# Assessing the Impact of Andhra Pradesh Community Managed Natural Farming: A comprehensive Approach Using Crop Cutting Experiments

***Second Interim Report***
***Kharif 2020-21***

**Submitted To**
**Rythu Sadhikara Samstha**
Department of Agriculture
Government of Andhra Pradesh


**Institute for Development Studies, AP**
**Engineering College Campus**
**Andhra University, Visakhapatnam 530003**
**Phone: +91-9949219613, 08912543366;**


**July, 2021**

## PROJECT TEAM

*Prof. S. Galab, Project Director*
*Dr G. Bhaskara Rao*
*Dr. Brajaraja Mishra*
*Prof. J Ramu Naidu*
*Dr P Prudhvikar Reddy*
*Prof. C Ravi*
*Dr D S R Raju*

# Acknowledgments

In completion of the Second Interim Report of Assessing the Impact of Andhra Pradesh Community Managed Natural Farming: A comprehensive Approach Using Crop Cutting Experiments, a large number of persons and agencies have helped us. First and foremost, we are grateful to our Chairman Prof. R. Radhakrishna for his encouragement to take up this study and his meticulous guidance and insightful comments at every stage of the work.

Special thanks are due to Shri. T. Vijay Kumar, IAS (Retired), Executive Vice Chairman, Rythu Sadhikara Samstha (RySS), Government of Andhra Pradesh for entrusting the project and reposing faith in us. We owe gratitude to Dr D V Raidu, IAS (Retired), Sri. G. Muralidhar, Dr. C.P. Nagi Reddy, RySS for their active participation, suggestions and continuous support in completion of this project. Our thanks are also due to Dr. (Smt.) Poonam Malakondiah, IAS, Principal Secretary, Department of Agriculture and Cooperation, Government of Andhra Pradesh and Sri. B. Rama Rao IAS., Special Commissioner, Department of Agriculture and Chief Executive Officer (CEO), RySS, Government of Andhra Pradesh for their support to the study. We thank the other members of the APCNF team at headquarters.

A number of RySS officials at field level have extended their help in facilitating our fieldwork. District Project Managers in all the thirteen districts and their staff gave all the support we needed to complete the fieldwork. We thank the Community Resource Persons (CRPs), Internal Community Resource Persons (ICRPs), and other staff in all the districts for their help and sharing their insights with us while conducting field survey.

We are grateful to Prof Swarna Vepa for giving the conceptual clarities in the study. She has gone through the text more than once and given many valuable insights and comments on the earlier versions of the chapters. She has also edited the text thoroughly. We acknowledge the services rendered by Prof. E. Nagabhusana Rao, Sri. P. Appa Rao, Mr. D. Satish, Mr. L Ravichandra Reddy. We appreciate the contribution of Sri. C M Reddy, Sri. P. Sam Sanjeev and their colleagues from NSSO for their staunch support in their respective areas.

We would like to record our appreciations of all the field supervisors and investigators, who have actively participated in the field work with all devotion, commitment and sincerity.

Lost but not least, we are indebted to the farmers of AP, who are the purpose of this study; particularly the sample farmers, who have given us their valuable time and educated us with their rich experience and inherent knowledge.

**Project Team**

# Contents

# List of Tables

# List of Figures

# Executive Summary

## 0.1. Context

0.1.1 The PMDS practice is a recent breakthrough in CNF. PMDS is a novel method of growing crops. PMDS enables farmers to raise crops in the dry seasons – before the monsoons, and also after the kharif crop.

0.1.2 It is a global breakthrough. The exact science is yet to be determined. The enhancement of soil biology through APCNF practices and raising 8 to 15 diverse crops create some special conditions. Those conditions enable seed germination with very little water and enable plants to harness water from the air.

0.1.3 It is a major instrument to harnesses the water vapor from atmosphere that drops to the land in the form of early morning dew. The dew supplies the required moisture to the soil. This is facilitated by the mulch material spread across the field. It uses this water vapor to provide moisture to the soil for plant to grow.

0.1.4 It contributes to cropping intensity, agricultural incomes, soil fertility and continuous green cover.

0.1.5 PMDS was taken up by 12,549 farmers in 24,307 acres in 1,800 villages across AP in 2019-20. This has gone up to over 50,000 farmers and over 50,000 acres of land across the state, in 2020-21.

## 0.2. Objectives

0.2.1 To compare the socio-economic profiles of PMDS+CNF farmers and non-APCNF farmers;

0.2.2 To estimate and compare the costs, yields and gross and net values of output from crop cultivation between PMDS + APCNF farmers and non-APCNF farmers;

0.2.3 To examine utilisation of land, labour, and credit for the adoption of CNF practices;

0.2.4 To examine environmental and health improvements due to PMDS+CNF; and

0.2.5 To provide suggestions in the implementation of APCNF on the basis of issues emerging from the analysis.

## 0.3. Methodology

0.3.1 The components for assessing the impact include “With and Without” Approach, Panel Surveys, Best farmers survey of PMDS+CNF farmers, Crop Cutting Experiments,

estimation of Costs and Returns of crops, qualitative surveys, and data collection and data management practices.

0.3.2 The study has employed a stratified, multi-stage random sampling scheme with Gram Panchayats (GPs) as first stage units and cultivators (households) as second stage units.

0.3.3 It has used two different universes of GPs for PMDS+CNF and non-CNF GPs to select sample Grama Panchayats and farmers. All the GPs where PMDS+CNF practices are followed constitutes the sample frame for drawing PMDS+CNF samples. The total list of GPs in the state, excluding the GPs of PMDS+CNF, formed the sample frame for non-CNF samples. In the sample design, each district is treated as a stratum. The total sample allocations are based on the stratum size.

0.3.4 The study proposed a total sample of 156 GPs with 104 GPs for the PMDS+CNF samples and 52 GPs for non- CNF samples. In case of PMDS+CNF, the sample of 104 GPs were allocated across the districts in proportion to the size of PMDS+CNF cultivators. However, in case of non-CNF, the total sample size of 52 GPs, was uniformly allocated to all the 13 districts, at the rate of 4 GPs for each district.

0.3.5 A sample of 10 cultivators was selected randomly from each GP, totalling 1,040 cultivators. Where 10 cultivators were not available in a GP, the deficit is compensated from another nearby sample GP. In order to cover at least 50 sample for each of the 12 crops, the study has increased sample size to 1,140 cultivators from 107 GPs. Using the same method and considerations, 646 non-CNF farmers were selected from 52 non-CNF villages.

0.3.6 Survey is limited to 12 major crops which account for more than 90% of the gross cropped area in the state. The crops include: (1) Paddy, (2) Groundnut, (3) Cotton, (4) Bengal gram, (5) Black gram, (6) Maize, (7) Red-gram, (8) Chillies, (9) Green gram, (10) Ragi, (11) Sugarcane, and (12) Horse gram.

## 0.4. Profiles of sample households

0.4.1 Representation of the most marginalized social groups such as scheduled castes (SCs) and scheduled tribes (STs) in CNF is considerable. This results in more social inclusiveness of CNF. The proportions of marginal farmers and pure tenant farmers are higher in CNF than those of non-CNF. The efforts of RySS in focusing on the marginalized sections of the society to achieve more socio-economic inclusiveness in CNF are met with success.

0.4.2 Relatively higher share of young farmers and also those in middle age in CNF is noteworthy. Similarly, proportion of educated and highly educated in CNF is considerably high. This is one of the greatest achievements of CNF. This may facilitate more experimentations in growing crops and innovative marketing strategies for marketing of CNF products. This in turn brings in vibrancy and ensures sustainability of CNF.

## 0.5. Changes in farming conditions

0.5.1 Given the sample size and other factors[1], the cost analysis is conducted for eight crops; and yield, gross and net values of outputs are analysed for six crops. Percentage changes in important parameters of farming are given at Table 0.1. The expenditure on biological inputs under CNF and chemical inputs under non-CNF are commonly referred as Plant Nutrients and Protection Inputs (PNPIs) in this study.

0.5.2 The expenditure on PNPIs and also paid-out costs is less under CNF in each of eight crops considered here. The savings are substantial in the resource intensive crops like Chillies, Cotton and Paddy.

0.5.3 Contrary to the expectations of higher prices for CNF output, the study got mixed results.

0.5.4 CNF farmers got higher yields in five out of six crops analysed here. This indicates that PMDS proved to be a boon for CNF. The yield variations, between CNF and non-CNF, also confirms the resilience potentials of CNF crops to heavy rains.

0.5.5 The gross values of CNF crop output are higher in all crops analysed.

0.5.6 Because of reduction in costs and increase in yields and better prices, five out of total six crops, analysed, got over 116% higher net values of output under CNF. In remain one crop, the net values of CNF output is higher by 59%.

0.5.7 ***The results indicate that CNF could be an effective method for doubling of the farmers income.***

0.5.8 A comparative analysis of gross values and net values, indicates that the reduction in cost of cultivation is the major contributory factors for the increase in net values of crop output. If CNF output commands at least a little, say 10%, higher prices over non-CNF output, farmers' incomes would double in one to two years.

[1] As RySS is interested in Ragi crop, it is included as a specal case, though adequate PMDS+CNF observations are not available.

