	26	62	58.06
Grand Total	855	773	1628	52.52

Table 3.3: Percentage of plots/ farmers fulfilling the PMDS protocols across zones and farmers' categories in 2021

Agroclimatic zones	Seeds treated	Dravajeev-amrutham	% of farmers with 0.203+ ha	Ghanajeev-amrutham	Mulching	% of Plots with 15 + crops	Live Fencing	Seeds pelletized	Temporary Fencing	Soil layer on mulching
HAT	95	74	68	80	1	57	14	30	29	1
North coastal	99	90	77	88	11	62	6	12	14	8
Godavari	100	100	97	86	-	30	0	19	0	-
Krishna	100	100	99	99	94	8	38	2	25	28
Southern	98	91	96	84	20	8	24	31	29	17
Scarce rainfall	100	100	97	100	78	33	32	14	10	11
Farm size categories										
Marginal	99	95	90	90	44	20	22	18	19	12
Small	99	91	96	89	38	14	21	14	15	11
Med&Large	100	96	96	95	41	27	20	25	14	17
Social categories										
SC	100	95	98	90	61	31	31	12	17	19
ST	96	81	77	80	6	29	15	25	21	6
BC	99	97	93	93	47	25	23	12	15	13
OC	99	96	97	93	43	28	29	20	19	10
AP	99	94	92	90	42	34	22	17	17	12

Chapter 4: Costs of, and, returns from, PMDS

4.1. Introduction

Like any other economic activities, PMDS too involves costs and returns. However, the major purpose of PMDS is to enrich the soil, by protecting and improving the microorganism in the soil by controlling the soil temparature, through shade, and releasing a part of plants nutrients, which are prepared through photosynthses, into the soil. It implies that PMDs is strictly not for profit activity. Still, it is important to estimate the costs and returns of PMDS. In this chapter, costs of cultivation of PMDS and returns from PMDS are estimated and compared. The costs include costs of seeds, Ghanajeevamrutham, Dravajeevamrutham, Beejamrutham, machinery used, implements used, other inputs used, irrigation, bullock labour, human labour used, etc. The costs are, further, grouped into costs of own items used and purchased items used. The returns include the value of main crop obtained, if any; the value of intermittent items such as vegetables, leafy-vegetables, flowers, other food items obtained for family consumption and sale; value of fodder extracted and grazed; and the value of green manure incorporated into the soils, etc. All the data used in this chapter are obtained from the farmers. The values of inputs used such as Ghanajeevamrutham, FAM, machinery, etc are stated by the farmers. Similarly, the values of fodder obtained, value of green manure incorporated into the soils, etc are stated by the farmers.The numbers/ data is provided by each of 1,529 sample farmers.

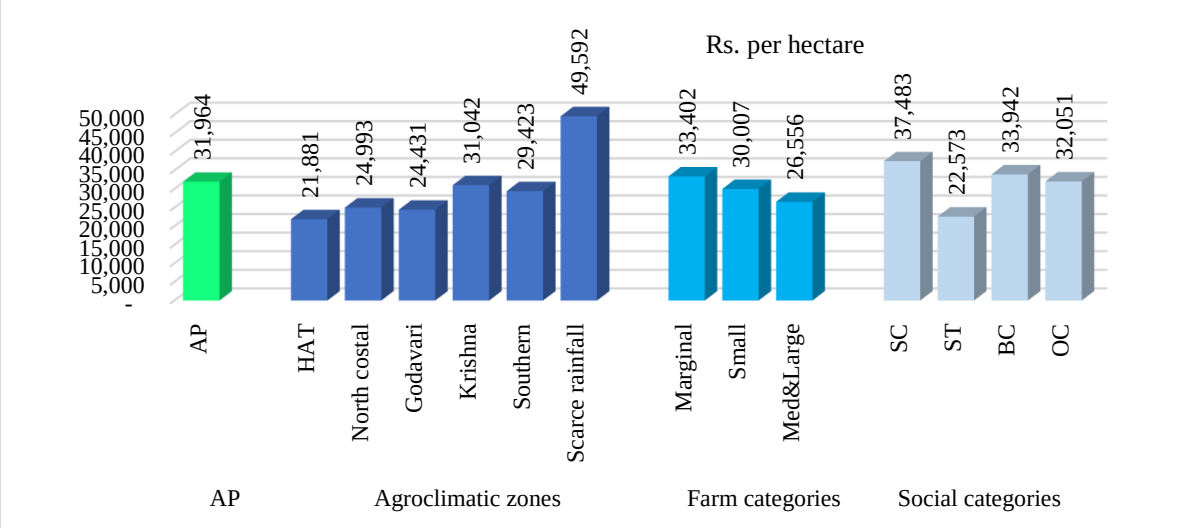
4.2. Cost of cultivation

Under the cost of PMDS cultivation, the values of own inputs used and the expenditure incurred on purchased inputs were collected. The inputs include Seeds, Beejamrutham, Ghanajeevamrutham, Dravajeevamrutham, Kashayams, Ashtrams, Fencing, Mulching, Farm Yard Manure (FYM), Machinery services, Bullock labour, Human labour, and Irrigation. The costs are analysed in four ways in this section, viz., (1) total costs – include values of all own inputs used plus the values of all purchased inputs for PMDS cultivation, (2) percentage share of each individual input in total expenditure/ value, (3) the cost of only the purchased inputs and percentage share of own and purchased inputs in the total cost of cultivation, and (4) paid-out cost, i.e., the total cost (mentioned in [1] above) minus the value of the family labour.

4.2.1. Total cost of cultivation

As mentioned above, the total costs include the values of all own inputs used plus the values of all purchased inputs used in the cultivation of PMDS. At the state level, the total cost of PMDS cultivation is estimated at ₹.31,964 per hectare. Actually, each farmer might have spent less than ₹.12,000, since each farmer on average cultivated PMDS on about one acre. Further, as can see in the next section that more than two-thirds of cost was met from own inputs, particularly, family labour. The total costs vary from ₹.21,881 per hectare in HAT zone, ₹.24,431 per hectare in Godavari zone and ₹.24,993 per hectare in North coastal zone to ₹.42,592 per hectare in the Scarce rainfall zone. The variations across farm size categories are relatively less than those of social categories (Figure 4.1). Further, it should be noted that some of inputs used such as ploughing, application of FAM, Ghanajeevamrutham, etc are not just linked/ limited to PMDS. Their impact would be experienced throuhout year. This phenomenon was observed in the previous year study also.[10] ***In a sense, PMDS is enabling the farmers to optimise the use of their own inputs such as labour, machinary, implements, bullock labour, etc. PMDS also reduces the peak level demand for certain agriculture inputs.***

Figure 4.1: Agroclimatic zone, farm category, social category wise total cost of PMDS cultivation in 2021



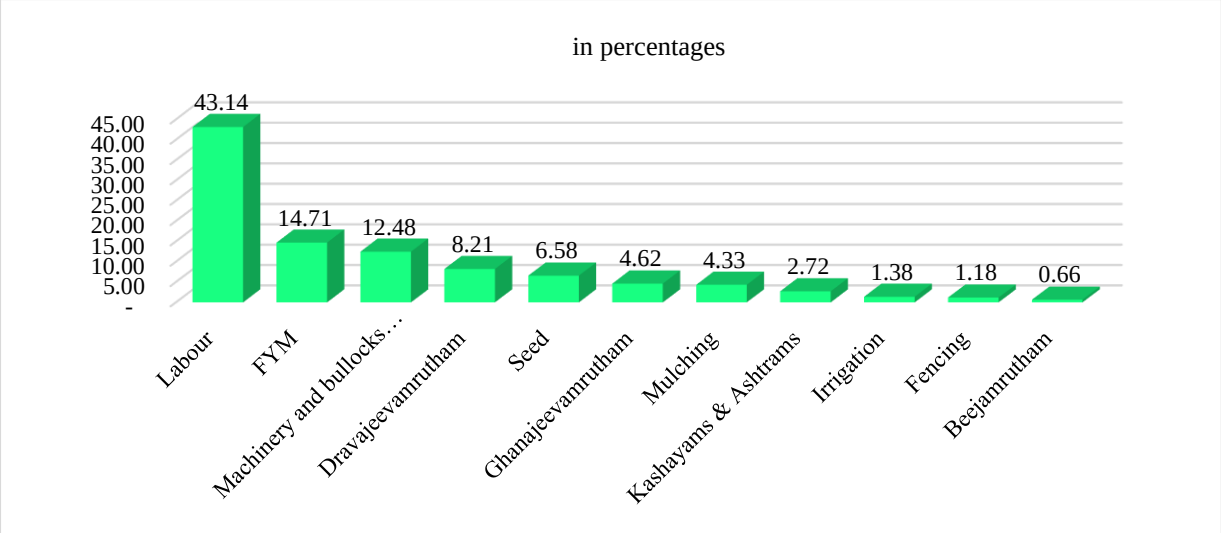
Source: IDSAP Survey, 2021-22

[10] In the previous report it was observed that first time the reduction in the paid-out cost, in absolute values, was larger than that in Plant Nutrients and Protection Inputs (PNPIs). In earlier studies, the pattern was that the most of the reduction used to be in PNPIs and some increase in other inputs, resulting in lesser reduction in paid-out costs compared to reduction in PNPIs. One of the reasons was shifitng of certain agriculture operations, particularly the land preparation, to PMDS from Kharif crops.

4.2.2. Share of different inputs in the total cost of cultivation

An analysis of the shares of different inputs in the cultivation of PMDS gives useful insights for the policy making and field intervensions. The percentage share of different inputs in the toatal costs at the state level are shown in Figure 4.2. While labour accounts for over 43 percent of total costs, the biological inputs including Ghanajeevamrutham, Dravajeevamrutham, Beejamrutham, Kashayams and Ashtrams, add up to 16 percent. Machinery and bullock labour covers over 12.48 percent (Figure 4.2). Even in the chemica-based farming, these three items, viz., labour, agriculture chemcial inputs (instead of biological inputs) and machinery and bullocks account for the line share of the cost of cultivation. The major shift observed is that labour has emerged as the major inputs in CNF (agri-chemicals are major inputs in the chemical based agriculture). Use of higher doses of labour input is needed in the PMDS. As many more crops are grown as mixed crops under PMDS, mechanized harvesting is not possible. More labour input is needed to harvest thoses crops. Surprisingly, FYM's share is 14.7 percent. As mentioned above that all inputs applied during PMDS need not be exclusively for PMDS crops. Their impact can be experienced throughout the year. FYM is one such input. It is well known that FYM takes time to decompose and release the nutrients for the crop. Normolly, farmers apply FYM during initial ploughing of fields, well before the Kharif sowing. Further, they apply FYM for a few select fields. Another reason for applying unusually a larger quantity of FYM could be the practice of mixing of Ghanajeevamrutham with larger quantities of FYM and applying in the fields.

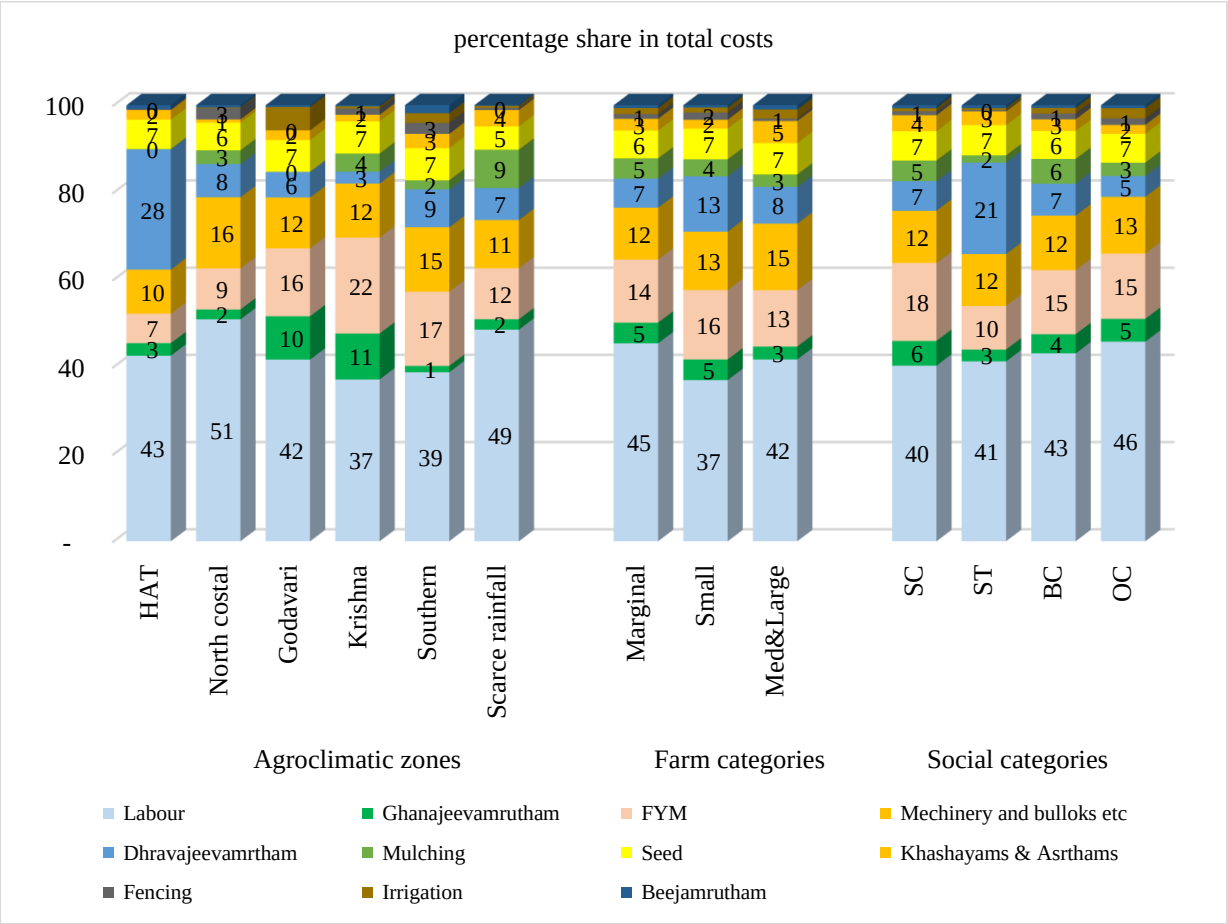
Figure 4.2: Percentage share of different agriculture inputs in the cultivation of PMDS at state level in 2021



Source: IDSAP Survey, 2021-22

The percentage shares of different inputs in the total costs across the zones and farmers' categories are presented in the Figure 4.3. Though Human labour, Ghanajeevamrutham, FAM, Machinery & Bullock labour, Dravajeevmrutham, Kashayams & Ashtrams and Seed remained major inputs across all zones and categories. However, their respective importance vary across the zones and categories. For example, the share of labour varies from 37 percent in Krishna zone to 51percent in North coastal zone. The share of Ghanajeevamrutham varies from 3 percent for ST farmers to 6 percent for SC farmerss. As mentioned elsewhere in this report, the data in the Figure 4.3 confirms that either of Ghanajeevamrutham and Dravajeevamrutham can be used interchagebly as per the local conditions. For example in HAT zone about 28 percent expenditure is on Dravajeevamrutham and 3 percent is on Ghanajeevamrutham; but in Krishna zone only 3 percent expenditure was on Draavjeevamrutham and 11 percent was on Ghanajeevamrutham (Figure 4.3). The variations across the farm categories are less compared to agroclimatic zones and social categories.