**Table 0.1 : Crops wise changes in important indicators of farming due to CNF**

***(In Percent)***

| Crop | Expenditure on PNPIs | Paid-out costs | Reported prices | Yields | Gross values of output | Net values of output |
|---|---|---|---|---|---|---|
| Paddy | -60.37 | -24.76 | 4.01 | 4.25 | 4.86 | 59.22 |
| Groundnut | -43.30 | -3.94 | 13.00 | 12.91 | 39.66 | 142.20 |
| Cotton | -67.56 | -28.34 | -12.12 | 13.59 | 14.40 | 390.87 |
| Black gram | -49.19 | -29.70 | -4.76 | -12.51 | 46.04 | 116.76 |
| Maize | -54.55 | -31.01 | 0.47 | | | |
| Red gram | -32.36 | -43.36 | -1.06 | 1.23 | 92.41 | 348.25 |
| Chillies | -79.02 | -57.93 | -5.26 | | | |
| Ragi | -1.57 | -35.47 | -10.25 | 51.26 | 49.53 | 721.68 |

Note: All the figures are in percentages; the basic units are in quintals for yields & ₹. for all others per hectare,
*Source: IDSAP, Field Survey 2020-21*

## 0.6. Changes in input use

0.6.1 The area allocated towards CNF as a percentage of operated area in kharif season has increased from 26.48 in 2017-18 to 62.81 in 2020-21 at the state level and also in all agro-climatic zones.

0.6.2 The CNF sample farmers have cultivated 1,151.7 ha during the study season. Out of this, they have cultivated PMDS+CNF crops on 38% and only CNF crops on 24%. Over 56% Groundnut area is under PMDS+CNF model. The same is 48% in Paddy, 46% in Black gram and 42.4% in Cotton.

0.6.3 While only 9.1 percent of non-CNF farmers are growing mixed crops, 15.5% of CNF farmers are cultivating the mixed crops in the state. There are wider inter-zone variations in raising mixed crops. None of CNF and non-CNF farmers are raising mixed crops in Godavari and Krishna zones. On the other hand, 95.2% CNF farmers are growing mixed crops in High Altitude zones, which is about 58 percentage points higher than that of non-CNF farmers in that zone. Further, 43.3% CNF farmers in Scarce Rainfall Zone are cultivating mixed crops, which is about 40 percentage points higher than that of non-CNF farmers.

0.6.4 The average number of CNF inputs used and practices adopted by the CNF farmers has increased from 2.3 in 2017-18 to 5.5 in 2020-21. Further, there is a convergence among all agro-climatic zones. While High Altitude Zone has been adopting 6-7 practices since 2017-18, all other zones are quickly catching up.

0.6.5 Present survey results, once again, confirms that CNF is labour intensive process. It is interesting to note that relatively more labour is used, under CNF, in less input intensive crops. Such practices might have resulted in high crop yields, under CNF, in those crops. The share of own labour, including exchange labour, is high in all crops.

0.6.6 About 92% of CNF farmers have mobilized funds for cultivation and other purposes from own sources. This is about seven percentage points higher than that of non-CNF farmers. Relatively higher (3.4 percentage points) proportion of CNF farmers have mobilized funds from friends and relatives. This may be related to advances given to CNF farmers to supply the CNF food items. CNF farmers have mobilized 46% of required funds from own savings; it is about five percentage points higher than that of non-CNF farmers. CNF farmers' dependency on loans from formal and informal sources is relatively less vis-à-vis non-CNF farmers.

## 0.7. Environmental and health benefits

0.7.1 As expected, improvement in the soil health/ quality is extensively reported by 96 percent of farmers, at the state level. Out of 96% farmers, who have reported an improvement in soil quality, 97% have reported softening of soils, 81% experienced more green cover in their fields, 75% viewed more earthworms in their fields and 65% stated an improvement in the soil moisture.

0.7.2 Cascading impact of improvement in soil health improved crop health/ quality. About 94% CNF farmers have reported 'strong stems' in CNF crops vis-à-vis non-CNF crops; 90% have perceived an increase in 'grain weight'; and 75% stated that CNF crops can 'withstand heavy-rains'. Other benefits perceived by CNF farmers are related to CNF crops' 'tolerance to dry spells' (72%) and to 'withstand strong winds' (62%).

0.7.3 Around 77 percent of the farmers at the state level reported improvement in family members' health and 75% have stated reduction in paid-out costs towards health care.

0.7.4 Other wellness benefits reported include 'consuming CNF food' (96%); 'CNF food is tasty' (93%), 'liking CNF agriculture' (90%); 'improvement in family finance' (77%) and 'reduction in tension or increase in happiness' (59%).

## 0.8. Challenges and policy implications

0.8.1 The analysis and the discussions with the farmers have brought out clearly four challenges to be addressed by RySS. They are: (1) marketing support for CNF crops for obtaining higher prices compared to those of non-CNF; (2) utilization of land for

adopting CNF practices; (3) lack of adequate knowledge about CNF; and (4) the scarcity of raw material for preparing biological inputs.

0.8.2 First, marketing of the crop at remunerative price remains a major issue.

0.8.3 Measures such as issuing organic certificate to the farmers who have been practicing PMDS of CNF at least for three years; encouraging young professionals to get into CNF and to introduce innovative marketing models that would link up the CNF farmers with supply chains; encouraging farmers to promote Farmer Producer Organizations (FPOs) with the help of NGOs; and encouraging women's self-help groups and their federations to promote marketing of organic produce with the help of NGOs may address the marketing issue. Public procurement of CNF products is another option.

0.8.4 The second issue is that utilization of cultivated land for adopting CNF practices. It has two dimensions. Farmers may be encouraged to convert their land under non-CNF to PMDS+CNF across all districts. The analysis has also brought out the opportunities for shifting from single crops to mixed cropping pattern to improve the fertility and productivity of land in the districts.

0.8.5 The third issue is that there is a need for reducing the non-core workload and make more time available to grassroots level field staff for attending to extension work. The Rythu Bharosa Kendras should also be utilized effectively by the field staff for educating the farmers. Promotion of Compact Blocks of CNF in each cluster of villages as a demonstration block which is developed with all practices and models of CNF may encourage farmers to adopt CNF practices, this is evident from the discussions with DPMs.

0.8.6 The fourth issue is the availability of inputs for adopting CNF practices. In addition to the existing institutions which are in place to provide readymade inputs, the women self-help groups and their federations should be encouraged to run the NPM shops wherever possible through bank linkages for meeting the credit requirements. Moreover, some government land may be provided to these groups to grow plants required, as raw material, for preparing biological inputs. Provision of backward and forward linkage to prepare biological inputs may address the issues of availability of inputs. Local interest should be generated about the livelihood opportunities around CNF.

# Chapter 1: Context, Objectives and Methodology

## 1.1. Introduction

The Government of Andhra Pradesh has introduced the 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). It is a paradigm shift in agricultural development in the state and in the country. The program has targeted to cover all six million farmers and the entire cropped area in the state. To implement the programme effectively, an independent organization, known as Rythu Sadhikara Samastha (RySS), a not-for-profit company, was established. So far, the organisation has enrolled about 0.7 million farmers from 400 clusters covering 1,911 villages in 345 mandals, spread across all the 13 districts. The program plans to support each of participating farmer family for at least five years, till they attain remunerative and sustainable livelihoods. APCNF also aims at creation of human and social capital necessary for vibrant, inclusive, and sustainable agricultural production. Grassroots institutions such as Self-Help Groups (SHGs), Village Organizations (VOs) of SHGs and Farmers' SHGs and Farmers Producer Organizations (FPOs) are being strengthened and involved in the implementation of this transformation. Several training and awareness programs are being conducted to encourage farmers to use locally available natural organic resources instead of buying the chemical and other agricultural inputs from the market.

Apart from the state and regional level training, Non-Governmental Organizations (NGOs) and RySS offer training and technical support to successful local APCNF farmers called Master Farmers (MF) or Internal Community resource Persons (ICRP) who act as the main agents of change to get other farmers to adopt APCNF practices. The strategies of propagation include farmer-to-farmer learning through Master farmers, Community Resource Persons (CRPs), and pico-videos of tested practices. ICRPs, CRPs and Cluster Assistants (CAs) provide training on APCNF farming principles and practices such as input preparations, crop diversification, increasing cropping intensity, multi-layer crops, mixed or inter cropping and allied farming livelihoods.

## 1.2. Pre-Monsoon Dry Sowing

Recently RySS has made one of the major breakthroughs in APCNF in the form of the ***Pre-Monsoon Dry Sowing (PMDS)***. PMDS is a novel method of growing crops. PMDS enables farmers to raise crops in the dry seasons – before the monsoons. It is a global breakthrough. The exact science is yet to be determined. The enhancement of soil biology through APCNF practices and raising of 8 to 15 diverse crops creates some special conditions, which enable seed germination with very little water and enable the plants to harness water from the air. It is a catalyst to harnesses the water vapor from atmosphere that drops to the soil surface in the form of early morning dew. The dew can provide the required moisture to the soil. This is facilitated by the ***mulch material*** spread across the field. This is mostly practiced before the advent of monsoon, during summer and before beginning of the Rabi season. This system believes that land should always be covered with vegetation and farmers should not depend on rainy season alone for growing crops. It contributes to cropping intensity, agricultural incomes, soil fertility and continuous green cover. Farmers practicing PMDS should follow the RySS's PMDS Protocols. According to the data base of RySS, PMDS was taken up by 12,549 farmers in 24,307 acres in 1,800 villages across AP in 2019-20. This has gone up to around 90,000 farmers and about 50,000 acres of land, across the state, in 2020-21.

Broad objectives of APCNF are of *i*) reduction in cost of cultivation through elimination of chemical fertilizers and pesticides, *ii*) usage of locally available inputs, *iii*) adoption of natural means of soil fertility and soil quality enhancement, *iv*) 365 Day Green Cover (365 DGC) and different models of agriculture and v) promotion of village seed banks. These and climate risks are addressed by treating each holding as a watershed and adopting diversified crop models such as 5-layer models (multiple layers of crops are grown on a piece of land simultaneously) and 36*36 models (a piece of 36 meter by 36-meter land developed with diversified crops to yield sustainable and continuous income to farmer household throughout the year). System of Root Intensification (SRI) and Micro Irrigation are promoted to improve water usage efficiency. APCNF is a set of practices that include seed treatment through liquid microbial solution (Beejamrutham), soil treatment and soil fertility enhancement through locally made liquid and solid microbial materials, from local cow dung-based formulations (Beejamrutham, Dravajeevamrutham and Ghanajeevamrutham), soil protection by taking crop residues back to the soil and using live mulching to keep the ground covered all the time through poly-cropping. However, the farmers adopt these practices sometimes for full season cycle, sometimes for part

season cycle. Sometimes they allot part of their land to natural farming. Thus, the agroecological practices of different models of APCNF impact the production conditions of farmers such as improved soil fertility, improved yield, improved quality of output, improved health of farming community and resilience of crops to droughts, floods, and cyclones differently. In the above backdrop, it is proposed to assess the impact of PMDS+CNF on farming and farmers.

## 1.3. Objectives

The current study is in continuation of the impact studies for 2019-20 undertaken by Institute for Development Studies Andhra Pradesh (IDSAP), Visakhapatnam. This is the second interim report of 2020-21 study, covering the Kharif 2020 season. The objectives of the study are:

i. To compare the socio-economic profiles of PMDS+CNF farmers and non-APCNF farmers.
ii. To estimate and compare the cost structure, yields and net returns from crop cultivation between PMDS + APCNF farmers and non-APCNF farmers.
iii. To examine utilisation of land, labour, credit for the adoption of PMDS+CNF practices
iv. To examine environmental and health improvements due to PMDS+CNF, and
v. To provide suggestions in the implementation of APCNF based on issues emerging from the analysis.

## 1.4. Methodology

### *1.4.1. The Basic Approach*

This study is a variation of the previous impact studies conducted in 2018-19 and 2019-20 on APCNF. Earlier studies assessed the effectiveness of APCNF with the help of field surveys on various aspects. This study covers the same aspects with a fresh random sample of farmers adopting PMDS+CNF and non-APCNF farmers.

The study has deployed “with and without” method to assess the impact of PMDS+CNF. In this method the outcomes of PMDS+CNF farmers, cultivating a particular crop, are compared with the outcomes of the non-APCNF farmers cultivating the same crop, using chemical inputs. Costs and returns for the crops considered for the analysis have been obtained from the farmers through farmer household survey to assess the impact of PMDS+ APCNF on costs and returns of crops. Crop Cutting Experiments (CCEs) have been conducted to assess the yields of the

crops scientifically. Community Managed Natural farming (CNF) is used interchangeably to mean APCNF as well as PMDS+CNF and PMDS+CNF. Similarly non-APCNF or non-CNF are used interchangeably.

### *1.4.2. Sample Design*

The main approach of the study, as mentioned earlier, is based on what is known as "with and without" methodology wherein the outcomes of a random sample of PMDS+CNF cultivators are compared with the outcomes of another random sample of non-CNF cultivators. Also, to avoid the possible contamination due to the influence of PMDS+CNF on non-CNF outcomes, the study followed two different sampling schemes separately for PMDS+CNF and non-APCNF with different sample frames. In both the cases the study followed a stratified, multi-stage sampling scheme with Gram Panchayats (GPs) as first stage units and cultivators (households) as second stage units.

### *1.4.3. Coverage of the Survey*

The study is conducted in all the 13 districts of the State of Andhra Pradesh. For PMDS+CNF the coverage of the study is the entire area where PMDS+CNF is practiced. Rest of Andhra Pradesh is covered under non-CNF. All the GPs, where PMDS+ CNF practices were followed, constitutes the sample frame for drawing PMDS+CNF samples. This list with number of cultivators following PMDS+CNF *as of September 2020* is provided by RySS. According to the data provided by RySS, the universe for PMDS+CNF cultivators consists of 3,135 GPs with 63,812 cultivators practicing PMDS+CNF as of September 2020. The district wise distribution of PMDS farmers is given in Table 1.1.

**Table 1.1: District wise Number of PMDS cultivators in Andhra Pradesh (as of September 2020)**

| Sl. No | District | Total Gram Panchayats (GPs) | Total PMDS cultivators | Total PMDS+CNF cultivators |
|---|---|---|---|---|
| 1 | Anantapuramu | 250 | 2,258 | 2,150 |
| 2 | Chittoor | 283 | 6,940 | 4,358 |
| 3 | East Godavari | 237 | 7,997 | 4,639 |
| 4 | Guntur | 219 | 6,951 | 1,653 |
| 5 | YSR Kadapa | 455 | 10,059 | 9,266 |
| 6 | Krishna | 266 | 5,154 | 3,360 |
| 7 | Kurnool | 270 | 5,481 | 5,178 |
| 8 | PSR Nellore | 246 | 5,587 | 3,180 |
| 9 | Prakasam | 152 | 4,364 | 1,138 |

| | | | | |
|---|---|---|---|---|
| 10 | Srikakulam | 80 | 6,048 | 6,048 |
| 11 | Visakhapatnam | 260 | 4,647 | 4,139 |
| 12 | Vizianagaram | 213 | 18,849 | 14,457 |
| 13 | West Godavari | 204 | 5,337 | 4,246 |
| | Total | 3,135 | 89,672 | 63,812 |

Source: RySS, 2020

The total list of GPs in the state excluding the GPs of PMDS+CNF formed the sample frame for non-CNF samples. In the sample design, each district is treated as a stratum. The total sample allocations are based on the stratum size.

Further, in a survey of this nature, it is not feasible to cover many crops, given the sample size. Therefore, survey is limited to 12 major crops that are identified based on the cropped area in the state. These crops together account for more than 90% of the gross cropped area in the state. The crops include: (1) Paddy, (2) Groundnut, (3) Cotton, (4) Bengal Gram, (5) Black Gram, (6) Maize, (7) Red Gram, (8) Chillies, (9) Green Gram, (10) Ragi, (11) Sugarcane and (12) Horse gram. Some of these crops are one season crops (e.g., Bengal gram is predominantly a Rabi crop) and some Kharif crops are long duration crops (e.g., Sugarcane and Chillies), whose harvesting continues into Rabi season. It implies that lesser than above 12 crops were covered during the Kharif survey and in this report

### *1.4.4. Selection of Gram Panchayats (GPs)*

The study proposed a total sample of 156 GPs with 104 GPs for the PMDS+CNF samples and 52 GPs for non- CNF samples. In case of PMDS+CNF, the sample of 104 GPS were allocated across the districts in proportion to the size of PMDS+CNF cultivators (see Table 1.1). However, in case of non-CNF, the total sample size of 52 GPS, was uniformly allocated to all the 13 districts at the rate of four GPs in each district. This is so because the total sample size for non-CNF itself is only 52 and proportional allocation would be less efficient. Further, in case of non-CNF GPs, there was no information of on **size** (total cultivators), the selection was based on simple random sampling.

### *1.4.5. Selection of PMDS+CNF sample*

The sampling frame for selecting the cultivators is derived from a household listing carried in each GP covering all the PMDS+CNF cultivators. At the time of listing information on whether the cultivator is practicing PMDS+CNF is collected to *eliminate non-CNF cultivators in sample selection*. This formed the universe for the selection of sample PMDS+CNF farmers.

From this, a sample of 10 cultivators was selected randomly from each sample GP, totalling 1040 cultivators. Wherever 10 cultivators were not available in a GP, the deficit is compensated from another nearby sample GP, preferably from the same Mandal. While drawing samples, care has been taken to make sure that each of the 12 crops would be covered in at least 50 samples. This was achieved by increasing sample size of GPs and cultivators. As a result, the survey covered a total sample size of 1,140 cultivators from 107 GPs (See Table 1.2).

**Table 1.2: District wise sample GPs and allocated sample farmers**

| Sl. No | District | Sample GPs for survey | Sample PMDS+CNF cultivators |
|---|---|---|---|
| 1 | Anantapuramu | 5 | 32 |
| 2 | Chittoor | 8 | 84 |
| 3 | East Godavari | 11 | 111 |
| 4 | Guntur | 7 | 65 |
| 5 | YSR Kadapa | 8 | 80 |
| 6 | Krishna | 7 | 72 |
| 7 | Kurnool | 7 | 70 |
| 8 | PSR Nellore | 7 | 75 |
| 9 | Prakasam | 7 | 77 |
| 10 | Srikakulam | 10 | 101 |
| 11 | Visakhapatnam | 7 | 69 |
| 12 | Vizianagaram | 16 | 234 |
| 13 | West Godavari | 7 | 70 |
| | Total | 107 | 1,140 |

Source: IDSAP Field Survey, 2020-21

### *1.4.6. Selection of non-CNF sample*

In case of non-CNF samples, the listing was carried out as in case on PMDS+CNF. However, to save time and costs, the listing is confined to about 250 cultivators. In GPs with less than 250 cultivators, entire GP is listed. When the number of cultivators is more than 250, the listing is confined to 3 randomly selected Panchayat Wards of GP and in another randomly selected ward in case of deficit. As in case of PMDS+CNF, the listing operation, of non-CNF, collected all the relevant information for selecting of sample cultivators. From each GP, a sample of 10 cultivators was selected randomly for the survey. However, to get the required minimum number of observations for each of selected crops, total sample size has been increased from 520 to 646 (Table 1.3).