Figure 4.3: Percentage shares of different inputs in the costs of cultivation of PMDS across the zones and categories in 2021

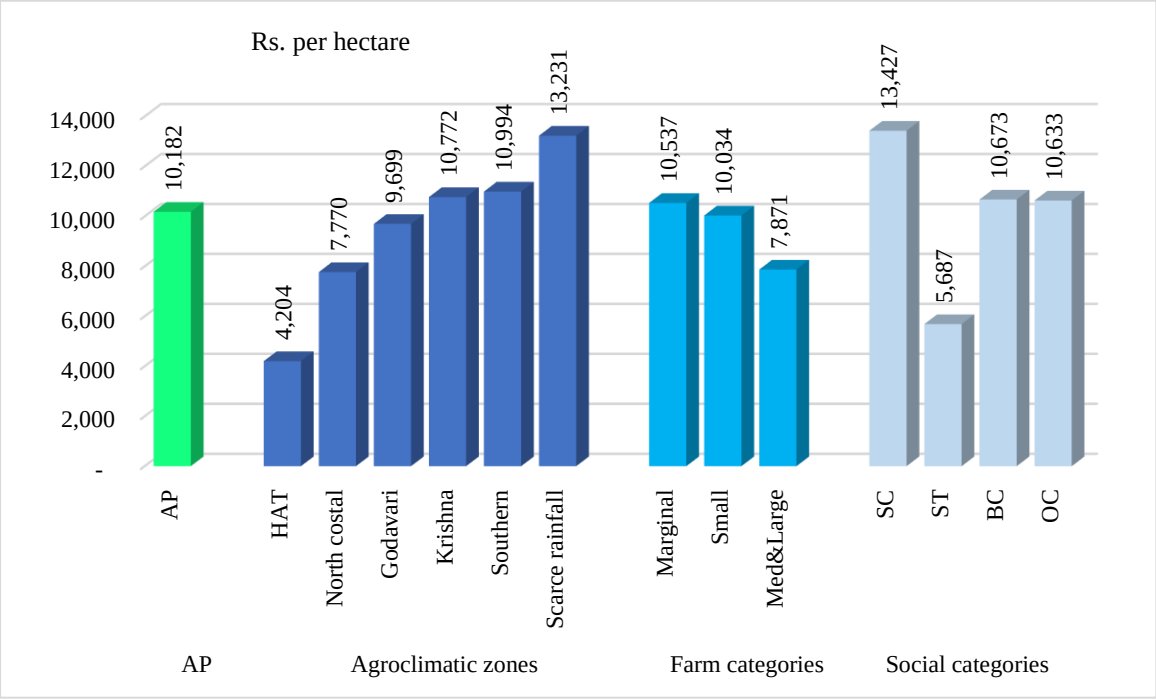


Source: IDSAP Survey, 2021-22

4.2.3. Purchased inputs cost in PMDS cultivation

The average cost of all purchased inputs in PMDS cultivation at the state level is ₹.10,181 per hecatre. Since each farmer cultivated PMDS on average in one acre, each farmer might of spend about ₹.4,000 during the year. Per hectare cost of purchased inputs varies from ₹.4,204 in HAT zone to ₹.13,231 in Scarce rainfall zone; from ₹.7,871 for medium and large farmers to ₹.10,537 for marginal farmers; and from ₹.5.687 for ST farmers to ₹.13,427 for SC farmers (Figure 4.4). The medium and large farmers, who might have owned more number of agriculture machinery, implements, bullocks and irrigation infrastructure, have used less purchased inputs vis-à-vis small and marginal farmers.

Figure 4.4: Value of purchased inputs for PMDS cultivation during 2021 across agroclimatic zones and farmers' categories

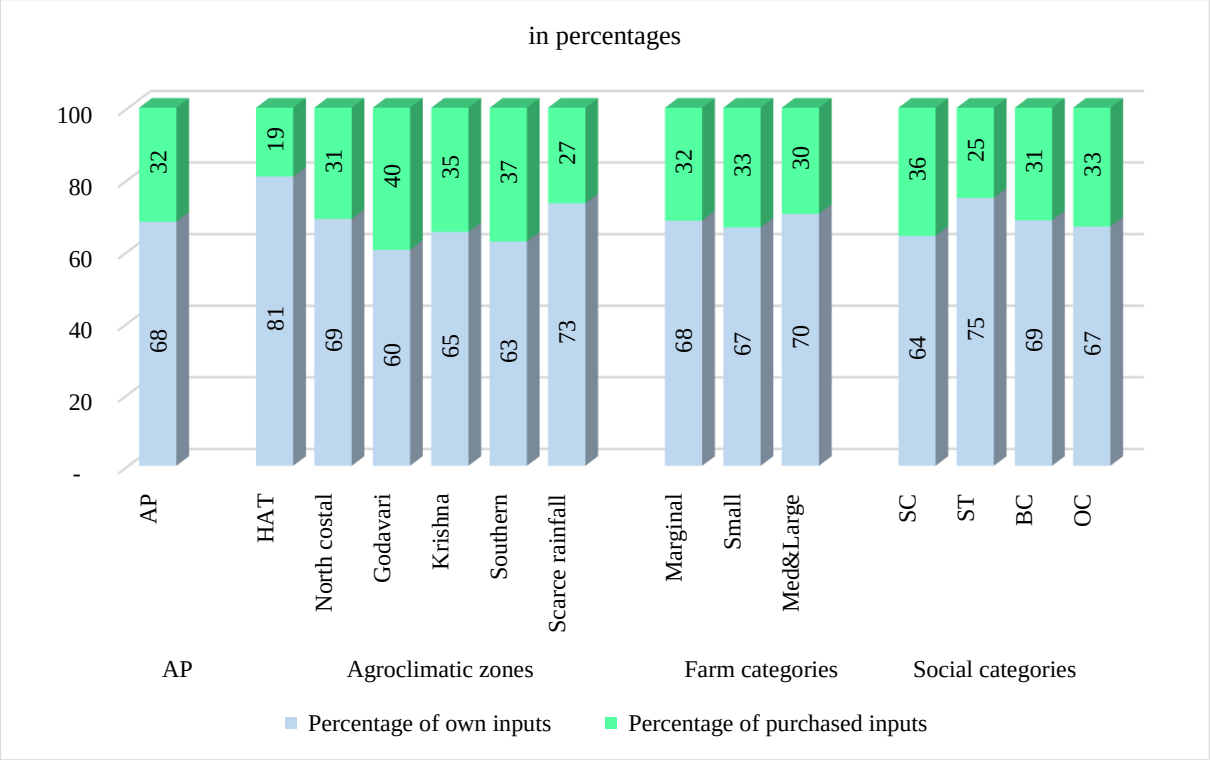


Source: IDSAP Survey, 2021-22

The analysis of the shares of own and purchased inputs in the total cost of cultivation gives additional insighsts about the PMDS cultivation in the state. At the state level over 68 percent total costs were met from own inputs. The patterns across the zones and categories follow the intituitive trends. The resource poor zones such as HAT zone, Scarce rainfall zone and the North coastal zone have higher share of own inputs in the total costs. But, medium and large farmers have relatively higher share of own inputs compared to small and marginal farmers, may be due to higher incidence of ownership of agriculture machinery and assets. On the other

hand, SC farmers have lower share of own inputs compared to other social categories, may be due to their resources poverty (Figure 4.5). Though ST farmers are also recource poor in terms agriculture machinery and assets,

Figure 4.5: Percentage shares of own and purchased inputs in the total cost of cultivation of PMDS in 2021 across zones and categories

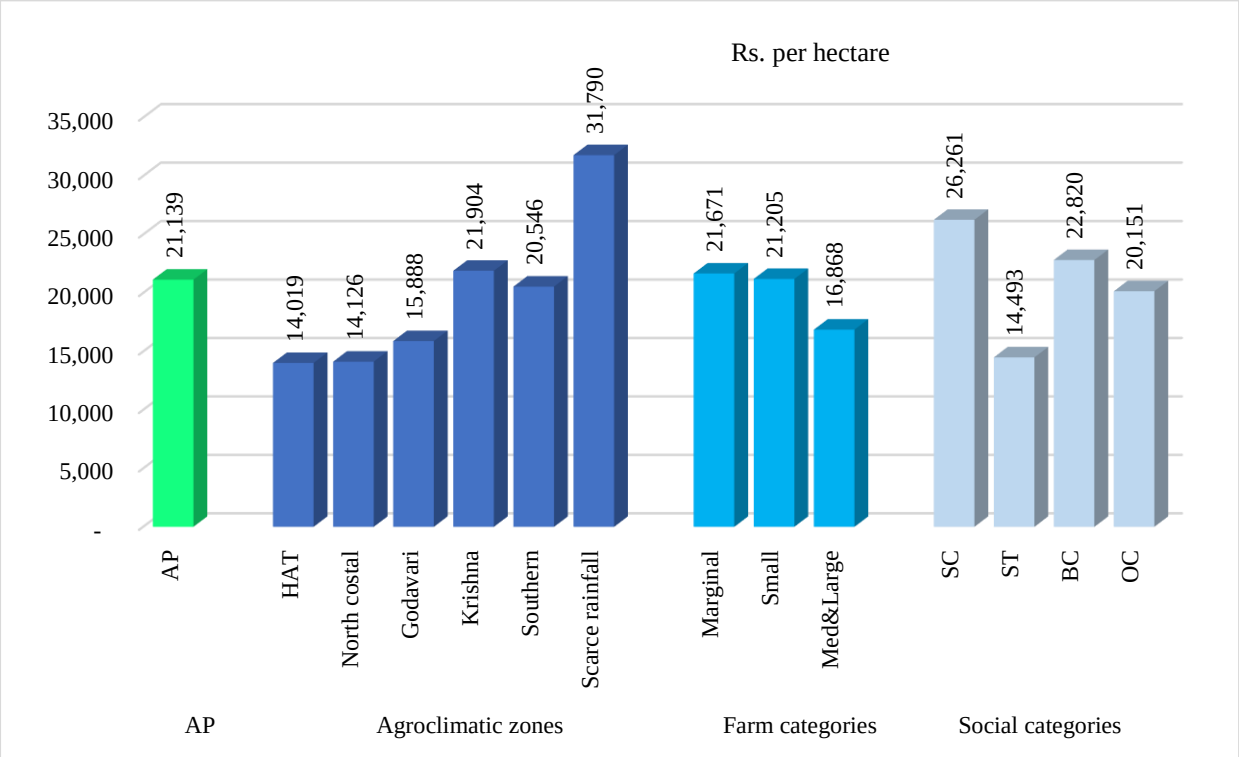


Source: IDSAP Survey, 2021-22

4.2.4. Paid-out costs

Paid-out cost is estimated by deducting the value of own labour from the total cost of cultivation, as discussed above. This concept is used in all earlier APCNF Impact Assessment reports. At the state level, the average paid-out cost is ₹.21,139 per hectare. It is low in HAT zone (₹.14,019 per hectare), North coastal zones (₹.14,126 per hectare) and Godavari zone (₹.15,888 per hectare); and high in Scarce rainfall zones (₹31,790 per hectare). It is higher for marginal and small farmers; and low for medium and large farmers. Among the socail categories, the paid-out cost of PMDS varies from ₹.14,493 per hectare for ST farmers to ₹.26,261 per hectare for SC farmers (Figure 4.6). Broadly, the trends observed in total coasts, and purchased items holds true in the paid-out costs to across the agroclimate zones and farmers' categories.

Figure 4.6: Paid-out cost of PMDS during 2021 across the agroclimatic zones and farmers' categories



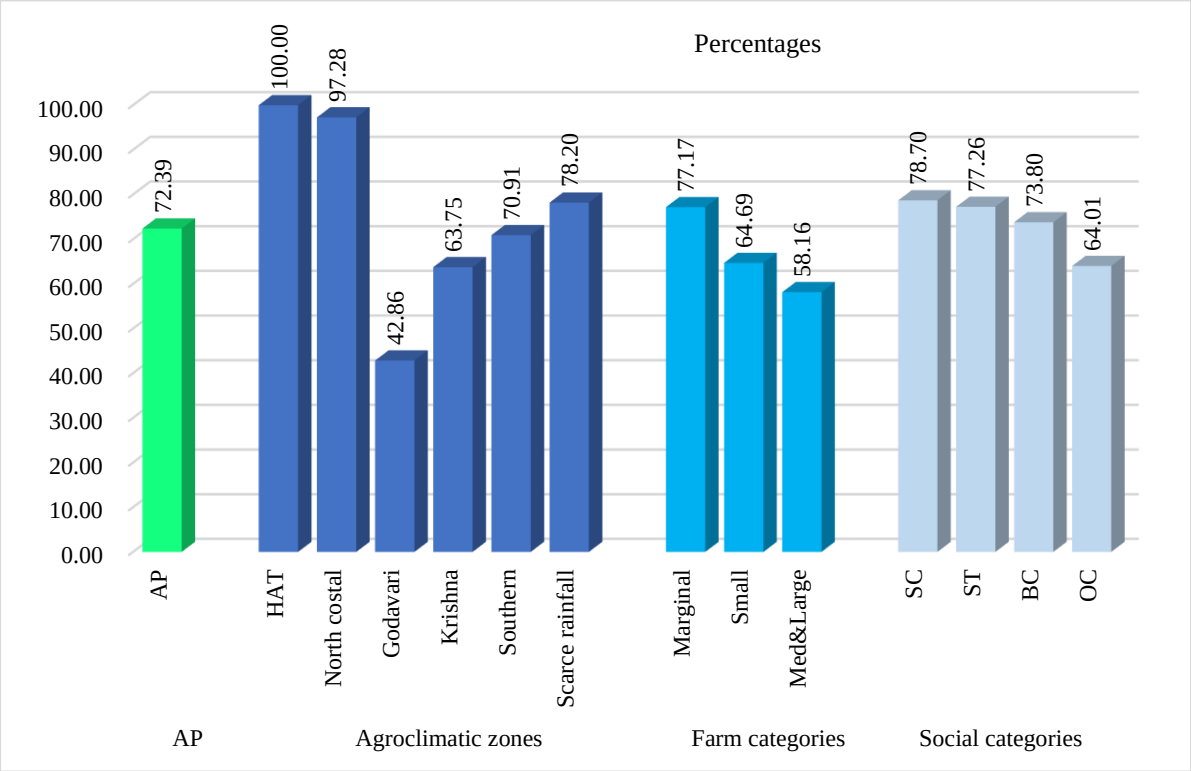
Source: IDSAP Survey, 2021-22

4.3. Returns from PMDS

Though the major purpose of PMDS is not economic returns[11], majority of farmers have sown a main crop, along with several other crops, to reap the potential benefits of full harvest of one or few crops, along with other benefits such as intemettent food and other items for consumption and sale, fodder, green manure, etc. Even the farmers, who planted multiple crops[12] (in equal proportion) could harvest at least a few crops out of many planted crops of pulses, cereals, millets, oil seeds, along with all other benefits mentioned above. At the state level, 72.39 percent farmers have harveste their PMDS crops, either fully or partly, in 2021. It varies from 42.86 percent in Godavari zone to 100 percent in HAT zone; from 58.16 percent for medium and large farmers to 77.17 percent for marginal farmers and from 64.01 percent of OC farmers to 78.7 percent for SC farmers (Figure 4.7).