### *1.4.7. Panel and Best Farmer Sample Surveys*

Besides cross-sectional surveys in PMDS+CNF and non-CNF farmers, 260 Panel-1 (10 farmers from each of two sample villages of all 13 districts) and 130 panel-2 farmers (5 farmers from each of two villages of all 13 districts) of the CNF households were surveyed for kharif 2020. Further, 130 Best Farmers at the rate 10 per each of 13 districts were selected randomly from the list of Best Farmers provided by RySS, and they were surveyed (Table 1.3).

**Table 1.3:Sample size of CNF and non-CNF villages and farmers during Kharif 2020-21**

| | CNF | | Non-CNF | |
|---|---|---|---|---|
| | No. of villages | Sample Size | No. of villages | Sample Size |
| Cross section sample | 107 | 1,140 | 52 | 646 |
| Panel 1 * | 26 | 252 | | |
| Panel 2 * | 13 | 129 | | |
| Best farmers | | 130 | | |
| Total Quantitative sample | 146+ | 1,651 | 52 | 646 |

*Note: * There is some shortfall in Panel data, because some farmers are not doing cultivation due to different reasons.*
*+ Best farmers data is collected from several villages across the district and state. Hence, total number of CNF villages is much more.*
*Source: IDSAP, Field Survey 2021.*

It was planned to collect the qualitative information through three methods, viz. 78 focus group discussions (FGDs), 13 strategic interviews (SIs) with the district project managers (DPMs) and 65 case studies (CSs) of progressive and model farmers and (social) entrepreneurs. This work is in progress

The study has included 12 major crops cultivated across the state for detailed study during the year. The crops include: (1) Paddy, (2) Groundnut, (3) Cotton, (4) Bengal Gram, (5) Black Gram, (6) Maize, (7) Red Gram, (8) Chillies, (9) Green Gram, (10) Ragi, (11) Sugarcane and (12) Horse gram.

## 1.5. Data Collection and Management Process

In all, a total of seven research tools, viz. (1) Household listing schedules, (2) Village survey schedule (3) Questionnaire for PMDS+CNF households, (4) Questionnaire for non-APCNF households, (6) Checklist for Case Studies, and (7) Checklist for Strategic Interviews were instrumented and (7) Checklist for Focused Group Discussions were used. The quantitative

filed-based instruments have in-built checks with appropriate skip patterns over and above the supportive manual with instructions and clarification for all questionnaires. The research tools were finalized through a series of brainstorming consultations. An intensive training and field testing were carried out to train the field investigators and supervisors at Andhra University, Visakhapatnam during last week of September 2020. The field staff is placed continuously in the field/ districts to track the farming and related activities of sample farmers throughout the year. Each sample farmer would be visited about eight times by the field staff to collect the data about farmer households details and farming throughout the year.

The household survey for the Kharif season of 2020-21, was conducted from early- November 2020 to end of February 2021. As per the design, each sample farmer is visited minimum two times during the season to collect the household and farming data and to conduct the Crop Cutting Experiments (CCEs). Senior team members have visited the field and cross-checked the information filled and participated in data collection processes; conducted SIs with DPMs and a few field staff of RySS, participated in the FGDs, visited fields, especially the model farmers and farm practices and social entrepreneurs.

Out of total 12 crops, proposed to be covered during the present yearlong study, 30 plus sample observations, for cost and returns estimates, were obtained for eight crops, viz., Paddy, Groundnut, Cotton, Black gram, Maize, Red gram, Chillies and Ragi from non-CNF farmers. But 30 plus observations were obtained only for first six crops from PMDS+CNF farmers (Table 1.4). The distribution of sample farmers according to Agroclimatic Zones, Districts and Category of farmers is presented in Annexure Table 1.1. All the eight crops, including Chillies and Ragi, which have only 16 observations each, are analysed with respect to cost of cultivation and marketing parameters. Other four crops viz., Bengal gram, Sugarcane, Green gram, and Horse gram will be covered in the Rabi season.

Table 1.4: Number of sample observations for Cost of cultivation and returns estimates

| Crop | PMDS+CNF plots | Non-CNF plots |
|---|---|---|
| Paddy | 819 | 501 |
| Groundnut | 46 | 58 |
| Cotton | 54 | 57 |
| Black gram | 13 | 50 |
| Maize | 29 | 55 |
| Red gram | 45 | 66 |
| Chillies | 15 | 41 |

| | | |
|---|---|---|
| Ragi | 9 | 48 |

*Source: APCNF Field Survey 2020-21*

Crop Cutting Experiments (CCEs) were conducted scientifically to get an independent estimate of crop yields under PMDS+CNF and non-APCNF. For each of the selected farmer, a plot where the farmer is growing the major crop, is identified. From this parcel of land, a plot of *size as required by the procedure* has been selected at random for estimating yield through CCEs. It is to be noted that the study has adopted standard methodology of Indian Agricultural Statistical Research Institute (IASRI), which is followed by NSSO and Directorate of Economics and Statistics (DES) of all state, including Andhra Pradesh, for conducting CCEs. It was planned to conduct at least one CCE for each sample farmer to get adequate sample for each crop. Crop wise number of CCEs conducted at district level is shown in Table 1.5. In all 840 CCEs from PMDS+CNF plots of project sample and 407 CCEs from non-CNF plots of control sample were conducted during Kharif season. These totals include all twelve crops planned during the year. However, adequate sample observations of 30 plus were obtained for six PMDS+CNF crops and five non-CNF crops (Table 1.5). All these crops are analyzed with respect to yield and returns parameters. The distribution of CCEs according to crops, type of farming, and agroclimatic zones is presented in Annexure Table 1.2.

**Table 1.5: Crop wise number of CCEs conducted during Kharif 2020-21**

| Crop | PMDS+ APCNF | Non-APCNF |
|---|---|---|
| Paddy | 507 | 129 |
| Groundnut | 33 | 32 |
| Cotton | 82 | 45 |
| Black Gram | 36 | 31 |
| Red Gram | 48 | 62 |
| Ragi | 32 | 20 |
| Total (Including other crops) | 840 | 407 |

*Source: IDSAP Field Survey 2020-21*

The data entry Programme was written in CS-Pro software and used for data entry and processing. Data is processed using the SPSS and Excel software. A separate mobile-based app is developed/ generated to enter the CCEs' information; and training is given to all the field staff, after duly installing the app on their mobiles. Descriptive statistics, frequency distributions and cross tabulation are generated at state level, agro-climatic zone wise, farm

category wise and district wise. The list of agro-climatic zones is stated in Annexure Table 1.3. A more rigorous statistical analysis of the data would be carried out in a separate report.

## 1.6. Sample Weights for Cross Section Survey

For any estimate of the aggregate for the state, $Y_s$ is derived as the sum of estimates of aggregates of the strata (districts) i.e.

$$Y_s = \sum Y_j$$

where $Y_j$ is estimate of aggregate for the j[th] Strata (district).

The aggregate estimate for any district Y is given by dropping subscript j

### *1.6.1. In case of PMDS+CNF*

$$\hat{Y} = \frac{Z}{n} \sum_{i=1}^{n} \frac{1}{z_i} \left[ \frac{H_i}{h_i} \sum_{k=1}^{h_i} y_{ik} \right]$$

where, Z = total number of PMDS+CNF cultivators in the district,

n = number of Gram Panchayats in the district,

$z_i$ = number of PMDS+CNF cultivators in GP,

$H_i$ = number of households listed,

$h_i$ = number of households selected,

y = any characteristic of household.

'i' stands for the GP and 'k' stands for the farmer

### *1.6.2. In case of non-CNF,*

$$\hat{Y} = \frac{N}{n} \sum_{i=1}^{n} \frac{W_i}{w_i} \left[ \frac{H_i}{h_i} \sum_{k=1}^{h_i} y_{ik} \right]$$

where, N = total non-CNF GPs of a district,

n = sample number of GPs in the district (which is 4),

$W_i$ = number of Wards in the village,

$w_i$ = number of wards selected for listing,

$H_i$ = number of households listed,

$h_i$ = number of households selected, and

y = any characteristic of household.

## 1.7. Structure of the Report

The context, objectives and methodology of the study have been presented in Chapter 1. Chapter 2 describes the socio-economic profile of the sample PMDS+CNF and non-APCNF households. The parameters used include socio-economic group composition, literacy levels, and age of the farmers, the head of the households. Chapter 3 consists of the comparative analyses between the PMDS+CNF and non-CNF farmers with regards to the changes in expenditure on Plant Nutrient and Plant protection inputs (PNPIs), paid-out costs, crop yields, gross and net values of output. Resources used to adopt CNF practices have been analyzed in chapter 4. The environmental and health benefits of the APCNF are presented in Chapter 5. Chapter 6 contains the discussions on the issues and challenges and policy suggestions. Apart from all these chapters, executive summary is also presented in the Report.

**Annexure to Chapter 1**

**Annexure Table 1.1: Number of sample farmers covered across Districts, Argo-climate zones, and Category of farmers**

| | Type of Sample Farmers | |
|---|---|---|
| | PMDS+CNF | Non-CNF |
| **Agroclimatic Zone** | | |
| High Altitude Zone | 42 | 98 |
| North Coastal Zone | 362 | 109 |
| Godavari Zone | 150 | 70 |
| Krishna Zone | 219 | 140 |
| Southern Zone | 270 | 124 |
| Scarce Rainfall Zone | 97 | 105 |
| Total | 1140 | 646 |
| **Farm Category** | | |
| Pure Tenant | 96 | 20 |
| Marginal | 677 | 385 |
| Small | 292 | 180 |
| Medium & Large | 75 | 61 |
| Total | 1140 | 646 |
| **District** | | |
| Srikakulam | 101 | 39 |
| Vizianagaram | 234 | 63 |
| Visakhapatnam | 69 | 95 |
| East Godavari | 80 | 40 |
| West Godavari | 70 | 40 |
| Krishna | 70 | 40 |
| Guntur | 72 | 40 |
| Prakasam | 77 | 60 |
| SPS Nellore | 75 | 40 |
| YSR Kadapa | 111 | 40 |
| Kurnool | 65 | 50 |
| Anantapuramu | 32 | 55 |
| Chittoor | 84 | 44 |
| Total | 1140 | 646 |

Source: IDSAP Field Survey, 2020-21

**Annexure Table 1.2: Number of CCEs Conducted across Districts, Agroclimatic Zones, Category of farmers for PMDS+CNF, Non-APCNF, Panel 1 and Panel 2 Farmers**

**Farming Type: PMDS+CNF**

| | High Altitude Zone | North Coastal Zone | Godavari Zone | Krishna Zone | Southern Zone | Scarce Rainfall Zone | Total |
|---|---|---|---|---|---|---|---|
| Paddy | 95 | 155 | 92 | 106 | 47 | 12 | 507 |
| Groundnut | 0 | 0 | 0 | 0 | 11 | 22 | 33 |
| Cotton | 11 | 12 | 0 | 20 | 17 | 22 | 82 |
| Bengal Gram | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| Black Gram | 3 | 7 | 2 | 14 | 10 | 0 | 36 |
| Maize | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Red Gram | 12 | 0 | 0 | 0 | 3 | 33 | 48 |
| Chillies | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| Green Gram | 0 | 10 | 0 | 2 | 5 | 2 | 19 |
| Ragi | 25 | 0 | 0 | 0 | 7 | 0 | 32 |
| Sugarcane | 0 | 40 | 0 | 0 | 0 | 0 | 40 |
| Other crops | 0 | 40 | 0 | 0 | 0 | 1 | 41 |

Source: IDSAP Field Survey, 2020-21

**Farming Type: Non-CNF**

| | High Altitude Zone | North Coastal Zone | Godavari Zone | Krishna Zone | Southern Zone | Scarce Rainfall Zone | Total |
|---|---|---|---|---|---|---|---|
| Paddy | 33 | 38 | 10 | 12 | 31 | 5 | 129 |
| Groundnut | 0 | 0 | 0 | 0 | 5 | 27 | 32 |
| Cotton | 4 | 14 | 0 | 9 | 9 | 9 | 45 |
| Bengal Gram | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Black Gram | 0 | 25 | 0 | 0 | 6 | 0 | 31 |
| Maize | 0 | 0 | 0 | 3 | 0 | 0 | 3 |
| Red Gram | 0 | 24 | 0 | 0 | 1 | 37 | 62 |
| Chillies | 0 | 0 | 0 | 0 | 6 | 3 | 9 |
| Green Gram | 0 | 8 | 0 | 3 | 3 | 2 | 16 |
| Ragi | 20 | 0 | 0 | 0 | 0 | 0 | 20 |
| Sugarcane | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
| Other crops | 0 | 40 | 0 | 0 | 0 | 0 | 40 |
| Total | 57 | 169 | 10 | 27 | 61 | 83 | 407 |

Source: IDSAP Field Survey, 2020-21

**Annexure Table 1.3: List of Agro-climatic zones in Andhra Pradesh**

| Sl. No. | Name of the Zone | Districts |
|---|---|---|
| I | High altitude and Tribal areas Zone | High altitude and Tribal areas of Srikakulam, Vizianagaram, Visakhapatnam and East Godavari districts |
| II | North Coastal Zone | Srikakulam, Vizianagaram, Visakhapatnam |
| III | Godavari Zone | East Godavari, West Godavari |
| IV | Krishna Zone | Krishna, Guntur, Prakasam |
| V | Southern Zone | Chittoor, Kadapa, Nellore |
| VI | Scarce Rainfall Zone | Kurnool, Anantapur |

Source: CRIDA, Hyderabad

# Chapter 2: Indications of Social Sustainability of APCNF: Evidence from Profiles of PMDS+CNF and Non-APCNF Farmers

## 2.1. Introduction

This chapter compares the profiles of the sample farmers of PMDS+CNF with those of non-APCNF to assess whether they differ in their composition of profiles. It is very pertinent to note here that the PMDS+CNF sample of farmers are drawn from the PMDS+CNF universe of the Grama Panchayats and the sample of non-APCNF farmers are from the non-APCNF farmers of the Grama Panchayats. It should also be noted that Community Natural Farming (CNF for short) is used for PMDS+CNF and similarly, non-CNF is used for non-APCNF hereafter for enhanced readability.

The profile is characterized through the parameters such as social categories of farmers (Scheduled Castes, Scheduled Tribe, Backward Castes and Other Castes) gender categories of farmers by land ownership (Male and Female), land ownership categories by class of farmers (pure tenants, marginal farmers, small farmers, and other category of farmers including medium and large farmers). The profile includes literacy levels of the farmers, (illiterate and educated farmers with different levels of education), age of the farmers (young, middle, and old age farmers). The analysis is conducted for agroclimatic zones, districts, and category of farmers.

There is an argument in the literature that the CNF should bring socio-economic inclusiveness in agriculture. In simplistic terms the socio-economic inclusiveness means the participation of larger proportion of marginalized social groups such as Scheduled Castes (SCs), Scheduled Tribes (STs), women, and marginalized economic groups like pure tenants, marginal and small farmers in the CNF over non-CNF to share the benefits that flow from CNF. More of these groups' participation in CNF indicates policy of inclusiveness in agriculture. The socio-economic inclusiveness contributes to the sustainability of CNF. Other socio-economic groups participate in CNF as they realize the benefits of CNF due to better access to information and better access to resources. But the marginalized socio-economic groups get their due space in

CNF due to institutional policy interventions such as Rytu Sadhhikar Samstha. There is also an argument that young and educated farmers are attracted by CNF.

This chapter makes a preliminary analysis to examine the sustainability of CNF through socio-economic inclusion of marginalised sections, and presence of relatively younger and more educated. This analysis is conducted at agroclimatic zones level, district level and category of farmers' level.

## 2.2. Research Questions

In the above backdrop, this chapter addresses the following specific research questions:

i. Whether the presence of farmers belonging to SCs, STs and women is more in CNF over those in non-CNF?
ii. Were there more pure-tenant, marginal and small farmers in CNF compared to non-CNF?
iii. How far the young, educated have been attracted to CNF compared to non-CNF?
iv. How do these parameters of profiles differ between CNF and non-CNF farmers across agroclimatic zones, districts, and category of farmers?

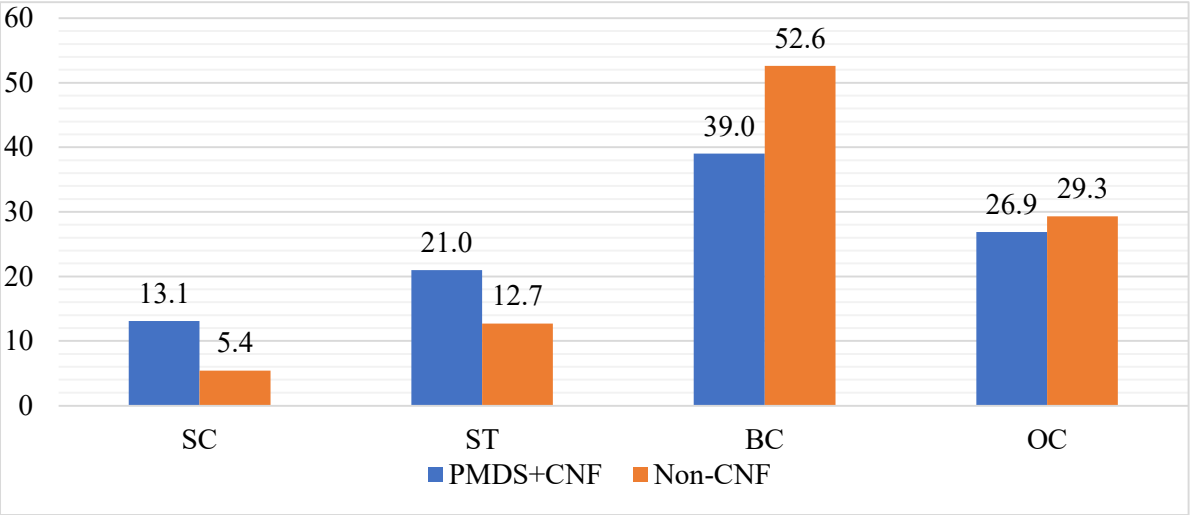
## 2.3. Social Inclusiveness

### *2.3.1. Caste Composition*

Representation of SCs is more among CNF compared to non-CNF in all the agroclimatic zones except in the high-altitude zone where predominantly tribal population resides. Similarly, Tribal farmers are also present in higher proportion among CNF in all the zones except Scarce Rainfall Zone. It is important to note that almost all the tribal farmers have adopted CNF in the CNF gram panchayats of High Altitude Zone. As a matter of fact, the participation of tribal farmers in CNF is higher by 30 percentage points over non-CNF. The conversion into CNF from non-CNF of these communities is faster due to the benefits from CNF that alleviate their distress conditions. Moreover, natural farming is close to their hearts down the centuries. The social profile of farmers seems to be broad based in Scarce Rainfall and Southern and North Coastal zones due to more distress conditions in non-CNF agriculture. Presence of SCs and STs across all the categories of farmers in CNF compared to non-CNF indicates the fact that

the marginalised sections of farmers are shifting to CNF from non-CNF (Figure 2.1 and Annexure Table 2.1).