[11] One of the purposes, if not the major purpose, of PMDS is to enrich the soils by preserving and developing the microorganism in the soils and enhancing the carbon content in the soil.
[12] Who could not say which the is main crop or predominent crop in their field/ plot

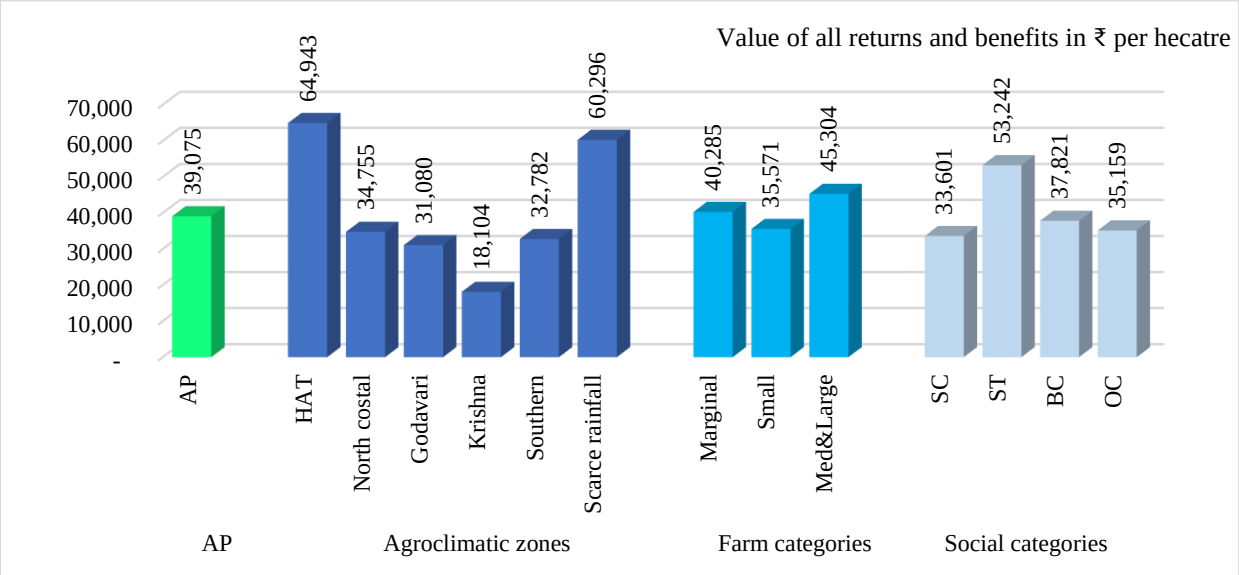
Figure 4.7: Percentage of farmers, who have harvested PMDS crops across the zones and categories in 2021



Source: IDSAP Survey, 2021-22

Vallue of all items, harvested, extracted, used, grazed, and incorporated into soil, are estimated across all agrclimatic zones and all categories of farmers and shown at Figure 4.7. At the state level, the average returns are ₹.39,075 per hectare. The same varies from ₹.18,104 per hectare Krishna zone to ₹.64,943 per hectare in HAT zone and ₹.60,296 in the Scarce rainfall zone. The values of returns obtained in HAT and Scarce rainfall appeared to be on higher side. But various case studies and anocdotal data from different parts of the state, especially, from Anantapur prove that much more returns than the currently estimated results, are possible. Among the farm categories, the variations are moderate compared to those of agroclimatic zones. Among the social categories also the varitions are moderate, except in case of ST farmers, whom are concentrated mostely in the HAT zones. ***Potentially the fresh agrriculture items, including vegetables, green pulses, corncobs, green fodders, fetch good prices during the summer months; hence, there is a good scope to raise the farmers incomes through PMDS.***

Figure 4.8: Agroclimatic zones, farm categories and social categories wise values of all kinds of returns from PMDS in 2021

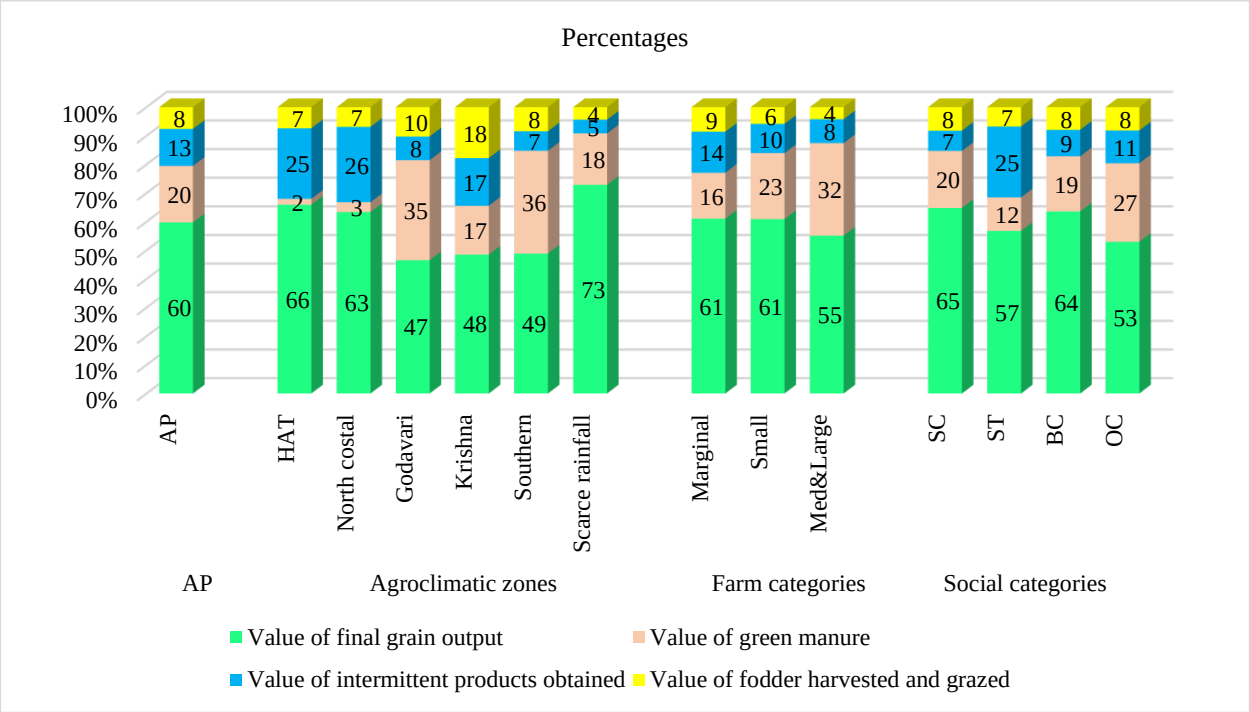


All the returns/ benefits from PMDS cutivation are diveded into four groups, viz., (1) crop yields (normal crop yields) of some crops, mostly the 'main crop', (2) green manure[13], (3) intermettent collectins suchas fruites, vegetables, leafy vegetables, flowers, fresh pulses, fresh corncobs, etc., for consumption and sale, and (4) fodder harvested and grazed. Apart from these, PMDS is expected to preserve and enhance the benign microorganism in the soils by prviding shade (controling the soil temparature) and releasing a part of the plant nutrients and food, which were prepared through Photosynthesis, into the soils. But the monetory values of these services are not known and estimated. As expected, at the state level, harvested crops have given highest benefit/ returns of 60 percent of total benefits, followed by green manure (20 percent), intermettent collectiosn (13 percent) and fodder (8 percent). Returns from crops harvest remained major benefit across all zones and categories. It varies from 47 percent in Godavari zone to 73 percent in Scarce rainfall zone; from 55 percent for medium and large farmers to 61 percent for small and marginal farmers; and 53 percen for OC farmers to 65 percent for SC farmers (Figure 4.8). Surprisingly, the farmers of HAT and North coastal zones placed the benefits of green manure at last place and stated that vaule of green manure as 2 percent and 3 percent of total benefits, respectively. Apart from these two zones, farmers of Krishna zone and ST farmers, among the social categries, placed the share of green manure at

[13] Green manure is commonly used to enrich soils through enhancing the carbon content and other nutrients in the soil

third place in the total benefits. Krishna and Godavari zones placed the benefits from fodder and grazing at the second and third palces, respectively. Barring these expections most of the zones and categories percived green manure as the second largest benfit, intermettent collections as the third largest and fodder as the fourth largest benefits (Figure 4.9).

Figure 4.9: Share of different benefits in the total returns from PMDS crops across the zones and categories of farmers in 2021



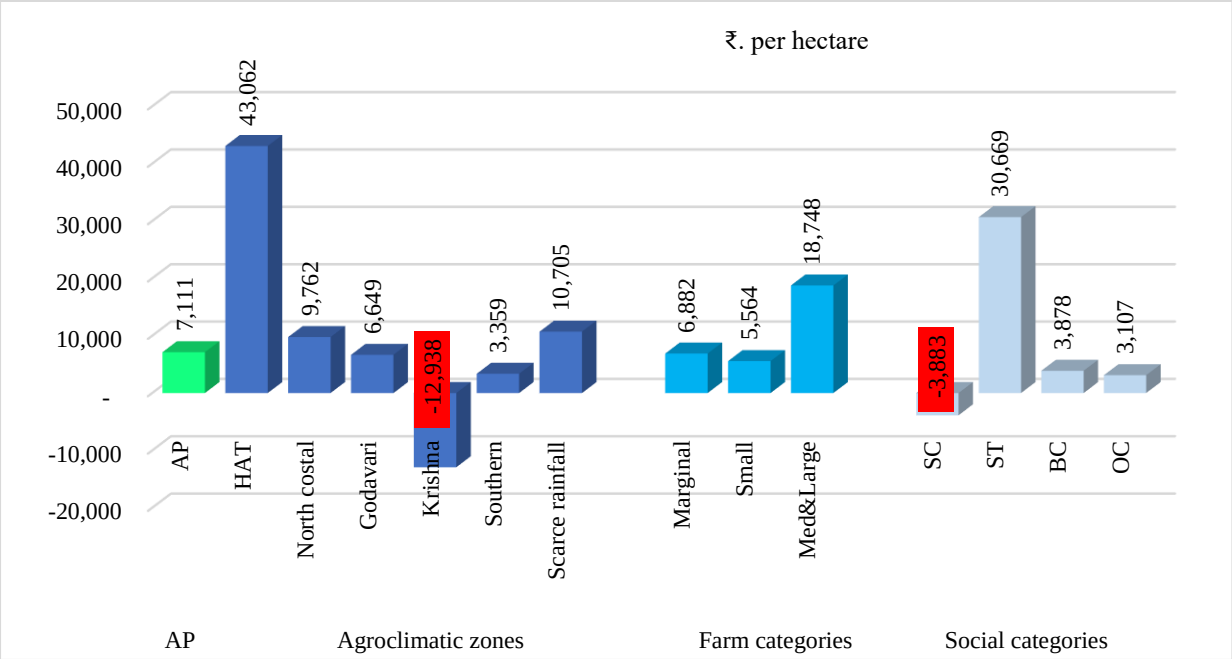
4.4. Surpluses and deficits from PMDS cultivatin

Surpluses and deficits from PMDS cultivatin is estimated in three ways, using the above discussed three different cost cncepts, viz., (1) total cost of cultivatin, including the values of all own and purchased inputs utilized in the PMDS cultivation, (2) paid-out costs, i.e., total cost minus value of own family labour, and (3) cost of only purchased agriculture inputs.

When compared to the total cost of PMDS cultivation of ₹.31,964 per hectare, and total returns of ₹.39,075 per hectare, there is an average surplus of ₹.7,111 per hectare at the state level. Only Krishna zone and SC farmers got deficit; all other zones and farmers' categories recored surplues. The surpluses and deficits vary from a deficit of (-) ₹.12,938 per hectare in Krishna zone to a surplus of ₹.43,062 per ha in the HAT zone. Each of farm catery farmers got surpluses in the range of ₹.5,564 per haectare for small farmers to ₹.18,748 for medium and large farmers.

While SC farmers recorded a deficit of ₹.3,883 per hectare, remaining three categories registered surpluses in the rang of ₹.3,107 per hecatre for OC to ₹.30,669 per hectare for ST (Figure 4.10). It may be noted that as each farmer cultivated PMDS on around one acre (0.203 hectare), each sample farmer might of got meger surplus of ₹.2,500 to ₹.3,000 in PMDS cultivation, during 2021. It may be, further, noted that each of inputs used, such as FYM, ploughing, etc., are not completely meant for PMDS only. If this factor is consider the average surpluses would be higher. ***The very fact that five out of total six zones; all thre farm size categories and three out of total four social categories have obtained surpluses, even after considering the total costs (including imputed family labour), from PMDS cultivation indicates that the PMDS is economically viable. RySS has to plan to build on this fact and potentials***.

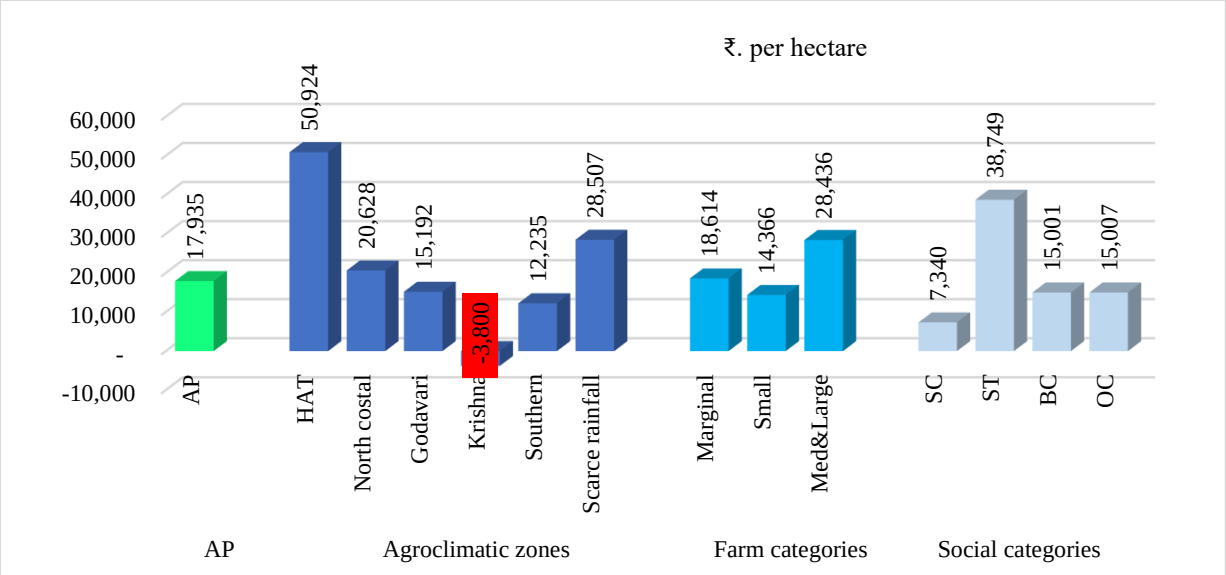
Figure 4.10: Surpluses/ deficit, over total costs, from PMDS cultivation across zones and categories of farmers in 2021



Compared to the average paid-out cost of ₹.21,139 per hectare, and average returns of ₹.39,075 per hectare, the surplused from PMDS cultivation, at the state level, have increased to ₹.17,935 per hectare. Further, except Krishna zone, all agroclimatic zones and all categories of farmers have obtained surpluses; in the range from a deficit of (-) ₹.3,800 in Krishna zone to ₹.50,924 per hectare in HAT zone; from ₹.14,366 per hectare for small farmers to ₹.28,436 per hectare for medium and large farmers; frm ₹.7,340 per hectare for SC farmers to ₹.38,749 per hectare for ST farmers (Figure 4.11). As mentioned above that each of inputs used during PMDS, such

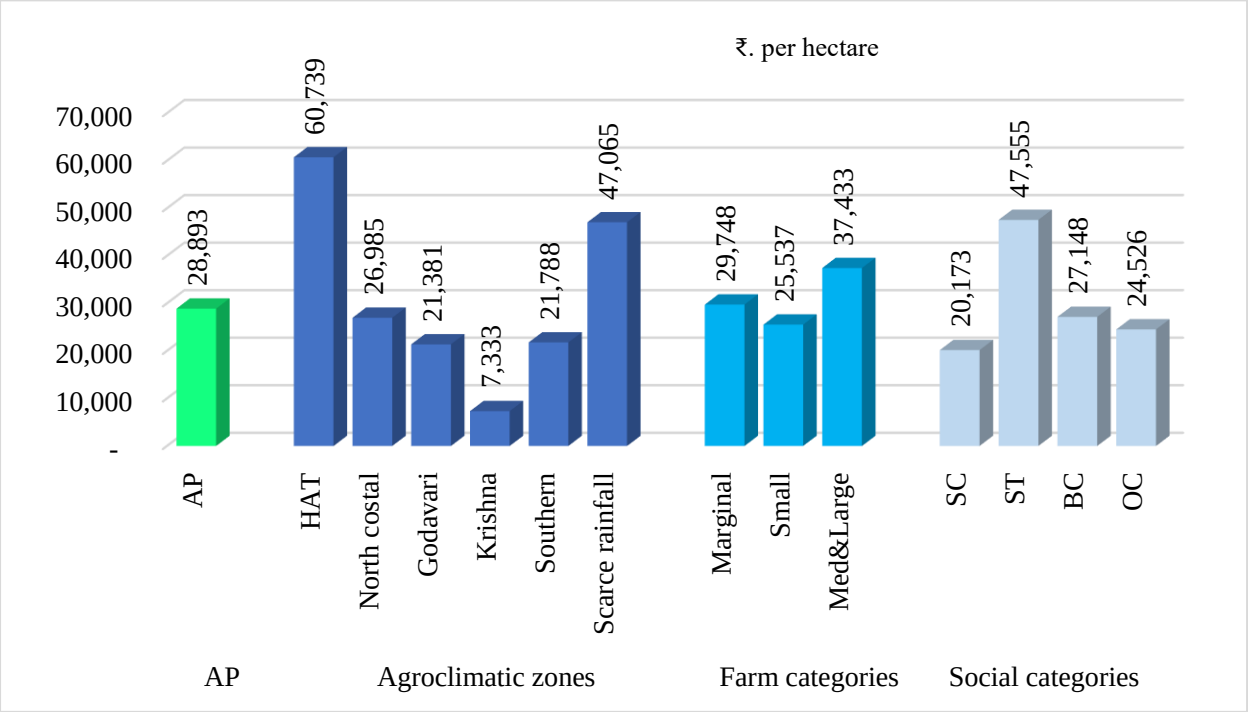
as FYM, ploughing, etc., are not completely intended for PMDS only. If this factor is considered, the average surpluses would increase further.

Figure 4.11: Surpluses/ deficit, over paid-out costs, from PMDS cultivation across zones and categories of farmers in 2021



As anticipated, compared to the average purchased inputs' cost of ₹.10,181 per hecatre and the average returns (from all benefits) of ₹.39,075 per hectare, the average surpluses have increased to ₹.28,893 per hectare at the state level. The average surpluse ranges from ₹.7,333 per hectare in Krishna zone to ₹.60,739 per hectare in HAT zone; varies from ₹.25,537 for small farmers to ₹.37,433 per hectare for medium and large farmers; and from ₹.20,173 per hectare for SC farmers to ₹.47,555 per hectare for ST farmers (Figure 4.11). ***It is well known fact that almost all agriculture machinery, implements, bullocks, particularly land, etc., and most of the family labour remained idle during the summar months. By utilizing the land, agriculture machnery, assets and family labour in the cultivation of PMDS, the farmers can get real economic benefits, along with invaluable environmental services. As some of the agricultural operations such as land preparation, ploughing, application of FYM, Ghanajeevamrutham, etc, are shiftef from Kharif/ Rabi cultivation to PMDS cultivation, it reduces the peak time demand for labour and agriculture machenery and assets. In the process, it reduces stress related to peak time demand of some agriculture operation and optimize the use of cultivators' family labour, agriculture machenary and assets.***

Figure 4.12: Surpluses/ deficit, over the cost of purchased farm inputs, from PMDS cultivation across zones and farmers' categories in 2021



4.5. Conclusion

Though PMDS cultivatin is not competely aimed at the economic returns, over 71 percent of sample farmers have harvested some crop or other. Even after meeting all costs of own inputs used, including the value of own labour and the cost of all purchased inputs, except Krishna zone and SC farmers, all zones and farmers' categories recored surplues.[14] It indicates that the PMDS has good potential to generate econommic, if not financial, surpluses over and above the total costs. RySS has to plan to reap these potentials. Compared to the average paid-out cost of ₹.21,139 per hectare, and average returns, of all known benefits, of ₹.39,075 per hectare, the surplused from PMDS cultivation, at the state level, have increased to ₹.17,935 per hectare. Further, almost all agroclimatic zones and all categories of farmers have obtained surpluses. As anticipated, compared to the average purchased inputs' cost of ₹.10,181 per hectare and the average returns, of all benefits, of ₹.39,075 per hectare, the average surpluses, at the state level, have increased to ₹.28,893 per hectare. Every zone and farmers' category have obtained surpluses from PMDS.

[14] However, it may be noted that the the monetory values of some of the benefits suchas values of green mandure and values of grazed fodder, etc are farrmers' own estimates.

It is well known fact that almost all agriculture machinery, implements, bullocks, etc., particularly land, and most of the family labour remained idle during the summar months. By utilizing the land, agriculture machnery, assets and family labour in the cultivation of PMDS, the farmers can get real economic benefits, along with invaluable environmental services. As some of the agricultural operations such as land preparation, ploughing, application of FYM, Ghanajeevamrutham, etc, are shiftef from Kharif/ Rabi cultivation to PMDS cultivation, it reduces the peak time demand for labour and agriculture machenery and assets. In the process, it reduces stress related to peak time demand of some agriculture operation and optimize the use of cultivators' family labour, agriculture machenary and assets.

Table 4.1: Agroclimatic zone, farm size category, social category and district wise cost of different inputs in PMDS in 2021

Agroclimatic zone	Seed cost	Beejamrutham		Ghanajeevamrutham		Dhravajeevamrtham		Khashayams		Asrthams		Fencing		Mulching		FYM	
		Own	Purchaged	Own	Purchaged	Own	Purchaged	Own	Purchaged	Own	Purchaged	Own	Purchaged	Own	Purchaged	Own	Purchaged
HAT	1,470	189	1	420	208	5,992	44	215	29	212	27	53	3	-	13	1,379	97
North costal	1,587	129	9	520	45	1,882	20	120	13	50	3	181	453	225	561	2,004	352
Godavari	1,775	88	13	559	1,868	1,203	237	203	126	138	79	1	1	0	0	2,895	911
Krishna	2,292	46	40	1,865	1,407	680	164	1	6	372	92	300	146	1,203	91	5,330	1,497
Southern	2,171	525	16	356	73	2,347	212	507	20	427	12	281	456	206	404	3,541	1,467
Scarce rainfall	2,651	62	10	610	572	3,510	140	149	1	1,359	344	180	61	2,602	1,753	5,489	326
Farm categories																	
Marginal	2,124	205	16	839	748	2,047	182	217	38	503	145	194	164	897	652	4,061	775
Small	2,110	143	22	641	781	3,692	113	111	19	439	41	190	314	833	340	3,616	1,160
Med &Large	1,911	256	6	407	378	2,177	70	551	5	764	24	101	49	533	214	2,453	986
Social categories																	
SC	2,525	221	41	695	1,431	2,272	268	275	9	613	473	172	165	1,173	605	5,104	1,596
ST	1,567	150	3	359	255	4,599	132	179	15	464	48	35	32	69	312	1,891	365
BC	2,172	202	12	861	628	2,366	126	167	35	652	56	201	246	1,164	760	4,245	746
OC	2,119	197	21	859	821	1,375	160	299	43	264	47	261	220	688	291	3,701	1,095
District																	
Srikakulam	706	15	0	369	71	-	-	-	-	-	-	163	977	95	12	2,822	1,091
Vizianagaram	1,754	270	1	403	16	6,946	8	-	-	-	-	-	-	-	14	411	62
Visakhapatnam	1,462	24	14	574	111	1,735	19	608	23	571	5	348	205	352	1,022	2,833	25
East Godavari	1,717	113	23	700	4,095	427	358	265	286	301	211	2	3	0	0	3,560	1,383
West Godavari	1,821	78	5	484	110	1,686	164	184	22	2	-	-	-	-	-	2,646	426
Krishna	2,591	10	2	826	535	1,362	457	4	2	1,069	289	157	209	2,093	174	7,710	1,688
Guntur	2,149	71	126	546	3,606	150	185	-	25	282	111	-	10	289	57	1,298	2,547

Agroclimatic zone	Seed cost	Beejamrutham		Ghanajeevamrutham		Dhravajeevamrtham		Khashayams		Asrthams		Fencing		Mulching		FYM	
		Own	Purchaged	Own	Purchaged	Own	Purchaged	Own	Purchaged	Own	Purchaged	Own	Purchaged	Own	Purchaged	Own	Purchaged
Prakasam	2,228	50	19	2,892	803	624	31	-	-	115	-	494	180	1,229	70	6,105	951
PSR Nellore	2,427	265	8	338	75	1,967	611	32	1	59	40	504	921	132	43	870	789
YSR Kadapa	2,074	731	24	313	53	2,571	80	812	33	683	4	214	352	156	629	4,149	1,957
Kurnool	2,623	59	10	614	568	3,611	128	151	1	1,402	88	142	64	2,538	1,790	5,722	343
Anantapuramu	3,176	117	6	548	654	1,566	358	112	-	518	5,272	901	-	3,831	1,050	1,018	-
Chittoor	2,159	131	0	545	146	2,066	125	56	-	2	-	201	161	502	84	5,200	616
AP	2,102	194	17	752	724	2,468	155	219	30	510	109	185	191	849	536	3,811	890

Table 4.1: Continued

Table 4.1: Continues

Agroclimatic zone	Machinery and bulloks		Male Labour		Female Labour		Irrigation	Total cost	Total own cost	Total purchased cost	Total paid out costs
	Own	Purchaged	Own	Purchaged	Own	Purchaged					
HAT	632	1,582	6,974	1,143	888	308	-	21,881	17,677	4,204	14,019
North costal	238	3,840	6,231	813	4,635	1,038	43	24,993	17,223	7,770	14,126
Godavari	846	2,002	5,102	1,212	3,441	424	1,306	24,431	14,731	9,699	15,888
Krishna	556	3,288	7,220	1,338	1,918	1,041	147	31,042	20,271	10,772	21,904
Southern	387	3,957	5,499	1,341	3,377	1,186	653	29,423	18,429	10,994	20,546
Scarce rainfall	3,284	2,186	11,196	2,656	6,607	3,605	240	49,592	36,361	13,231	31,790
Farm size category											
Marginal	1,304	2,666	7,940	1,719	3,791	1,708	467	33,402	22,866	10,537	21,671
Small	777	3,242	5,501	1,298	3,301	990	333	30,007	19,973	10,034	21,205
Med&Large	657	3,391	6,458	720	3,229	662	551	26,556	18,685	7,871	16,868
Social Categories											
SC	1,420	3,068	6,987	1,811	4,235	2,062	262	37,483	24,056	13,427	26,261
ST	478	2,207	6,278	960	1,802	271	102	22,573	16,886	5,687	14,493

BC	1,329	2,912	6,882	1,715	4,241	1,789	436	33,942	23,269	10,673	22,820
OC	1,036	3,134	8,408	1,452	3,492	1,316	753	32,051	21,418	10,633	20,151
District											
Srikakulam	-	4,971	1,422	-	748	-	-	13,462	5,633	7,829	11,292
Vizianagaram	382	2,142	2,881	753	1,531	160	0	17,733	13,778	3,956	13,321
Visakhapatnam	583	2,717	19,181	2,462	6,170	1,730	80	42,852	34,173	8,678	17,501
East Godavari	1,178	286	2,467	1,777	1,131	999	194	21,476	12,013	9,462	17,878
West Godavari	714	3,018	6,921	613	4,963	202	1,962	26,023	17,932	8,091	14,139
Krishna	84	3,407	9,989	5,557	6,237	4,467	-	48,919	29,613	19,306	32,693
Guntur	-	4,405	1,045	294	92	92	120	17,500	4,223	13,277	16,363
Prakasam	1,004	2,743	8,779	8	892	5	222	29,443	22,208	7,235	19,772
PSR Nellore	69	3,859	13,083	912	7,145	731	555	35,436	25,697	9,739	15,208
YSR Kadapa	579	4,286	3,645	1,850	2,470	1,678	849	30,192	17,239	12,953	24,077
Kurnool	3,359	2,110	11,427	2,777	6,773	3,735	252	50,288	36,573	13,715	32,088
Anantapuramu	1,833	3,654	6,741	330	3,411	1,109	-	36,204	22,032	14,171	26,052
Chittoor	134	2,852	1,276	46	1,224	-	58	17,585	12,993	4,592	15,084
AP	1,116	2,872	7,204	1,528	3,620	1,438	441	31,964	21,150	10,814	21,139

Table 4.2: Agroclimatic zone, farm size category, social category and district wise value of of different outputs obtained from PMDS in 2021

Agroclimatic zone	Value of final grain output	Value of green manure	Value of intermittent products	Value of fodder harvested and grazed	Total
HAT	42,813	1,342	15,995	4,793	64,943
North costal	22,018	1,193	9,143	2,400	34,755
Godavari	14,470	10,856	2,574	3,180	31,080
Krishna	8,780	3,090	3,016	3,219	18,104
Southern	16,020	11,767	2,226	2,768	32,782
Scarce rainfall	43,948	10,826	2,875	2,648	60,296
Farm size category					
Marginal	24,596	6,460	5,772	3,456	40,285
Small	21,660	8,203	3,625	2,083	35,571
Medium & Large	24,984	14,627	3,784	1,910	45,304
Socials categories					
SC	21,773	6,691	2,373	2,764	33,601
ST	30,238	6,229	13,177	3,598	53,242
BC	24,051	7,280	3,492	2,997	37,821
OC	18,621	9,652	4,018	2,867	35,159
District					
Srikakulam	854	627	233	6	1,720
Vizianagaram	2,580	1,428	930	998	5,937
Visakhapatnam	1,18,154	1,107	45,679	16,923	1,81,863
East Godavari	12,414	1,785	2,610	3,148	19,956
West Godavari	15,855	16,814	3,707		
Krishna	15,095	6,139	4,044	3,914	29,193
Guntur	5,918	2,150	1,504	995	10,567
Prakasam	7,363	2,038	3,368	4,122	16,891
PSR Nellore	11,228	2,533	1,799	5,822	21,383
YSR Kadapa	19,268	16,143	2,496	1,008	38,915
Kurnool	44,499	11,188	2,875	2,557	61,119
Anantapuramu	33,348	4,932	2,867	4,170	45,317
Chittoor	10,897	8,263	1,440	4,910	25,510
Total	**23,348**	**7,714**	**5,047**	**2,965**	**39,075**

Table 4.3: Agroclimatic zone, farm size category, and social category wise value of all outputs, total cost and surpluses/ deficit from PMDS in 2021

Agroclimatic zone	Value of all kinds of outs	Total costs	Surplus/ deficit over total costs	Total purchased inputs cost	Surplus/ deficit over purchased costs	Total paid out costs	Surplus/ deficit over paid-out costs
HAT	64,943	21,881	43,062	4,204	60,739	14,019	50,924
North costal	34,755	24,993	9,762	7,770	26,985	14,126	20,628
Godavari	31,080	24,431	6,649	9,699	21,381	15,888	15,192
Krishna	18,104	31,042	-12,938	10,772	7,333	21,904	-3,800
Southern	32,782	29,423	3,359	10,994	21,788	20,546	12,235
Scarce rainfall	60,296	49,592	10,705	13,231	47,065	31,790	28,507
Farm size caregories							
Marginal	40,285	33,402	6,882	10,537	29,748	21,671	18,614
Small	35,571	30,007	5,564	10,034	25,537	21,205	14,366
Med&Large	45,304	26,556	18,748	7,871	37,433	16,868	28,436
Scocial categories							
SC	33,601	37,483	-3,883	13,427	20,173	26,261	7,340
ST	53,242	22,573	30,669	5,687	47,555	14,493	38,749
BC	37,821	33,942	3,878	10,673	27,148	22,820	15,001
OC	35,159	32,051	3,107	10,633	24,526	20,151	15,007
AP	39,075	31,964	7,111	10,182	28,893	21,139	17,935

Chapter 5: Non-monetary benefits derived from, and, challenges encountered in adopting, PMDS

5.1. Introduction

This chapter is an attempt to analyse the additional benefits which, accrued to the farmers beyond costs and returns through raising crops under PMDS. It also analyses the problems encountered by farmers in adopting PMDS. Six benefits have been identified based on the experience of last year's report on PMDS. They are: incorporation of multi-crop biomass in to soil to improve soil quality; capturing of atmospheric water vapour; protecting the microorganism/soil moisture; additional economic benefits from sale and consumption of PMDS products; availability of the quality and nutritious food for the family and green fodder for the livestock. The information as to whether the farmers received all or some of the above benefits was obtained from the discussions, the investigators had with the farmers. The same methodology is adopted for getting the information on the problems encountered in adopting PMDS and growing PMDS crops in the entire cultivated area of the farmers. The nature of extension services made available by the promoters of PMDS during the PMDS crop season has been assessed. The number of interactions with extension personnel, and the satisfaction levels of the farmers have been assessed during the PMDS crop period- March to June. Based on the information collected, this chapter addresses the following aspects.:

i) What are the benefits that accrued to farmers beyond costs and returns from the crops grown under PMDS program?

ii) What are the problems encountered by farmers in adopting PMDS?