**Figure 2.1: Social Group wise Composition of PMDS+CNF and non-CNF farmers**
**(In percentage)**




Source: IDSAP Field Survey, 2020-21

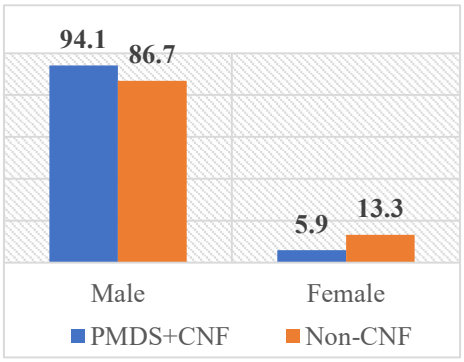
### *2.3.2. Gender Composition*

The male farmers owning land dominate both CNF and non-CNF. Participation of women farmers who own land is low in CNF(PMDS+CNF) compared to their participation in non-CNF. This is true across all the agroclimatic zones, districts, and all categories of farmers (Figure 2.2).

Female participation is lower, in comparison with the state average female farmers participation, in Krishna Zone and in the districts of Srikakulam, West Godavari, Krishna, Guntur, Anantapuramu and Chittoor. There are fewer females among pure tenants and small farmers in non-CNF. However, female participation in CNF is higher, compared to state average participation of female farmers in North Coastal Zone and Scarce Rainfall Zone. Srikakulam, Vizianagaram, East Godavari, Prakasam, SPS Nellore and YSR Kadapa among the districts indicate more than average female participation. It is interesting to note that the participation of female farmers is the highest (16.7 per cent) in Nellore among the districts in CNF (Annexure Table 2.2). Similarly, compared to the state average participation of female farmers in CNF, female participation is higher among marginal and small farmers. The female farmer participation in CNF is higher than the state average of female farmer participation, while is it lower than that of state average in non-CNF (Annexure Table 2.2).

**Figure 2.2: Distribution of PMDS+CNF and non-CNF according to the Gender of Household Head**

**(In Percentage)**



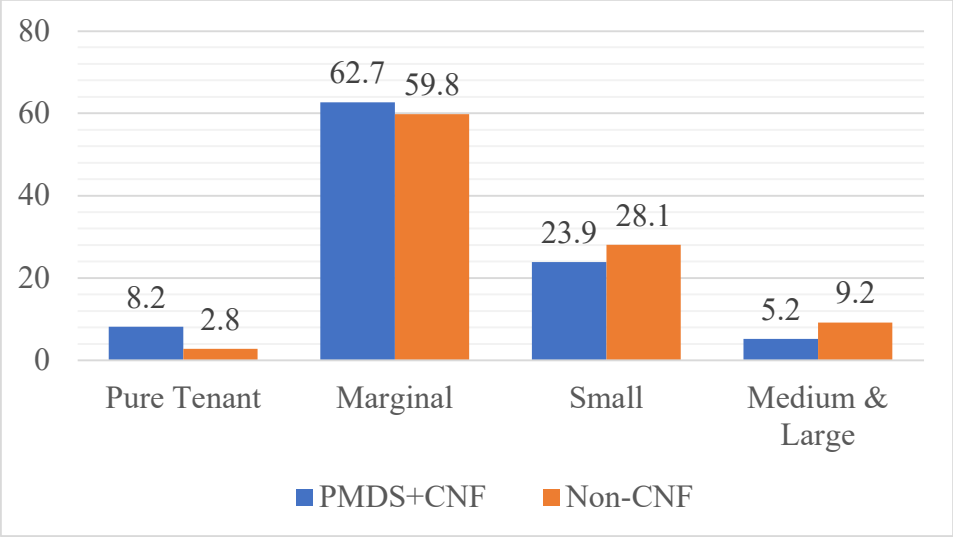

Source: IDSAP Field Survey, 2020-21

## 2.4. Economic Inclusiveness

### *2.4.1. Composition of Category of Farmers*

Marginal farmers and pure tenant farmers are higher in CNF than that of non-CNF by 2.9% and 5.4% respectively in the state (Figure 2.3). Across all the agroclimatic zones except the High-Altitude Zone, the presence of pure tenant farmers in CNF is higher than those in non-CNF. There are no pure tenant farmers in CNF Grama Panchayats in High Altitude Zone as a higher percentage of tribal population own some piece of land. The pure tenants are more among CNF as well as non-CNF in Godavari and Krishna zones as tenancy is highly prevalent in these zones. The presence of pure tenants is higher among CNF compared to non-CNF in delta districts such as East Godavari, Krishna and Guntur districts. West Godavari is an exception to this, having fewer pure tenants among the CNF. It is also interesting to note that tenancy is conspicuously absent in Chittoor and SPS Nellore districts not only in CNF Grama Panchayats but also in non-CNF grama Panchayats. However, the pure tenants are present in all other districts, though they vary in percentages, in CNF over non-CNF. This indicates that the local conditions influence the tenancy transactions to enable the pure tenants to get into CNF. Benefits of CNF over non-CNF may encourage owners to evolve flexible terms and conditions favourable to both owners and tenants in course of time. For instance, even though the districts Anantapuramu and Kurnool are from Scarce Rainfall Zone, in Anantapuramu, compared to Kurnool, higher percentage of pure tenants got into CNF. This institution of tenancy has been used as a risk-sharing mechanism traditionally in Anantapuramu (Annexure Table 2.3).

**Figure 2.3: Farm-category wise Distribution of PMDS+CNF and non-CNF farmers (%)**




Source: IDSAP Field Survey, 2020-21

As far as marginal farmers are concerned, their participation in CNF and non-CNF is predominant across all the zones and districts. However, higher percentage of marginal farmers were into CNF compared to non-CNF in High Altitude, Southern and Scarce Rainfall zones. CNF is an age-old tradition for tribal farmers. But their higher participation in other two zones may be due to benefits from CNF over non-CNF (Annexure Table 2.3).

The presence of small farmers is higher in CNF over non-CNF in High Altitude and Godavari zones among the zones. Compared to High Altitude Zone, the small farmers are more into CNF over non-CNF in Godavari zone. The district level analysis reveals that apart from Srikakulam and East Godavari; Prakasam from Krishna Zone; YSR Kadapa and Nellore from Southern zone; and Kurnool from Scarce Rainfall Zone did also have higher presence of small farmers in CNF over non-CNF. This again provides testimony to the fact that local condition decides the movement of farmers into CNF from non-CNF (Annexure Table 2.3).

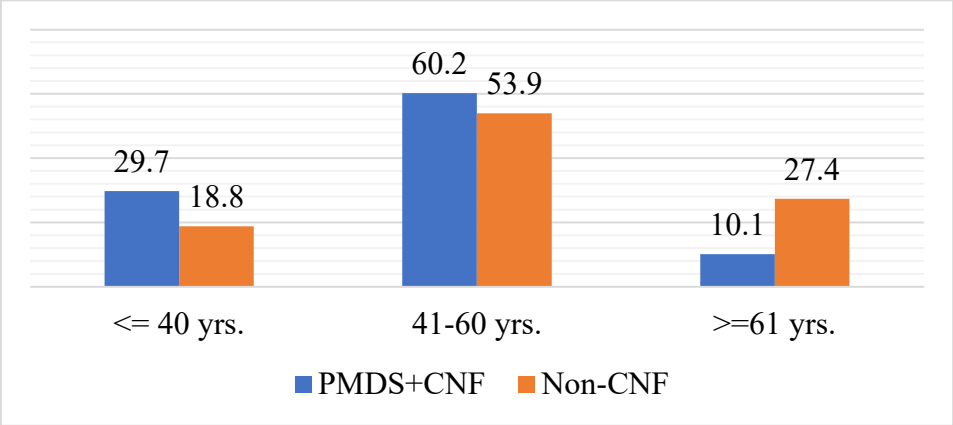
The participation of medium and large farmers is lower compared to other farmers (marginal and small farmers) in both the CNF and non-CNF across the zones and districts. Among the zones, the presence of medium and large farmers is higher in CNF over non-CNF in Godavari, Southern and North Coastal Zones in that order. The district level analysis has revealed that apart from Srikakulam from north coastal zone, West Godavari from Godavari zone, Guntur from Krishna zone and Anantapuramu from Scarce Rainfall Zone have higher percentage of medium and large farmers into CNF over non-CNF. The movement of medium and large farmers into CNF from non-CNF from Anantapuramu is striking (Annexure Table 2.3).