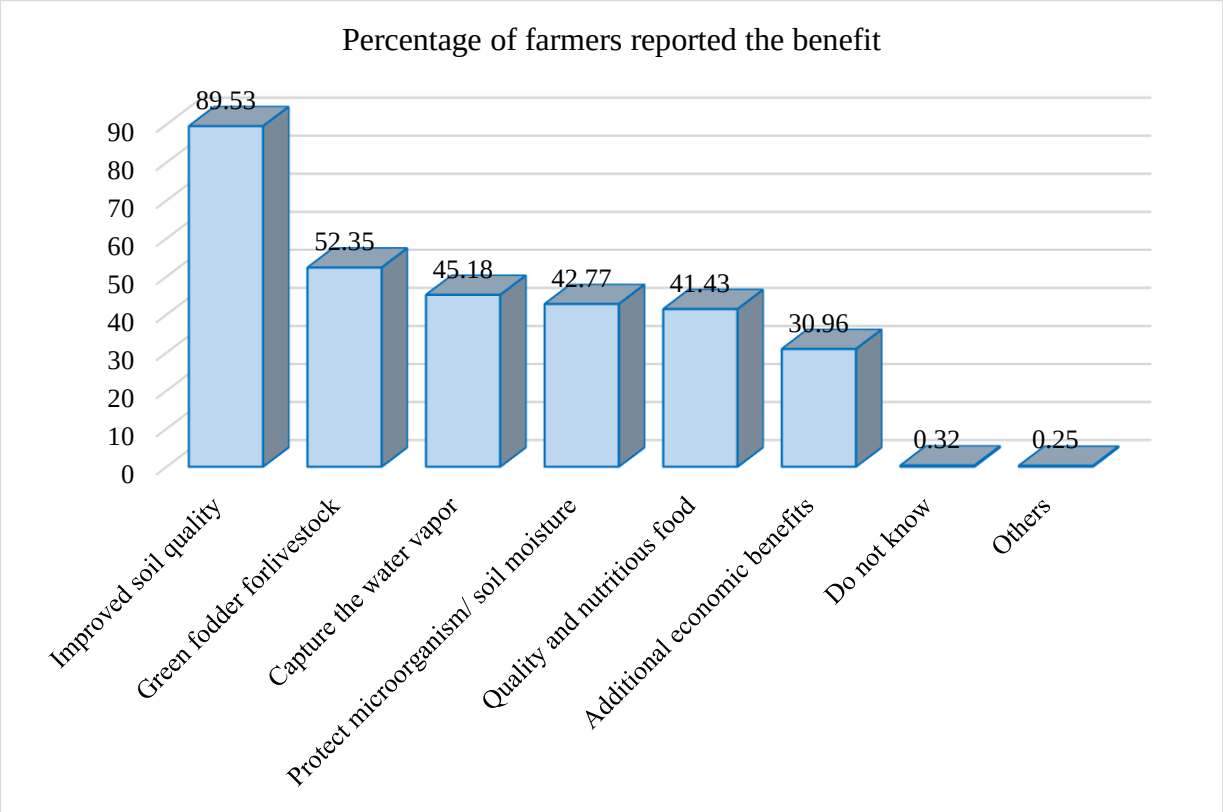
iii) How far have the extension services provided were useful and satisfactory to the farmers?

5.2. Benefits of PMDS reported by the farmers

The reported benefits have been accorded ranks on the basis of the percentage of farmers reporting the benefit. The benefit which is reported by largest highest percentage of farmers is considered as the most important benefit while the benefit which is reported by the lowest percentage of farmers is treated as the least important benefit. The other benefits are ranked in

between the highest and the lowest in descending order as per the reported percentage of farmers (Figre 5.1 & Table 5.1). As per the above criterion, as high as 90 percent of the farmers reported that the incorporation of the multi-crop biomass into the soil improves soil quality. Availability of green fodder from PMDS crops to the animals in summer season was the second most important benefit reported by the farmers. Capturing the water vapour from atmosphere is reported as the third important benefit of PMDS. Keeping the soil under the shade to protect microorganism/soil moisture was mentioned as the fourth important benefit of PMDS. Availability of quality and nutritious food to the family; and additional economic benefits from sale and consumption of PMDS produce are ranked as the fifth and sixth important benefits by the farmers. It is clear from this analysis that farmers have gained ecological benefits along with economic benefits from PMDS in the state.

Figure 5.1: Percentage of farmers reporting various benefits from PMDS in 2021



Source: IDSAP Survey, 2021-22

The importance of the benefits has varied across the agroclimatic zones. The farmers from rainfall dependent zones have reported availability of green fodder as second important benefit while farmers from Delta zones of Krishna and Godavari gave third rank for the same in order of importance. This is understandable that availability of green fodder during summer season

in rainfall dependent zones is difficult unless farmers grow fodder crops under borewell irrigation. Farmers have accorded 4th or 5th rank for keeping the soils under the shade to protect the microorganism/ soil moisture across the zones. However, there are also similarities in reporting of farmers across the zones. It is interesting to note that while additional economic benefits from sale and consumption of PMDS produces has been reported by least percentage of farmers across all the zones, the incorporation of the multi- crop biomass in to soil to improve soil quality has been reported by the highest percentage of farmers across all the zones. This indicates that farmers have derived more ecological gains than economic gains. On the whole, even though there are zone specific benefits for the farmers, farmers from all the zones have gained higher benefits of improvements in soil fertility besides economic benefits.

A comparison across the category of famers has revealed that the small landholders -marginal and small farmers-have reported similar kind of preference, in terms of percentages, which is different from those of for the large landholders. The percentage of farmers reported is the highest for incorporation of the multi-crop biomass in the soil to improve the soil fertility followed by availability of green fodder for animals, capturing water vapour from the atmosphere, keeping soils under the shadow to protect microorganism/soil moisture, availability of the quality and nutritious food for the family by small landholders. However, the large landholders have also reported incorporation of the multi-crop biomass to improve soil quality as the main benefit, followed by availability of green fodder for animals. But the importance given for other benefits by large landholders differ from those given by small landholders. This once again provides evidence that both small landholders as well as large landholders have gained benefit of improvement in soil fertility as well as capturing water vapour from atmosphere, compared to economic benefits. Further, the linkage between agriculture and animal husbandry have been strengthened

A comparison of benefits across the districts reveals that the incorporation of the multi-crop biomass to improve soil quality has been reported by the highest percentage of farmers across the districts, while the benefits of additional economic benefits from sale and consumption of PMDS produce has been given 5th/6th importance in terms of percentage of farmers reporting benefits. The importance for other benefits derived is specific to the local conditions prevalent in the districts. Thus, it is evident from the analysis that the PMDS intervention has provided more ecological benefits along with economic benefits across the districts.

5.3. Problems encountered in adopting PMDS

The problems encountered by the farmers in practising PMDS have been classified in to eight categories based on the experience of last year's report on PMDS. They include shortage of hired labour, shortage of family labour, shortage of mulching material, shortage of fencing material, not leaving adequate time to raise kharif and Rabi crops, shortage of seeds, lack of protection for PMDS crop from grazing animals and non-availability of suitable machinery for harvesting/ threshing of PMDS crops. Another question asked was about any type of problem which they may have faced at all (Figure 5.2 and Table 5.2).

The data has revealed that 35 per cent of farmers have not encountered any problems at all in adopting PMDS in the state. The remaining 65 per cent of farmers have encountered problems. Among the factors that have held back these farmers from adopting PMDS, protection of crops from grazing of animals has been reported by 26 per cent, the first popular reason for non-adoption. Non-availability or shortage of seeds was the second highest problem reported by farmers. The next problem mentioned was that raising of PMDS crop does not leave adequate time for sowing of Kharif and Rabi crops on time. Shortage of mulching material was reported as a problem by 21 per cent of the farmers. Then, Shortage of hired labour, fencing material and family labour have been reported by farmers in that order of importance in adopting PMDS in the state. It is evident that apart from scarcity of different inputs, lack of protection from grazing animals and lack of adequate time to prepare soil for sowing kharif and Rabi crops on time, were the reasons for non-adoption of PMDS in the state

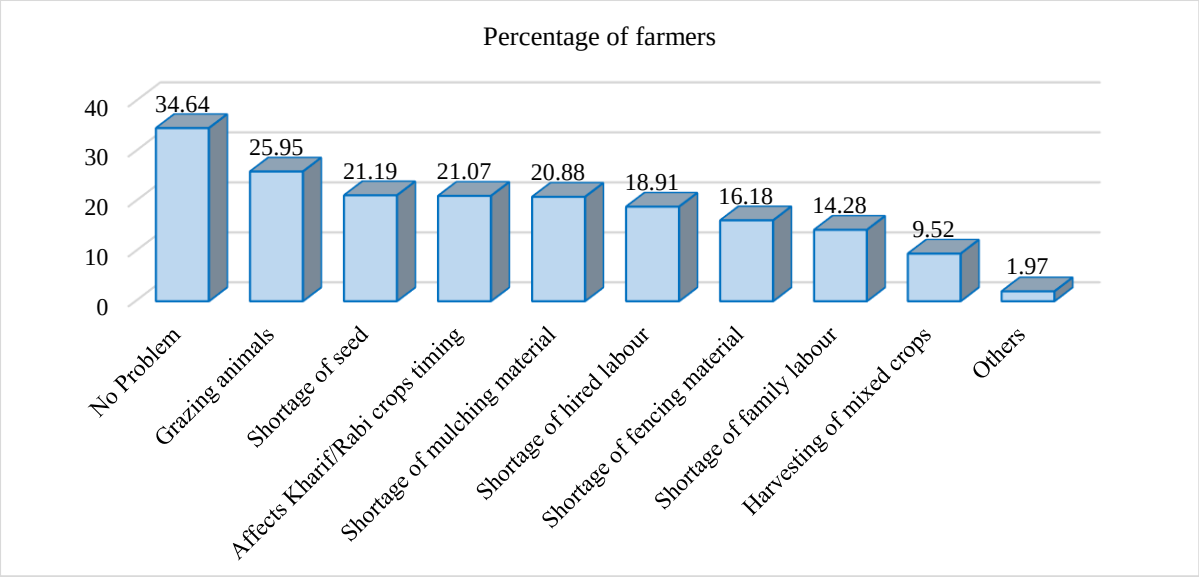
A cursory look across the Zones has revealed that in High Altitude zone (HAT), raising of PMDS crop is preventing sowing of kharif and Rabi crops on time. Protection of PMDS crops from animal grazing and non-availability/scarcity of seeds are also encountered by the farmers in HAT zone. The farmers from North coastal Andhra have also reported the first two problems of HAT zone along with shortage of hired human labour as the important problems compared to other problems. In Godavari zone, shortage of hired and family labour are the predominant reasons. Shortage of inputs such as fencing material, seed, and mulching material are the important reasons in Krishna zone. Southern zone has encountered problem relating to inputs and protection of PMDS crops from grazing animals. Shortage of inputs, inadequate time between PMDS and Kharif and Rabi crops, and protection of PMDS crops from animal grazing were cited by farmers from scarce rainfall zone. The southern and the scarce rainfall zones among the zones have encountered more problems. This indicates that the zones that

experience more deficit in rainfall have encountered many problems compared to other zones. Shortage of seeds and protection from grazing animals are the problems faced by all the zones except Godavari zone.

It is interesting to note that all the categories of farmers have encountered similar problems. The only exception is that the large landholders faced scarcity of family labour, while the small landholders have not reported the family labour scarcity.

A comparison across the districts has revealed that all the districts except Godavari and Krishna delta districts have encountered majority of the problems mentioned. It is striking to note that the farmers who have not encountered any problem in raising PMDS crops is conspicuously absent in Anantapuramu district. Visakhapatnam and SPS Nellore districts also have very low percentage farmers reported that they have not encountered any problem. Lack of protection of PMDS crops from grazing animals has been reported by the farmers in majority of the districts (9 out of 13 districts).

Figure 5.2: Percentage of farmer reporting different challenges in adopting PMDS



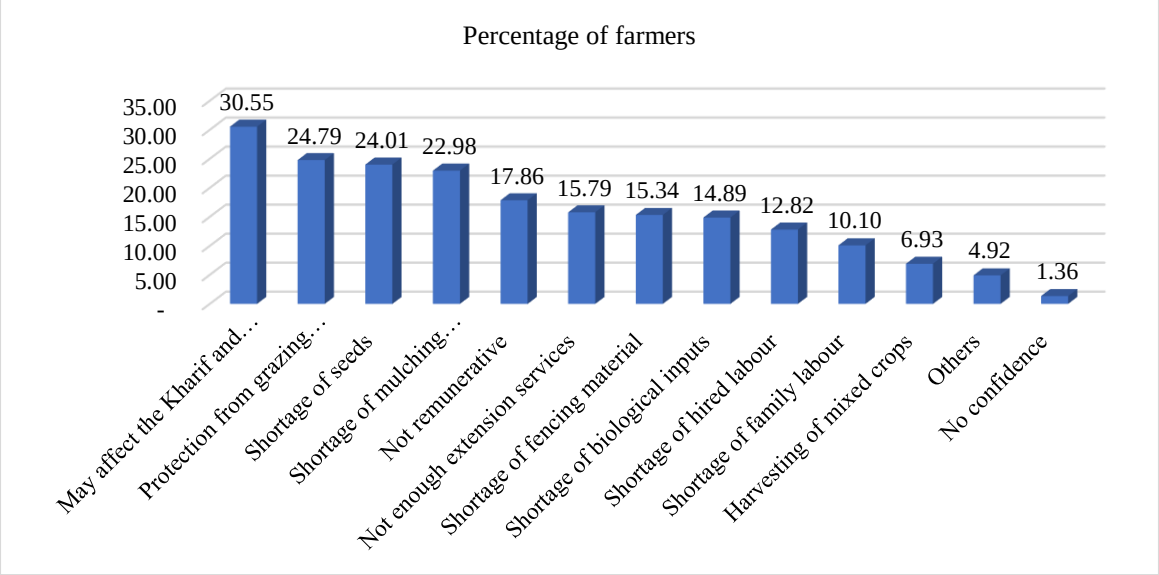
Source: IDSAP Survey, 2021-22

The survey sought answers from the farmers as to why they did not cultivate PMDS in their entire land. The farmer was expected to choose one or more possible reasons suggested in the survey. Apart from reasons indicated in the above section, additional reasons included are: 1.

PMDS is not remunerative, 2. Extension services were inadequate, 3. Shortage of biological inputs, and 4. No confidence in PMDS. The data is shown in Figure 5.3 and Table 5.3).

The first four dominant reasons for not growing PMDS in the entire cultivated area are: (1) raising of PMDS is not leaving adequate time to prepare the soil and sow the kharif and Rabi crops on time; (2) shortage of seeds; (3) lack of protection of PMDS crops from grazing animals and (4) shortage of mulching material in that order were mentioned. The same pattern has emerged across the category of farmers by and large. The pattern has varied across zones and districts depending on the local specific conditions. However, lack of adequate extension services has also constrained farmers in growing PMDS crops in the entire cultivated area at the state level. The farmers in rainfall dependent zones have experienced inadequate extension services in relation to those farmers in assured irrigation zones-Godavari and Krishna. But the shortage of hired as well as family labour constrained farmers in growing PMDS in Godavari zone. It is clear from this analysis that extension and short duration PMDS crop varieties play a crucial role in expanding the area under PMDS.

Figure 5.3: Percentage of farmers reporting the reasons for not cultivating PMDS on their entire operational holding



Source: IDSAP Survey, 2021-22

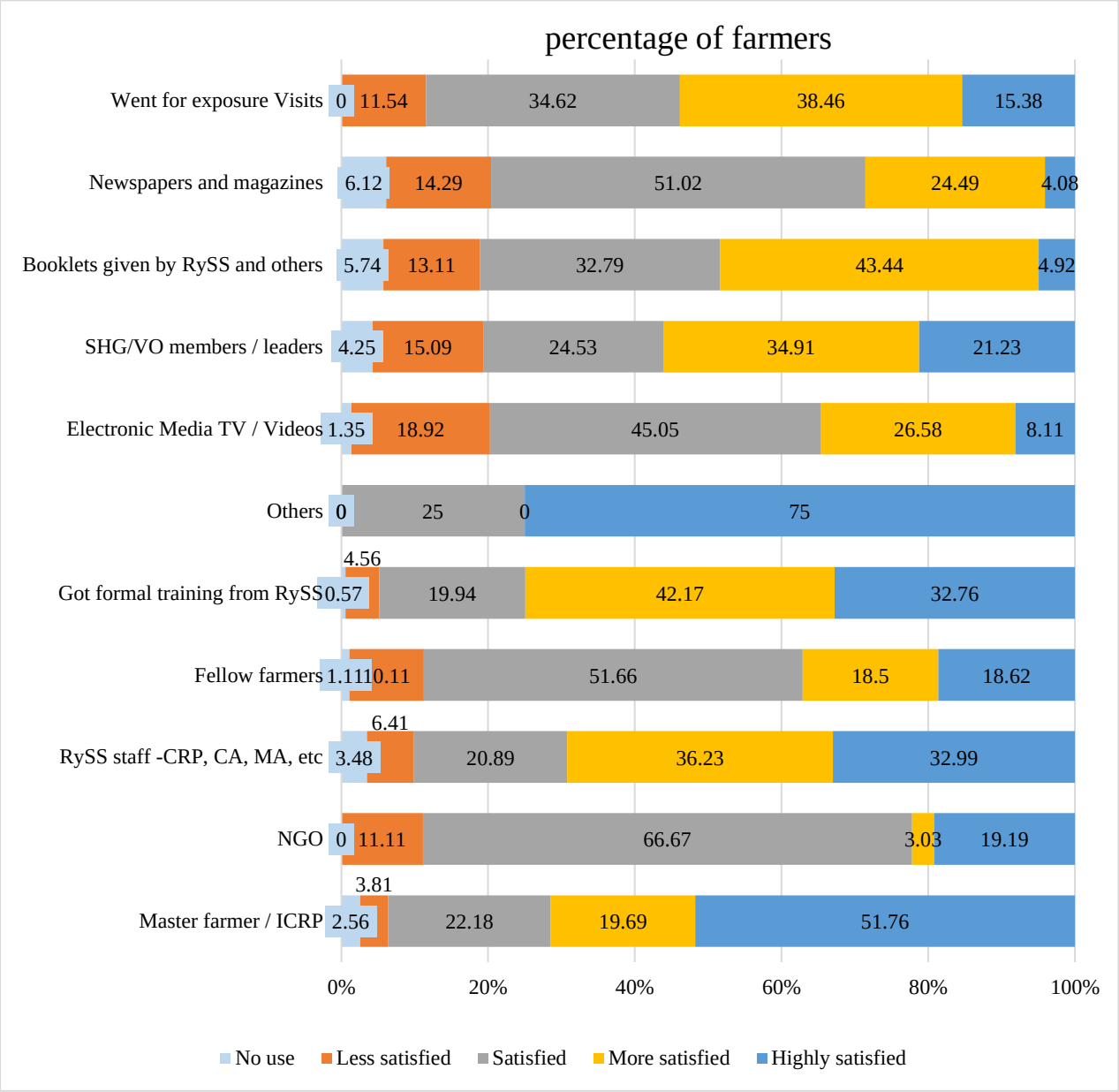
In addition, an open ended question was asked farmers about the challenges in adopting PMDS and expanding the area under PMDS. Farmers response are summarized below. They are almost similar to the listed reasons in the above section.

a. Shortage of inputs such as seeds, mulching material, fencing material, and hired labour and family labour;
b. Raising of PMDS crops does not leave adequate time to raise kharif and Rabi crops;
c. Lack of protection for PMDS crop from grazing animals; and
d. Inadequate extension services.

5.4. Extension services and expansion of the area under PMDS

The data on extension services provided by the promoters of PMDS crops, in terms number of times of interaction with farmers and satisfaction levels of farmers due to interactions have been captured across agroclimatic zones, districts and category of farmers (Figure 5.4 and Tables 5.4 to 5.16). The extension services provided by RySS through master farmer/ ICRP, RySS level like CRPs, CAs, MAs, et al., staff at field; formal training, exposure visits, Booklets distributed, SHG/VO members/leaders have led to frequent interaction with farmers. This has led to higher satisfaction levels among the farmers. This is true across all categories of farmers, agroclimatic zones and districts. Farmer to farmer interactions have also improved the satisfaction levels. However, a comparison across the category of farmers has revealed that there is scope to improve quality of interaction of ICRPs with the pure tenants. This is because the percentage of farmers who reported higher levels of satisfaction is lower among pure tenant farmers compared to pure owner, and owner-cum-Tenants. The same is the case with small farmers among the category of farmers. Among the Zones, the quality of interaction needs to be improved in HAT, North Coastal, Godavari and southern zones. Further the pattern of satisfaction levels of the tribal farmers from HAT zone is quite different from those of the other zones. The farmer-to-farmer interactions has led to higher levels of satisfaction in the HAT zone among all the zones. This is due to higher degree of cohesiveness among the tribal communities. Furthermore, the satisfaction levels are very high due to interaction with SHG/VO leaders/members in this zone. It is also evident that interaction with the leaders of the Community institutions like SHGs/VOs has led to higher level of satisfaction in scarce rainfall zone among the zones, but next to tribal zone. This indicates Community institutions work well in the zones where there are high agricultural distress conditions. There is a need to improve quality of interaction of SHG/VO leaders/members with farmers to improve satisfaction levels of farmers across the zones. These improvements would result in the expansion of area under PMDS across the state.

Figure 5.4: Percentage of farmers response about the satisfaction levels of about different extention services



5.5. Suggestions for expansion of PMDS in the state

The suggestions are devided into two groups, viz., (1) qualitative suggestions given by the farmers directly at the time individual intervies, (2) suggestion given from the literature, research team's interaction with farmers and other stakeholders during the their field visits, field notes of investigators and supervisors, personal knowledge of the project team.

5.5.1. Suggestons by the farmers

a. Seeds should be supplied by RySS through Rythu Bharosa Kendras at the village level to ensure quality as well as just price of the seeds. They further suggested seeds should be made available at subsidised price.
b. They furthermore suggested that short duration crop should be raised under PMDS so that adequate time will be available for raising Kharif and Rabi crops.
c. Mulching material and fencing material should be supplied through NPM shops in villages.
d. The scarcity of hired labour and family labour can be overcome by linking MGNREGS with Agriculture.
e. Farmers have reported extension services during PMDS are inadequate. They wanted more frequent interactions with ICRPs and CRPs during crop period of PMDS.
f. Success stories of farmers of PMDS crops should be displayed through ***Pico*** Videos in the villages.
g. Exposure: Visits to PMDS plots should be arranged for learning about PMDS.

5.5.2. Suggestions from other sources

g. RySS may integrate the PMDS seed supply with the Government's "green manure crops' seed supply" scheme.
h. RySS may facilitate collective/ cooperative cultivation of PMDS to share labour, irrigation water, guarding the fields from stray cattle, etc.
i. Social fencing or social control on free grazing may be facilitated.
j. Whereever, the groundwater and canal water is not avialble, RySS may facilitate development of farm ponds, which can hold water throughout the year.
k. RySS may review the region specific need of certain protocols such as mulching, temporary fenching, pelletizing, etc.

Tables of Chapter 5

Table 5.1: Benefits accrued to the farmers from PMDS according to agroclimatic zones, category of farmers and districts

S. No	Zones/ /	Type of Benefits and Percentage of farmers reported							
		Improved the soil quality	Additional Economic Benefits	Capture the atmospheric water vapor	Protecting Soil moisture / microorganism	Green fodder for the livestock	Quality and nutritious food for the family	Do not know	Others
1	HAT	90.32	45.16	53.76	48.39	65.59	64.52	0.00	0.54
2	North coastal	80.39	20.92	63.40	41.18	61.44	24.84	0.00	0.00
3	Godavari	97.13	35.89	59.33	77.51	69.86	51.20	0.00	0.00
4	Krishna	93.38	32.81	58.04	48.26	50.16	37.85	0.63	0.63
5	Southern	82.61	27.45	18.75	20.65	35.87	36.14	0.54	0.27
6	Scarce rainfall	92.42	26.82	40.23	37.90	50.15	39.36	0.29	0.00
	Farm Sizes								
1	Marginal	89.93	30.57	44.87	41.67	54.37	41.49	0.38	0.19
2	Small	89.95	30.41	46.65	45.36	47.16	40.46	0.26	0.52
3	Medium &Large	84.80	36.00	43.20	44.00	51.20	44.00	0.00	0.00
	Districts								
1	Srikakulam	98.44	6.25	65.63	29.69	29.69	7.81	0.00	0.00
2	Vizianagaram	74.59	18.23	40.88	29.28	59.67	33.70	0.00	0.00
3	Visakhapatnam	98.77	97.53	97.53	88.89	97.53	97.53	0.00	0.00
4	East Godavari	100.00	0.00	5.33	69.33	64.00	84.00	0.00	1.33
5	West Godavari	95.92	51.02	82.99	80.95	73.47	38.78	0.00	0.00
6	Krishna	85.92	39.44	12.68	15.49	71.83	64.79	0.00	0.00
7	Guntur	88.89	38.27	56.79	55.56	25.93	43.21	2.47	1.23
8	Prakasam	98.79	27.27	78.18	58.79	52.73	23.64	0.00	0.61
9	SPS Nellore	89.66	20.69	16.09	18.39	70.11	89.66	1.15	0.00
10	YSR Kadapa	77.06	35.78	21.10	23.85	13.76	16.97	0.46	0.46
11	Kurnool	92.66	26.30	40.98	37.31	51.68	37.61	0.31	0.00

12	Anantapuramu	87.50	37.50	25.00	50.00	18.75	75.00	0.00	0.00
13	Chittoor	92.06	7.94	14.29	12.70	65.08	28.57	0.00	0.00
1	**Andhra Pradesh**	**89.53**	**30.96**	**45.18**	**42.77**	**52.35**	**41.43**	**0.32**	**0.25**

Source: IDSAP Survey 2021-22

Table 5.2: Reasons for not practicing PMDS by the CNF farmers according to agroclimatic zones, category of farmers and districts

(Reasons Reported by the farmers in percentages)

Agroclimatic Zones	No Problem	Shortage of hired labour	Shortage of family labour	Shortage of mulching material	Shortage of fencing material	Affects the Kharif and Rabi crops timing	Non-availability/ shortage of seed	Protection of crops from grazing animals	Non-availability of suitable machinery for harvesting/ threshing	Others
HAT	39.25	13.44	8.06	4.30	3.23	47.31	34.41	35.48	34.41	0.00
North coastal	32.68	43.14	14.38	10.46	1.96	36.60	18.30	43.14	7.19	1.31
Godavari	34.45	41.63	35.89	3.35	12.44	9.57	0.96	13.40	0.00	1.44
Krishna	46.37	10.73	5.68	19.56	23.66	11.04	21.14	13.25	13.56	1.26
Southern	36.41	20.65	15.49	24.18	19.84	9.24	19.29	24.73	1.63	5.16
Scarce rainfall	20.41	2.92	11.08	42.86	20.99	28.86	29.74	33.82	7.58	0.87
Farmer Category										
Marginal	35.18	19.29	13.36	19.38	15.33	20.51	21.64	26.72	10.82	2.16
Small	36.86	18.30	15.21	22.68	17.78	19.07	16.49	22.16	5.93	1.55
Medium &Large	23.20	17.60	19.20	28.00	18.40	32.00	32.00	31.20	9.60	1.60
District										
Srikakulam	56.25	3.13	9.38	9.38	3.13	26.56	7.81	3.13	1.56	3.13
Vizianagaram	41.99	35.36	15.47	2.76	2.21	26.52	11.05	27.07	7.18	0.00
Visakhapatnam	2.47	30.86	2.47	16.05	3.70	95.06	82.72	97.53	75.31	0.00
East Godavari	62.67	0.00	1.33	0.00	1.33	29.33	0.00	14.67	0.00	4.00
West Godavari	23.13	59.18	51.02	4.76	17.01	0.00	1.36	12.93	0.00	0.00

Krishna	25.35	38.03	12.68	1.41	5.63	0.00	61.97	2.82	60.56	0.00
Guntur	23.46	6.17	3.70	49.38	28.40	43.21	24.69	27.16	0.00	0.00
Prakasam	66.67	1.21	3.64	12.73	29.09	0.00	1.82	10.91	0.00	2.42
SPS Nellore	9.20	6.90	19.54	11.49	41.38	5.75	43.68	67.82	5.75	19.54
YSR Kadapa	49.54	27.52	12.84	27.06	10.09	7.80	6.88	9.63	0.46	0.92
Kurnool	21.41	1.83	11.01	40.06	20.18	30.28	30.28	35.17	7.65	0.92
Anantapuramu	0.00	25.00	12.50	100.00	37.50	0.00	18.75	6.25	6.25	0.00
Chittoor	28.57	15.87	19.05	31.75	23.81	19.05	28.57	17.46	0.00	0.00
AP	**34.64**	**18.91**	**14.28**	**20.88**	**16.18**	**21.07**	**21.19**	**25.95**	**9.52**	**1.97**

Source IDSAP Survey 2021-22

Table 5.3: Reasons for not cultivating PMDS in the entire cultivated area according to agroclimatic zones, category of farmers and districts

(Reasons Reported by the farmers in percentages)

Agroclimatic zones	Not remunerative	Not enough extension services	Shortage of seeds	Shortage of biological inputs	Protection of crops from grazing animals	Non-availability of suitable tools and instruments	Shortage of hired labour	Shortage of family labour	Shortage of mulching materials	Shortage of fencing material	May affect the Kharif and Rabi crops timings	No confidence	Others	Others
HAT	29.57	35.48	31.72	12.90	36.56	19.89	15.05	6.45	11.83	1.08	75.81	1.08	1.08	0.54
North coastal	37.91	16.99	37.25	13.07	45.10	14.38	17.65	7.19	5.88	1.96	64.05	0.65	0.65	0.65
Godavari	8.61	3.35	1.91	12.44	9.09	1.91	43.54	36.84	0.48	8.61	7.66	0.48	1.44	0.00
Krishna	1.71	1.71	29.79	22.95	14.04	4.79	6.16	3.08	29.79	25.68	11.64	0.00	1.37	0.34
Southern	20.44	19.89	22.93	12.71	22.65	2.49	4.97	7.46	23.48	16.30	15.47	0.55	1.66	2.49
Scarce rainfall	19.24	19.83	23.62	13.70	30.32	6.12	4.66	5.83	44.02	23.32	37.03	4.37	11.37	2.62
														farmer category
Marginal	16.96	13.76	21.61	10.17	24.32	6.20	11.24	8.33	21.71	12.69	26.45	0.87	3.20	0.97
Small	19.85	18.04	25.77	25.00	25.00	8.51	15.98	13.40	24.48	22.16	37.37	1.29	4.38	1.80
Med & Large	19.20	25.60	38.40	22.40	28.00	8.00	16.00	14.40	28.80	16.00	43.20	5.60	4.00	3.20
Districts														
Srikakulam	96.88	9.38	7.81	1.56	0.00	9.38	0.00	10.94	1.56	0.00	26.56	0.00	0.00	1.56
Vizianagaram	19.34	38.12	38.67	21.55	30.94	9.94	17.68	7.73	2.76	2.21	77.35	1.66	0.55	0.00

Visakhapatnam	19.75	20.99	50.62	0.00	95.06	43.21	27.16	1.23	30.86	1.23	98.77	0.00	0.00	1.23
East Godavari	0.00	0.00	0.00	5.33	18.67	0.00	2.67	1.33	0.00	0.00	22.67	1.33	6.67	0.00
West Godavari	12.24	4.76	2.72	17.69	6.12	2.72	61.22	52.38	0.68	12.24	0.68	0.00	0.00	0.00
Krishna	5.63	0.00	18.31	2.82	0.00	16.90	16.90	1.41	0.00	0.00	0.00	0.00	0.00	0.00
Guntur	1.23	1.23	30.86	4.94	29.63	2.47	4.94	0.00	45.68	24.69	39.51	0.00	0.00	1.23
Prakasam	0.00	2.86	35.00	43.57	12.14	0.00	1.43	5.71	35.71	39.29	1.43	0.00	2.86	0.00
SPS Nellore	0.00	3.49	16.28	22.09	33.72	4.65	6.98	17.44	12.79	22.09	4.65	1.16	3.49	9.30
YSR Kadapa	32.86	30.99	18.78	12.21	7.98	0.94	0.00	0.47	23.00	9.86	20.66	0.47	1.41	0.47
Kurnool	18.35	20.80	22.32	11.31	30.89	6.42	3.06	5.50	41.28	22.94	38.84	4.59	11.62	2.75
Anantapuramu	37.50	0.00	50.00	62.50	18.75	0.00	37.50	12.50	100.00	31.25	0.00	0.00	6.25	0.00
Chittoor	6.35	4.76	46.03	1.59	57.14	4.76	19.05	17.46	39.68	30.16	12.70	0.00	0.00	0.00
A P	**17.86**	**15.79**	**24.01**	**14.89**	**24.79**	**6.93**	**12.82**	**10.10**	**22.98**	**15.34**	**30.55**	**1.36**	**3.56**	**1.36**

Source IDSAP Survey 2021-22

Table 5.4: Number of interactions and satisfaction levels of the extension services provided by source of extension services for all the farmers in the state during March to June 2021-22

Source of extension	Number of Interactions per farmer	Satisfactory levels by percentage of farmers				
		No use	Less satisfied	Satisfied	More satisfied	Highly satisfied
Fellow farmers	4.29	1.11	10.11	51.66	18.50	18.62
Master farmer / ICRP	8.35	2.56	3.81	22.18	19.69	51.76
RySS staff -CRP, CA, MA, etc	5.65	3.48	6.41	20.89	36.23	32.99
SHG/VO members / leaders	3.08	4.25	15.09	24.53	34.91	21.23
Got formal training from RySS	4.24	0.57	4.56	19.94	42.17	32.76
Went for exposure Visits	1.68	0.00	11.54	34.62	38.46	15.38
NGO	5.99	0.00	11.11	66.67	3.03	19.19
Electronic Media TV / Videos	3.35	1.35	18.92	45.05	26.58	8.11