## 2.5. Presence of Young and Educated in CNF

### *2.5.1. Age of Farmers*

The age composition of the farmers in CNF and non-CNF is given in the Annexure Table 2.4. It is striking to note that more of younger, and middle aged, and less of older farmers are into CNF than those into non-CNF. The younger and middle-aged farmers are more into CNF by 11 percentage points and 6 percentage points respectively and the old-aged farmers lower by 17.3 percentage points. This clearly provides compelling evidence that CNF has attracted the young and middle-aged farmers (Figure 2.4). All the zones experienced this pattern. But this is pronounced among the High Altitude, Godavari, Krishna, and Scarce Rainfall zones among the zones in case of young farmers. Similarly, North Coastal Zone and Southern Zone in case of middle-aged farmers. The same is true across districts except in West Godavari district where old age farmers have participated into CNF. This is also true across all the categories of farmers (Annexure Table 2.4)

**Figure 2.4: Composition of PMDS+CNF and non-CNF farmers according to Age of Head (%)**

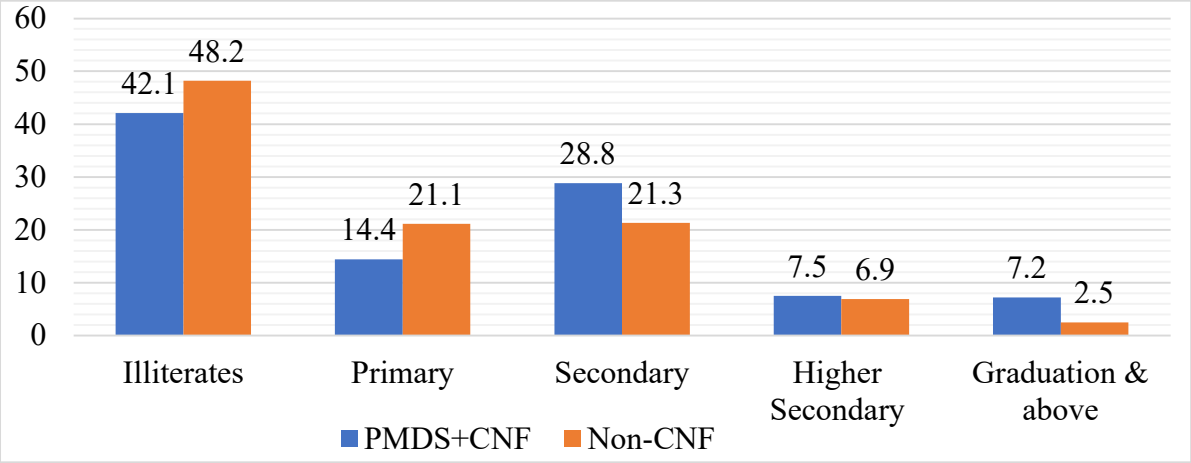



Source: IDSAP Field Survey, 2020-21

### *2.5.2. Literacy levels of Farmers*

Relatively fewer illiterate farmers and a greater number of highly educated farmers who have educational qualifications above secondary level, and above graduation are into CNF. The illiterate farmers are lower by 6.1 percentage points, farmers with secondary education, higher secondary/Diploma, and graduation and above are more by 7.5; 0.6; 4.7 per centage points in CNF over non-CNF in the state (Figure 2.5).

**Figure 2.5: Composition of PMDS+CNF and non-CNF farmers according to Education Level of Household Head (%)**




Source: IDSAP Field Survey, 2020-21

This is clearly a pointer to the fact that the educated are slowly moving into CNF. It provides evidence to the process of educated getting into CNF. All the agroclimatic zones have undergone by and large though this process of educated getting into CNF slowly. Visakhapatnam compared to Srikakulam and Vizianagaram is ahead in this. East Godavari district is relatively better off compared to West Godavari in this process in Godavari Zone. Guntur district compared to Krishna and Prakasam are faster in this process from Krishna Zone. Chittoor in comparison with YSR Kadapa and Nellore is moving faster in the process from Southern Zone. Anantapuramu district has moved relatively faster than Kurnool in this process.

Among the category of farmers, CNF attracted more highly educated and literate farmers over non-CNF in case of all the category of farmers except medium and large farmers. However, the medium and the large farmers who have secondary education have moved more into CNF. Among the category of farmers, pure tenants, marginal and small farmers compared to medium and large farmers have got into CNF relatively faster (Annexure Table 2.5)

## Annexure to Chapter 2

### Annexure Table 2.1 Agroclimatic zone wise, Farm size composition wise and district wise distribution of PMDS+CNF and non-CNF farmers across Social Communities (in Percentages)

| | SC | ST | BC | OC | Total |
|---|---|---|---|---|---|
| **I. Agroclimatic Zone** | | | | | |
| PMDS+CNF Farmers | | | | | |
| High Altitude Zone | 0.0 | 99.0 | 0.0 | 1.0 | 100.0 |
| North Coastal Zone | 5.5 | 25.3 | 63.8 | 5.4 | 100.0 |
| Godavari Zone | 4.0 | 38.7 | 25.0 | 32.2 | 100.0 |
| Krishna Zone | 23.5 | 1.6 | 48.0 | 27.0 | 100.0 |
| Southern Zone | 18.4 | 3.1 | 31.6 | 47.0 | 100.0 |
| Scarce Rainfall Zone | 17.1 | 1.8 | 78.2 | 2.9 | 100.0 |
| Total | 13.1 | 21.0 | 39.0 | 26.9 | 100.0 |
| Non-CNF Farmers | | | | | |
| High Altitude Zone | 1.5 | 69.2 | 27.1 | 2.2 | 100.0 |
| North Coastal Zone | 3.6 | 4.7 | 87.3 | 4.4 | 100.0 |
| Godavari Zone | 2.9 | 0.0 | 34.0 | 63.1 | 100.0 |
| Krishna Zone | 0.9 | 0.8 | 63.8 | 34.5 | 100.0 |
| Southern Zone | 9.7 | 1.6 | 29.6 | 59.2 | 100.0 |
| Scarce Rainfall Zone | 11.8 | 6.0 | 60.3 | 22.0 | 100.0 |
| Total | 5.4 | 12.7 | 52.6 | 29.3 | 100.0 |
| **II. Farm-Size Composition** | | | | | |
| PMDS+CNF Farmers | | | | | |
| Pure Tenant | 30.9 | 4.6 | 47.0 | 17.5 | 100.0 |
| Marginal | 13.5 | 21.1 | 42.3 | 23.0 | 100.0 |
| Small | 6.6 | 27.0 | 30.1 | 36.4 | 100.0 |
| Medium & Large | 9.4 | 18.2 | 28.1 | 44.3 | 100.0 |
| Total | 13.1 | 21.0 | 39.0 | 26.9 | 100.0 |
| Non-CNF Farmers | | | | | |
| Pure Tenant | 8.7 | 0.0 | 62.9 | 28.4 | 100.0 |
| Marginal | 5.6 | 10.7 | 58.1 | 25.6 | 100.0 |
| Small | 4.6 | 17.7 | 42.2 | 35.4 | 100.0 |
| Medium & Large | 5.6 | 14.4 | 45.4 | 34.7 | 100.0 |
| Total | 5.4 | 12.7 | 52.6 | 29.3 | 100.0 |
| **III. District wise Distribution** | | | | | |
| PMDS+CNF Farmers | | | | | |
| Srikakulam | 1.9 | 1.7 | 88.6 | 7.7 | 100.0 |
| Vizianagaram | 0.8 | 41.5 | 57.7 | 0.0 | 100.0 |
| Visakhapatnam | 6.1 | 72.2 | 16.0 | 5.8 | 100.0 |
| East Godavari | 1.7 | 29.7 | 43.7 | 24.9 | 100.0 |
| West Godavari | 5.7 | 45.3 | 11.4 | 37.5 | 100.0 |
| Krishna | 20.8 | 0.0 | 60.4 | 18.8 | 100.0 |
| Guntur | 37.8 | 4.1 | 27.2 | 30.9 | 100.0 |
| Prakasam | 17.5 | 3.3 | 34.6 | 44.5 | 100.0 |
| SPS Nellore | 22.4 | 15.1 | 47.2 | 15.3 | 100.0 |
| YSR Kadapa | 16.1 | 0.0 | 30.0 | 53.9 | 100.0 |
| Kurnool | 6.1 | 0.0 | 91.8 | 2.0 | 100.0 |
| Anantapuramu | 42.0 | 5.9 | 47.3 | 4.8 | 100.0 |
| Chittoor | 20.3 | 1.5 | 25.2 | 53.1 | 100.0 |

| | | | | | |
|---|---|---|---|---|---|
| Total | 13.1 | 21.0 | 39.0 | 26.9 | 100.0 |
| Non-CNF Households | | | | | |
| Srikakulam | 6.3 | 1.8 | 91.9 | 0.0 | 100.0 |
| Vizianagaram | 4.6 | 24.2 | 71.2 | 0.0 | 100.0 |
| Visakhapatnam | 0.0 | 43.1 | 50.8 | 6.1 | 100.0 |
| East Godavari | 0.0 | 47.6 | 13.8 | 38.6 | 100.0 |
| West Godavari | 4.5 | 0.0 | 36.6 | 58.9 | 100.0 |
| Krishna | 0.0 | 0.0 | 90.3 | 9.7 | 100.0 |
| Guntur | 0.0 | 3.3 | 60.5 | 36.1 | 100.0 |
| Prakasam | 2.2 | 0.0 | 44.3 | 53.5 | 100.0 |
| SPS Nellore | 32.4 | 0.0 | 11.0 | 56.7 | 100.0 |
| YSR Kadapa | 2.1 | 5.2 | 41.1 | 51.6 | 100.0 |
| Kurnool | 11.6 | 0.0 | 79.7 | 8.7 | 100.0 |
| Anantapuramu | 12.1 | 15.2 | 30.4 | 42.3 | 100.0 |
| Chittoor | 5.2 | 0.9 | 31.4 | 62.5 | 100.0 |
| Total | 5.4 | 12.7 | 52.6 | 29.3 | 100.0 |