Newspapers and magazines	2.44	6.12	14.29	51.02	24.49	4.08
Booklets given by RySS and others	2.58	5.74	13.11	32.79	43.44	4.92
Others	4.00	0.00	0.00	25.00	0.00	75.00

Source: IDSAP Survey 2021-22

Table 5.5: Number of interactions and satisfaction levels of the extension services provided by source of extension services for Marginal Farmers in the state during March to June 2021-22

Source of advice / extension	Number of Interactions per farmer	Satisfactory levels				
		% of farmers reported no use	% of farmers reported less satisfied	% of farmers reported satisfied	% of farmers reported more satisfied	% of farmers reported Highly satisfied
Fellow farmers	4.15	1.31	8.80	49.63	19.66	20.60
Master farmer / ICRP	7.83	2.03	3.74	19.64	21.02	53.58
RySS staff -CRP, CA, MA, etc	5.66	2.46	5.74	19.81	38.45	33.53
SHG/VO members / leaders	3.02	4.35	16.15	24.84	32.92	21.74
Got formal training from RySS	4.36	0.00	3.97	20.63	38.49	36.90
Went for exposure Visits	1.63	0.00	6.67	33.33	46.67	13.33
NGO	4.91	0.00	12.20	75.61	2.44	9.76
Electronic Media TV / Videos	3.09	2.19	17.52	46.72	24.82	8.76
Newspapers and magazines	2.39	0.00	17.86	46.43	32.14	3.57
Booklets given by RySS and others	1.94	3.49	5.81	33.72	53.49	3.49

Others	2.67	0.00	0.00	33.33	0.00	66.67

Source: IDSAP Survey 2021-22

Table 5.6: Number of interactions and satisfaction levels of the extension services provided by source of extension services for Small Farmers in the state during March to June 2021-22

Source of advice / extension	Number of Interactions per farmer	Satisfactory levels				
		% of farmers reported no use	% of farmers reported less satisfied	% of farmers reported satisfied	% of farmers reported more satisfied	% of farmers reported Highly satisfied
Fellow farmers	4.88	0.95	9.95	54.98	17.54	16.59
Master farmer / ICRP	9.26	3.73	4.66	28.57	13.35	49.69
RySS staff -CRP, CA, MA, etc	5.78	5.03	6.92	22.96	29.56	35.53
SHG/VO members / leaders	3.26	4.44	11.11	22.22	42.22	20.00
Got formal training from RySS	4.51	2.67	6.67	13.33	53.33	24.00
Went for exposure Visits	2.00	0.00	33.33	33.33	16.67	16.67
NGO	7.06	0.00	8.33	64.58	4.17	22.92
Electronic Media TV / Videos	3.74	0.00	20.90	40.30	29.85	8.96
Newspapers and magazines	2.65	18.75	6.25	50.00	18.75	6.25
Booklets given by RySS and others	4.03	6.90	34.48	27.59	24.14	6.90
Others	10.00	0.00	0.00	0.00	0.00	100.00

Source: IDSAP Survey 2021-22

Table 5.7: Number of interactions and satisfaction levels of the extension services provided by source of extension services for Medium & Large Farmers in the state during March to June 2021-22

Source of advice / extension	Number of Interactions per farmer	Satisfactory levels				
		% of farmers reported no use	% of farmers reported less satisfied	% of farmers reported satisfied	% of farmers reported more satisfied	% of farmers reported Highly satisfied
Fellow farmers	3.51	0.00	21.21	57.58	12.12	9.09
Master farmer / ICRP	10.24	3.74	1.87	25.23	27.10	42.06
RySS staff -CRP, CA, MA, etc	5.15	7.53	10.75	23.66	38.71	19.35
SHG/VO members / leaders	3.09	0.00	16.67	33.33	33.33	16.67
Got formal training from RySS	2.23	0.00	4.17	33.33	45.83	16.67
Went for exposure Visits	1.50	0.00	0.00	40.00	40.00	20.00
NGO	5.67	0.00	20.00	40.00	0.00	40.00
Electronic Media TV / Videos	3.95	0.00	22.22	50.00	27.78	0.00
Newspapers and magazines	2.14	0.00	20.00	80.00	0.00	0.00
Booklets given by RySS and others	4.22	28.57	14.29	42.86	0.00	14.29
Others	0.00	0.00	0.00	.	0.00	.

Source: IDSAP Survey 2021-22

Table 5.8

Table 5.8: Number of interactions and satisfaction levels of the extension services provided by source of extension services for Pure owners in the state during March to June 2021-22

Source of advice / extension	Number of Interactions per farmer	Satisfactory levels				
		% of farmers reported no use	% of farmers reported less satisfied	% of farmers reported satisfied	% of farmers reported more satisfied	% of farmers reported Highly satisfied
Fellow farmers	4.39	0.97	10.07	51.03	17.79	20.14
Master farmer / ICRP	8.33	2.49	3.86	22.89	17.75	53.01
RySS staff -CRP, CA, MA, etc	5.62	3.55	6.56	21.45	34.49	33.95
SHG/VO members / leaders	3.09	3.90	15.61	23.90	34.63	21.95
Got formal training from RySS	4.34	0.60	3.93	19.34	42.90	33.23
Went for exposure Visits	1.79	0.00	8.70	39.13	39.13	13.04
NGO	5.54	0.00	11.34	68.04	3.09	17.53
Electronic Media TV / Videos	3.11	1.58	20.53	42.11	27.37	8.42
Newspapers and magazines	2.51	6.67	11.11	55.56	22.22	4.44
Booklets given by RySS and others	2.43	6.54	14.02	31.78	42.99	4.67
Others	2.29	0.00	0.00	33.33	0.00	66.67

Source: IDSAP Survey 2021-22

Table 5.9: Number of interactions and satisfaction levels of the extension services provided by source of extension services for Pure Tenants in the state during March to June 2021-22

Source of advice / extension	Number of Interactions per farmer	Satisfactory levels				
		% of farmers reported no use	% of farmers reported less satisfied	% of farmers reported satisfied	% of farmers reported more satisfied	% of farmers reported Highly satisfied
Fellow farmers	2.77	0.00	6.98	62.79	25.58	4.65
Master farmer / ICRP	9.17	1.59	1.59	12.70	52.38	31.75
RySS staff -CRP, CA, MA, etc	5.42	0.00	2.50	15.00	60.00	22.50
SHG/VO members / leaders	2.25	0.00	0.00	50.00	50.00	0.00
Got formal training from RySS	2.64	0.00	0.00	50.00	16.67	33.33
Went for exposure Visits	0.75	0.00	50.00	0.00	50.00	0.00
NGO	0.00	0.00	.	.	.	.
Electronic Media TV / Videos	4.60	0.00	7.14	42.86	35.71	14.29
Newspapers and magazines	1.00	0.00	50.00	0.00	50.00	0.00
Booklets given by RySS and others	3.08	0.00	10.00	30.00	60.00	0.00
Others	10.00	0.00	0.00	0.00	0.00	100.00

Source: IDSAP Survey 2021-22

Table 5.10: Number of interactions and satisfaction levels of the extension services provided by source of extension services for Owner cum Tenants in the state during March to June 2021-22

Source of advice / extension	Number of Interactions per farmer	Satisfactory levels				
		% of farmers reported no use	% of farmers reported less satisfied	% of farmers reported satisfied	% of farmers reported more satisfied	% of farmers reported Highly satisfied
Fellow farmers	4.12	4.76	14.29	52.38	21.43	7.14
Master farmer / ICRP	8.12	5.26	5.26	17.54	26.32	45.61
RySS staff -CRP, CA, MA, etc	6.69	7.27	9.09	18.18	38.18	27.27
SHG/VO members / leaders	3.25	25.00	0.00	25.00	50.00	0.00
Got formal training from RySS	2.88	0.00	37.50	0.00	50.00	12.50
Went for exposure Visits	2.00	0.00	0.00	0.00	0.00	100.00
NGO	35.00	0.00	0.00	0.00	0.00	100.00
Electronic Media TV / Videos	4.89	0.00	11.11	77.78	11.11	0.00
Newspapers and magazines	3.50	0.00	50.00	0.00	50.00	0.00
Booklets given by RySS and others	5.75	0.00	0.00	50.00	25.00	25.00
Others	.	0.00	0.00	.	0.00	.

Source: IDSAP Survey 2021-22

Table 5.11: Number of interactions and satisfaction levels of the extension services provided by source of extension services for High altitude Zone in the state during March to June 2021-22

Source of advice / extension	Number of Interactions per farmer	Satisfactory levels				
		% of farmers reported no use	% of farmers reported less satisfied	% of farmers reported satisfied	% of farmers reported more satisfied	% of farmers reported Highly satisfied
Fellow farmers	2.55	1.18	8.24	15.29	21.18	54.12
Master farmer / ICRP	5.46	0.00	0.00	52.69	8.38	38.92
RySS staff -CRP, CA, MA, etc	3.99	2.14	3.57	42.14	35.00	17.14
SHG/VO members / leaders	1.33	11.11	0.00	0.00	22.22	66.67
Got formal training from RySS	2.00	0.00	0.00	0.00	6.25	93.75
Went for exposure Visits	.	0.00	.	.	.	.
NGO	4.67	0.00	10.59	75.29	0.00	14.12
Electronic Media TV / Videos	2.88	0.00	12.50	75.00	12.50	0.00
Newspapers and magazines	1.50	0.00	50.00	50.00	0.00	0.00
Booklets given by RySS and others	2.00	0.00	100.00	0.00	0.00	0.00
Others	.	0.00	0.00	.	0.00	.

Source: IDSAP Survey 2021-22

Table 5.12: Number of interactions and satisfaction levels of the extension services provided by source of extension services for North Coastal Zone in the state during March to June 2021-22

Source of advice / extension	Number of Interactions per farmer	Satisfactory levels				
		% of farmers reported no use	% of farmers reported less satisfied	% of farmers reported satisfied	% of farmers reported more satisfied	% of farmers reported Highly satisfied
Fellow farmers	3.64	1.72	17.24	34.48	29.31	17.24
Master farmer / ICRP	7.78	0.00	5.97	47.76	5.97	40.30
RySS staff -CRP, CA, MA, etc	5.14	0.76	16.03	42.75	21.37	19.08
SHG/VO members / leaders	3.67	0.00	0.00	100.00	0.00	0.00
Got formal training from RySS	2.90	0.00	0.00	0.00	0.00	100.00
Went for exposure Visits	2.00	0.00	0.00	0.00	0.00	100.00
NGO	6.75	0.00	0.00	25.00	50.00	25.00
Electronic Media TV / Videos	4.00	3.28	31.15	50.82	11.48	3.28
Newspapers and magazines	2.90	0.00	20.00	70.00	10.00	0.00
Booklets given by RySS and others	4.70	10.00	50.00	30.00	10.00	0.00
Others	.	0.00	0.00	.	0.00	.

Source: IDSAP Survey 2021-22

Table 5.13: Number of interactions and satisfaction levels of the extension services provided by source of extension services for Godavari Zone in the state during March to June 2021-22

Source of advice / extension	Number of Interactions per farmer	Satisfactory levels				
		% of farmers reported no use	% of farmers reported less satisfied	% of farmers reported satisfied	% of farmers reported more satisfied	% of farmers reported Highly satisfied
Fellow farmers	2.04	0.00	0.79	69.05	28.57	1.59
Master farmer / ICRP	6.10	0.00	0.00	14.49	52.17	33.33
RySS staff -CRP, CA, MA, etc	3.53	0.00	0.00	20.51	74.36	5.13
SHG/VO members / leaders	12.50	0.00	0.00	100.00	0.00	0.00
Got formal training from RySS	1.00	0.00	0.00	100.00	0.00	0.00
Went for exposure Visits	1.00	0.00	10.00	50.00	40.00	0.00
NGO	1.50	0.00	0.00	0.00	100.00	0.00
Electronic Media TV / Videos	1.38	0.00	0.00	75.00	25.00	0.00
Newspapers and magazines	1.29	0.00	0.00	100.00	0.00	0.00
Booklets given by RySS and others	1.38	0.00	0.00	87.50	12.50	0.00
Others	.	0.00	0.00	.	0.00	.

Source: IDSAP Survey 2021-22

Table 5.14: Number of interactions and satisfaction levels of the extension services provided by source of extension services for Krishna Zone in the state during March to June 2021-22

Source of advice / extension	Number of Interactions per farmer	Satisfactory levels				
		% of farmers reported no use	% of farmers reported less satisfied	% of farmers reported satisfied	% of farmers reported more satisfied	% of farmers reported Highly satisfied
Fellow farmers	6.62	0.51	1.53	55.10	13.27	29.59
Master farmer / ICRP	10.15	0.00	2.24	4.48	30.22	63.06
RySS staff -CRP, CA, MA, etc	8.24	0.00	0.98	4.59	55.41	39.02
SHG/VO members / leaders	2.34	0.00	6.90	32.76	46.55	13.79
Got formal training from RySS	5.47	0.00	1.81	19.00	48.87	30.32
Went for exposure Visits	7.00	0.00	.	.	.	.
NGO	.	0.00	.	.	.	.
Electronic Media TV / Videos	3.45	0.00	13.21	52.83	26.42	7.55
Newspapers and magazines	3.40	0.00	10.00	50.00	40.00	0.00
Booklets given by RySS and others	1.71	0.00	0.00	28.95	64.47	6.58
Others	.	0.00	0.00	.	0.00	.

Source: IDSAP Survey 2021-22

Table 5.15: Number of interactions and satisfaction levels of the extension services provided by source of extension services for Southern Zone in the state during March to June 2021-22

Source of advice / extension	Number of Interactions per farmer	Satisfactory levels				
		% of farmers reported no use	% of farmers reported less satisfied	% of farmers reported satisfied	% of farmers reported more satisfied	% of farmers reported Highly satisfied
Fellow farmers	5.39	1.97	19.21	53.20	13.30	12.32
Master farmer / ICRP	10.37	10.97	10.97	22.26	18.18	37.62
RySS staff -CRP, CA, MA, etc	5.97	17.32	19.05	31.17	22.08	10.39
SHG/VO members / leaders	4.69	7.84	29.41	27.45	27.45	7.84
Got formal training from RySS	3.15	2.27	20.45	36.36	31.82	9.09
Went for exposure Visits	2.31	0.00	10.00	20.00	50.00	20.00
NGO	18.64	0.00	12.50	12.50	0.00	75.00
Electronic Media TV / Videos	5.64	0.00	54.55	27.27	18.18	0.00
Newspapers and magazines	3.00	20.00	20.00	40.00	20.00	0.00
Booklets given by RySS and others	5.65	16.67	44.44	33.33	5.56	0.00
Others	5.83	0.00	0.00	33.33	0.00	66.67

Source: IDSAP Survey 2021-22

Table 5.16: Number of interactions and satisfaction levels of the extension services provided by source of extension services for Scarce rainfall Zone in the state during March to June 2021-22

Source of advice / extension	Number of Interactions per farmer	Satisfactory levels				
		% of farmers reported no use	% of farmers reported less satisfied	% of farmers reported satisfied	% of farmers reported more satisfied	% of farmers reported Highly satisfied
Fellow farmers	2.78	1.40	15.38	58.04	18.18	6.99
Master farmer / ICRP	7.61	0.00	0.88	14.12	10.59	74.41
RySS staff -CRP, CA, MA, etc	4.89	0.00	2.66	10.30	14.95	72.09
SHG/VO members / leaders	3.24	4.44	14.44	16.67	34.44	30.00
Got formal training from RySS	1.53	1.69	5.08	18.64	42.37	32.20
Went for exposure Visits	0.89	0.00	20.00	40.00	20.00	20.00
NGO	0.75	0.00	100.00	0.00	0.00	0.00
Electronic Media TV / Videos	2.64	1.37	10.96	27.40	43.84	16.44
Newspapers and magazines	2.00	15.38	7.69	15.38	46.15	15.38
Booklets given by RySS and others	2.08	33.33	22.22	22.22	11.11	11.11
Others	0.33	0.00	0.00	0.00	0.00	100.00

Source: IDSAP Survey 2021-22

Chapter 6: Summary and Conclusion

6.1. Introduction

PMDS is a global breakthrough. The exact science of PMDS is yet to be determined. The enhancement of soil biology through CNF practices and raising of 8 to 15 diverse crops, as a mixed crops, creates some special conditions for the seed germination and plant survival during the dry seasons. The mulching material, which would be spread across the field, as a part of PMDS, 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 mulching material facilitates the percolation of the dew into the soil and prevents its evaporation again. Therefore, farmers grow PMDS during March-May/ June, followed by Kharif crops, Pre-Rabi Dry Sowing (PRDS) and Rabi crops, under the CNF scheme. The crops grown in PMDS and PRDS are used, ultimately, as green manure, after obtaining intermittently some cash income and food items to the farmers and green fodder to animals.

6.1.1. Objectives

The broad objective of this report is conducting a situational analysis of PMDS farming in the state. Specific objectives of this report are:

a. To know the status of PMDS adoption by farmers in the state
b. To assess the adoption of PMDS practices in relations to the protocols suggested by RySS
c. To estimate input use, costs, returns and other benefits of PMDS farming in the state
d. To identify major challenges faced by farmers in practicing PMDS farming, and
e. To suggest measures to improve the implementation of PMDS farming in the state for its rapid expansion among the farming community

6.1.2. Methodology

The entire report is based on the result of the primary survey, which is being undertaken by IDSAP during the agriculture year 2021-22. This report is a part of the study entitled "Assessing the impact of APCNF 2021-22" and the survey is being conducted as a part of the

entire study. Sample selection was based on the larger study needs. Some salient points of the methodology, especially, the sample selection process and size are discussed below. As mentioned in the beginning of this chapter, the focus of this year (Assessment of the Impact of CNF) study is to assess the impact CNF crops, which are grown on the PMDS plots. Hence, all CNF sample were drawn from the universe of CNF farmers who have cultivated PMDS during March to May/ June 2021.

This year also, the study adopted the agroclimatic zone wise analysis. Hence, the above data was reorganized into the six agroclimatic zones. Then, the agreed number of 104 sample GPs were allocated to the six zones in proportion to the number of PMDS+CNF farmers in that zone. The allocation varies from 11 GPs in the Scarce rainfall zone to 34 in the Southern zone. The High-altitude tribal areas (HAT) zone and Godavari zone got 13 GPs each . The household listing was conducted in each of 104 sample CNF GPs.

6.2. Status of PMDS in AP

- The sample farmers have cultivated PMDS in 1,629 plots. Out of total 1,629 total sample, 95 percent, i.e., 1,452 farmers have cultivated PMDS in plot each. Remaining 77 farmers (5 percent) have cultivated PMDS in more than one plot. On average each sample farmer cultivated 1.07 PMDS plot at the state level.
- Relatively better off zones (Godavari), farm category (medium and large farmers) and social category (OC) have higher number of PMDS plots per farmer. The average area allocated to PMDS during the study period, in any zone or by any category is higher than the recommended area of 0.203 hectares by RySS.
- At the state level, over 57 percent plots were grown on rainfall and nearly 38 percent of plots got irrigation from own or public (free) sources and 1.78 percent plots were irrigated with purchased water, including the tankers. Over 3 percent plots were grown on mist only.
- However, there are wide variations across the agroclimatic zones. While 98 percent plots in HAT zone are dependent on rainfall, about 80% of plots in the Southern zone are reliant on irrigation, including purchased water. It appears that irrigation is the major influencing factor in the size of area allocation for PMDS.
- Southern zone with irrigation facility to 80 percent of plots, has highest absolute and relative area allocation for PMDS in the state. Godavari zone with the irrigation

provision to majority of PMDS plots has second highest absolute area and third highest percentage area allocation for PMDS among all agroclimatic zones.

- As anticipated majority of PMDS plots of marginal and small farmers are based on rainfall and that of medium and large farmers are relied on irrigation. Here also the variations across the agroclimatic zones are larger than that of farm size categories. Over 6 percent PMDS plots in the North coastal and Southern zones got the required moistures from the mist only.
- Nearly 22 percent of PMDS plots were sown in the month of March 2021. More than 77 percent of PMDS plots were planted by the end of May 2021. About 95 percent plots were sown by the end of June 2021. There is hardly any pre-Rabi sowing of PMDS. This shows that RySS is successful in getting PMDS in time, i.e. pre-monsoon period.
- As per the listing datas of over 50,000 household, nearly two-thirds of CNF farmers have practiced PMDS in 2021.
- As high as 62 per cent of listed CNF farmers shifted to PMDS+CNF from CNF. Farmers irrespective of operational landholding size have shifted to PMDS+CNF from CNF. Pure tenants compared to pure owner farmers and owner-cum- tenant farmers have shifted to PMDS+CNF from CNF. It may be due to RySS focus on poor and vulnerable sections. Interestingly, higher percentage of farmers from assured irrigation zone have shifted to PMDS+CNF compared to those from rainfall dependent zones.

6.3. PMDS Farming Practices and RySS protocols

- **Area allocation:** RySS has recommended to allocate 0.5 acre, i.e., 0.203 hectare. Each of agroclimatic zone, farm size category and social category on average allocated more area for PMDS than recommended by RySS. On average each farmer has allocated 0.44 hectare for PMDS in 2021. In fact, 92 percent sample farmers in the state have allocated over 0.203 hectare to PMDS.
- **Number of Crops:** Cultivation of as many crops as possible under PMDS is very important, under PMDS design, to promote the diversity of lifeforms, especially the benign and useful microorganism, in the soils. Hence, RySS recommended to cultivate a mix of 15-20 crops under PMDS. On average 12 crops have been cultivated under PMDS plots by all farmers in the state in 2021. At the state level 34 percent of plots have less than 10 crops. The same are as high as 75 percent in Southern zone and 42 percent in Scarce rainfall zone; 60 percent for medium and large farmers; and 41

percent for OC, among social categories. About 27 percent plots in the states have over 15 crops. The same is as high as 62 percent in Godavari zone and 56 percent in North coastal zone; 32 percent for Marginal farmers and 30 percent for ST farmers.

- **Main crop:** Traditionally green manure crops were grown during the pre-monsoon period for green manure and fodder purposes. But in the PMDS, majority plots, over 52 percent (850) plots, are grown with some main crops. Main crop here means, sowing one crop, wither higher percentage of seeds, compared to other crops sown in the plot. The major purpose of main crop is to harvest the yields for the sale and/ or consumption. These are not meant for just fodder and manure purposes. Most prominent main crops are pulses crops grown, which are grown on 550 (one-third) plots; These include Black gram (18.49 percent plots), Green gram (4.91 percent), Horse gram (4.05 percent), Red gram (3.32 percent) and Bengal gram (2.75 percent). Groundnut is cultivated on 62 (3.81 percent) of total plots. Scarce rainfall zone with lowest rainfall in the state and less irrigation facilities have higher (71) percentage of plots with the main crop. It once again confirms the RySS assertion that a decent PMDS crops can be grown with minimum soil moisture equal to 2 mm rainfall.
- **Ghanajeevamrutham:** Application of Ghanajeevamrutham one of mandatory recommendation. However, there is no mentioned about the quantity to be applied and number of times it must be applied. Ghanajeevamrutham was applied one time in about 60 plots, two times in 25 percent plots and more than two times in the remaining plots. Ghanajeevamrutham was applied in 90 percent of sample PMDS plots in the state. The same varied from 80 percent in HAT zone and 84 percent in the Southern zone to 99 percent in Krishna zone and 100 percent in the Scarce rainfall zone.
- **Seed treatment with Beejamrutham:** Seed treatment is common operation in every model of agriculture. The seeds in 99 percent plots were treated with Beejamrutham before sowing. Even the lowest percentage of plots with seed treatment was 95.05 percent in HAT zone and 96.42 percent for ST farmers.
- **Pelletizing:** Pelletizing, i.e., coating seeds with with clay, Ghanajeevamrutham and ash, is one of the protocols given by RySS. However, only 17.29 percent plots were sown with pelletized seeds at the state level. The same varies from 2.25 percent in the Krishna zone to 31.42 percent in the Southern zone. Among the farm categories it varies from 14.48 percent plots of small farmers to 24.75 percent plots of medium and large farmers.
- **Dravajeevamrutham:** Application of Dravajeevamrutham is another method, along with Ghanajeevamrutham, of incorporating the microorganism into the soil. It would

be either sprayed directly on the crops or soil or mixed with water while irrigating the plot. It is one of the principal protocols for PMDS. At the state level, 94 percent PMDS plots were applied with Dravajeevamrutham. It varies from 74 percent in HAT zone to 100 percent Godavari, Krishna, and Scarce rainfall zone. Over 90 percent of PMDS plots of each of farm size category haven applied with Dravajeevamrutham.

- **Temporary Fencing:** Putting up of fence around the PMDS plots is one of the protocols of PMDS. However, only 17.49 percent plots at the state lever provided with the temporary fencing. Further, there are wider fluctuations across the zones, varying from 0.41 percent plots in the Godavari zone to 29.01 percent plots in the Southern zone. In the Scarce rainfall zones, where it is expected to be very useful, only 9.61 percent plots got temporary fencing. The variations across farm size and social categories are much less compared to that of agroclimatic zones.
- **Live fencing**: Live fencing with pole kinds trees such as Bamboo, Casuarina, Subabul, Drumstick, etc., which has minimum shade effect and busy plants, which reduce the wind velocity in the fields and protect crops from invading stray animals, is one of the recommended protocols of PMDS. At the state level, 21.73 percent plots got live fencing. It is hearting to note that the spread of live fencing is higher than the temporary fencing.
- **Mulching**: Mulching is yet another protocol of PMDS. At the state level, 42.14 percent plots were provided with mulching. But there are wider variations across the agroclimatic zones. While there is no mulching in Godavari and HAT zone, as many as 93.57 percent plots in the Krishna zone and 78.31 percent plots in Scarce rainfall zone. There are less variations among the plots of different farm categories.

6.4. Costs of, return, and surpluses/ deficits from, PMDS

- Though PMDS cultivatin is not competely aimed at the economic returns, over 71 percent of sample farmers have harvested some crop or other.
- Even after meeting all costs of own inputs used, including the value of own labour and the cost of all purchased inputs, except Krishna zone and SC farmers, all zones and farmers' categories recored surplues. ***It indicates that the PMDS has good potential to generate econommic, if not financial, surpluses over and above the total costs. RySS has to plan to reap these potentials.***

- Compared to the average paid-out cost of ₹.21,139 per hectare, and average returns, of all known benefits, of ₹.39,075 per hectare, the surplused from PMDS cultivation, at the state level, have increased to ₹.17,935 per hectare. Further, almost all agroclimatic zones and all categories of farmers have obtained surpluses. As anticipated, compared to the average purchased inputs' cost of ₹.10,181 per hectare and the average returns, of all benefits, of ₹.39,075 per hectare, the average surpluses, at the state level, have increased to ₹.28,893 per hectare. Every zone and farmers' category have obtained surpluses from PMDS.
- ***It is well known fact that almost all agriculture machinery, implements, bullocks, etc., particularly land, and most of the family labour remained idle during the summar months. By utilizing the land, agriculture machnery, assets and family labour in the cultivation of PMDS, the farmers can get real economic benefits, along with invaluable environmental services.***
- As some of the agricultural operations such as land preparation, ploughing, application of FYM, Ghanajeevamrutham, etc, are shiftef from Kharif/ Rabi cultivation to PMDS cultivation, it reduces the peak time demand for labour and agriculture machenery and assets. In the process, it reduces stress related to peak time demand of some agriculture operation and optimize the use of cultivators' family labour, agriculture machenary and assets.

6.5. Non-Monetary benefits of PMDS

- The incorporation of the multi-crop biomass into soil, improves soil quality, availability of green fodder to the animals in summer season, capturing water vapour from atmosphere, keeping the soil under the shade to protect microorganism/soil moisture, availability of quality and nutritious food to the family, and additional economic benefits from sale and consumption of PMDS produce are the benefits accrued to farmers in that order due to the PMDS crops in the project area of the state. Thus, farmers have gained more in ecological benefits along with economic benefits from PMDS in the state.
- Farmers from all the zone have gained higher benefits of improvements in soil fertility besides economic benefits, even though there are zone specific benefits like availability of green fodder for the farmers in the rainfall dependent zones.
- Small landholders as well as large landholders have gained more benefits of improvement in soil fertility as well as climate change by capturing water vapour from

atmosphere, compared to economic benefits. Further, the linkage between agriculture and animal husbandry have been strengthened due to PMDS.

- A comparison of benefits across the districts reveals that the incorporation of the multi-crop biomass to improve soil quality has been reported by the highest percentage of farmers across the districts, while the benefits of additional economic benefits from sale and consumption of PMDS produce has been given $5^{th}/6^{th}$ importance in terms of percentage of farmers reported. The importance for other benefits derived is specific to the local conditions prevalent in the districts. But it is evident that the PMDS intervention has provided more ecological benefits along with economic benefits also across the districts.

6.6. Challenges encountered in adopting PMDS

- The data has revealed that 35 per cent of farmers have not encountered any problems at all in adopting PMDS in the state as a whole. The remaining 65 per cent of farmers have encountered problems. Apart from scarcity of different inputs, lack of protection from grazing animals and leaving inadequate time to raise kharif and Rabi crops are the reasons holding back the farmers from adopting PMDS in the state. The same is true across zones, districts and category of farmer, Lack of extension services is one of the problems reported by the farmers that
- The first four dominant reasons for not growing PMDS in the entire cultivated area are: raising of PMDS is not leaving adequate time to raise kharif and Rabi crops; shortage of seeds; lack of protection of PMDS crops from grazing animals and shortage of mulching material in that order in the state as a whole
- The same pattern has emerged across the category of farmers by and large. The pattern has varied across zones and districts depending on the local specific conditions. However, lack of adequate extension services has also constrained farmers in growing PMDS crops in the entire cultivated area at the state level.
- The farmers in rainfall dependent zones have experienced inadequate extension services in relation to those farmers in assured irrigation zones-Godavari and Krishna. But the shortage of hired as well as family labour constrained farmers in growing PMDS in Godavari zone. It is clear from this analysis that extension plays a crucial role in expanding the area under PMDS.
- The extension services extended by RySS through master farmer/ ICRP, RySS staff at field level like CRPs, CAs, MAs, formal training, exposure visits, Booklets distributed,

SHG/VO members/leaders have led to frequent interaction with farmers. This has led to higher satisfaction levels for the farmers. This is true across all category of farmers, agroclimatic zones and districts.

- Farmer to farmer interactions have also improved the satisfaction levels. However, a comparison across the category farmers has revealed that there is a scope to improve quality of interaction of ICRPs with the pure tenants and small farmers The satisfaction levels are very high due to interaction with SHG/VO leaders/members Hence, there is also need to improve quality of interaction of SHG/VO leaders/members with farmers to improve satisfaction levels of farmers across the zones These improvements would result in the expansion of area under PMDS across the state.

6.7. Suggestions for expansion of PMDS in the state

- **Farmers have provided the following suggestions to overcome the problems encountered by them**:
  a. Seeds should be supplied by RySS through Rythu Bharosa Kendras at the village level to ensure quality as well as just price of the seeds. They further suggested seeds should be made available at subsidised price.
  b. They furthermore suggested that short duration crop should be raised under PMDS so that adequate time will be available for raising Kharif and Rabi crops.
  c. Mulching material and fencing material should be supplied through NPM shops in villages.
  d. The scarcity of hired labour and family labour can be overcome by linking MGNREGS with Agriculture.
  e. Farmers have reported extension services during PMDS are inadequate. They wanted more frequent interactions with ICRPs and CRPs during crop period of PMDS.
  f. Success stories of farmers of PMDS crops should be displayed through ***Pico*** Videos in the villages.
  g. Exposure: Visits to PMDS plots should be arranged for learning about PMDS.

- **Apart from above, the following suggestions are made from other sources**
  a. RySS may integrate the PMDS seed supply with the Government's "green manure crops' seed supply" scheme.

b. RySS may facilitate collective/ cooperative cultivation of PMDS to share labour, irrigation water, guarding the fields from stray cattle, etc.
c. Social fencing or social control on free grazing may be facilitated.
d. Whereever, the groundwater and canal water is not avialble, RySS may facilitate development of farm ponds, which can hold water throughout the year.
e. RySS may review the region specific need of certain protocols such as mulching, temporary fenching, pelletizing, etc.