Source: IDSAP Field Survey, 2020-21

**Annexure Table 2.2 Agroclimatic zone wise, Farm size composition wise and District-wise Gender classification of Head of Households of PMDS+CNF and non-CNF farmers (in Percent)**

| | PMDS+CNF | | | Non-CNF | | |
|---|---|---|---|---|---|---|
| | Male | Female | Total | Male | Female | Total |
| **I. Agroclimatic Zone** | | | | | | |
| High Altitude Zone | 95.6 | 4.4 | 100.0 | 85.2 | 14.8 | 100.0 |
| North Coastal Zone | 92.5 | 7.5 | 100.0 | 87.0 | 13.0 | 100.0 |
| Godavari Zone | 95.7 | 4.3 | 100.0 | 87.8 | 12.2 | 100.0 |
| Krishna Zone | 97.5 | 2.5 | 100.0 | 91.2 | 8.8 | 100.0 |
| Southern Zone | 92.0 | 8.0 | 100.0 | 86.3 | 13.7 | 100.0 |
| Scarce Rainfall Zone | 95.8 | 4.2 | 100.0 | 82.4 | 17.6 | 100.0 |
| Total | 94.1 | 5.9 | 100.0 | 86.7 | 13.3 | 100.0 |
| **II. Farm-Size Composition** | | | | | | |
| Pure Tenant | 97.0 | 3.0 | 100.0 | 90.0 | 10.0 | 100.0 |
| Marginal | 93.8 | 6.2 | 100.0 | 84.8 | 15.2 | 100.0 |
| Small | 93.6 | 6.4 | 100.0 | 90.2 | 9.8 | 100.0 |
| Medium & Large | 95.6 | 4.4 | 100.0 | 86.6 | 13.4 | 100.0 |
| Total | 94.1 | 5.9 | 100.0 | 86.7 | 13.3 | 100.0 |
| **III. District-wise Distribution** | | | | | | |
| Srikakulam | 90.3 | 9.7 | 100.0 | 89.5 | 10.5 | 100.0 |
| Vizianagaram | 93.6 | 6.4 | 100.0 | 83.9 | 16.1 | 100.0 |
| Visakhapatnam | 94.4 | 5.6 | 100.0 | 87.8 | 12.2 | 100.0 |
| East Godavari | 93.3 | 6.7 | 100.0 | 80.3 | 19.7 | 100.0 |
| West Godavari | 97.5 | 2.5 | 100.0 | 91.7 | 8.3 | 100.0 |
| Krishna | 100.0 | 0.0 | 100.0 | 100.0 | 0.0 | 100.0 |
| Guntur | 96.8 | 3.2 | 100.0 | 95.8 | 4.2 | 100.0 |
| Prakasam | 91.9 | 8.1 | 100.0 | 81.6 | 18.4 | 100.0 |
| SPS Nellore | 83.3 | 16.7 | 100.0 | 71.8 | 28.2 | 100.0 |
| YSR Kadapa | 93.2 | 6.8 | 100.0 | 74.2 | 25.8 | 100.0 |
| Kurnool | 96.1 | 3.9 | 100.0 | 77.0 | 23.0 | 100.0 |
| Anantapuramu | 94.9 | 5.1 | 100.0 | 90.6 | 9.4 | 100.0 |
| Chittoor | 95.0 | 5.0 | 100.0 | 94.8 | 5.2 | 100.0 |
| Total | 94.1 | 5.9 | 100.0 | 86.7 | 13.3 | 100.0 |

Source: IDSAP Field Survey, 2020-21

**Annexure Table 2.3: Agroclimatic zone wise and District-wise distribution of PMDS+CNF and non-CNF farmers across Farm-size Groups (in Percentages)**

| | PMDS+CNF | | | | | Non-CNF | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pure Tenant | Marginal | Small | Medium & Large | Total | Pure Tenant | Marginal | Small | Medium & Large | Total |
| **I. Agroclimatic Zone** | | | | | | | | | | |
| High Altitude Zone | 0.0 | 66.8 | 32.5 | 0.7 | 100.0 | 1.5 | 49.1 | 31.4 | 18.0 | 100.0 |
| North Coastal Zone | 4.3 | 71.2 | 20.4 | 4.1 | 100.0 | 0.0 | 76.6 | 23.1 | 0.3 | 100.0 |
| Godavari Zone | 12.9 | 60.6 | 18.5 | 7.9 | 100.0 | 12.0 | 80.1 | 7.3 | 0.6 | 100.0 |
| Krishna Zone | 24.8 | 58.2 | 14.0 | 3.1 | 100.0 | 7.5 | 61.7 | 24.2 | 6.5 | 100.0 |
| Southern Zone | 3.8 | 62.8 | 27.5 | 5.9 | 100.0 | 0.0 | 56.1 | 30.4 | 13.5 | 100.0 |
| Scarce Rainfall Zone | 4.1 | 48.3 | 36.2 | 11.5 | 100.0 | 0.3 | 44.7 | 41.8 | 13.2 | 100.0 |
| Total | 8.2 | 62.7 | 23.9 | 5.2 | 100.0 | 2.8 | 59.8 | 28.1 | 9.2 | 100.0 |
| **II. District-wise distribution** | | | | | | | | | | |
| Srikakulam | 1.4 | 67.3 | 23.8 | 7.5 | 100.0 | 3.4 | 86.4 | 6.8 | 3.4 | 100.0 |
| Vizianagaram | 1.6 | 70.5 | 23.6 | 4.4 | 100.0 | 0.0 | 55.8 | 32.5 | 11.8 | 100.0 |
| Visakhapatnam | 4.0 | 69.5 | 25.9 | 0.5 | 100.0 | 0.0 | 58.0 | 34.3 | 7.7 | 100.0 |
| East Godavari | 20.0 | 60.0 | 15.9 | 4.2 | 100.0 | 2.7 | 79.8 | 11.4 | 6.1 | 100.0 |
| West Godavari | 7.8 | 61.1 | 20.5 | 10.7 | 100.0 | 15.4 | 74.3 | 10.2 | 0.0 | 100.0 |
| Krishna | 28.8 | 62.2 | 7.1 | 1.9 | 100.0 | 15.7 | 62.3 | 16.1 | 5.9 | 100.0 |
| Guntur | 38.9 | 44.1 | 12.7 | 4.4 | 100.0 | 9.2 | 52.1 | 37.2 | 1.5 | 100.0 |
| Prakasam | 2.2 | 60.5 | 32.5 | 4.8 | 100.0 | 0.0 | 66.4 | 23.8 | 9.8 | 100.0 |
| SPS Nellore | 0.0 | 92.2 | 7.8 | 0.0 | 100.0 | 0.0 | 88.8 | 7.2 | 4.0 | 100.0 |
| YSR Kadapa | 7.1 | 51.6 | 30.4 | 10.8 | 100.0 | 0.0 | 35.2 | 27.0 | 37.8 | 100.0 |
| Kurnool | 2.0 | 51.5 | 39.2 | 7.3 | 100.0 | 0.0 | 53.2 | 27.8 | 18.9 | 100.0 |
| Anantapuramu | 8.6 | 41.1 | 29.3 | 21.0 | 100.0 | 0.8 | 31.6 | 63.3 | 4.4 | 100.0 |
| Chittoor | 0.0 | 66.0 | 34.0 | 0.0 | 100.0 | 0.0 | 53.0 | 38.7 | 8.3 | 100.0 |
| Total | 8.2 | 62.7 | 23.9 | 5.2 | 100.0 | 2.8 | 59.8 | 28.1 | 9.2 | 100.0 |

Source: IDSAP Field Survey, 2020-21

**Annexure Table 2.4: Agroclimatic zone wise, Farm-Size wise and District-wise distribution of PMDS+CNF and non-CNF farmers according to Age of Head of the Farmer (in Percent)**

| | PMDS+CNF | | | | Non-CNF | | | |
|---|---|---|---|---|---|---|---|---|
| | <= 40 yrs. | 41-60 yrs. | >=61 yrs. | Total | <= 40 yrs. | 41-60 yrs. | >=61 yrs. | Total |
| **I. Agroclimatic Zone** | | | | | | | | |
| High Altitude Zone | 58.7 | 41.3 | 0.0 | 100.0 | 17.4 | 54.8 | 27.8 | 100.0 |
| North Coastal Zone | 16.0 | 65.9 | 18.1 | 100.0 | 14.6 | 45.4 | 40.0 | 100.0 |
| Godavari Zone | 30.4 | 63.3 | 6.3 | 100.0 | 13.8 | 77.5 | 8.8 | 100.0 |
| Krishna Zone | 35.8 | 57.9 | 6.3 | 100.0 | 21.0 | 56.4 | 22.5 | 100.0 |
| Southern Zone | 23.3 | 64.4 | 12.2 | 100.0 | 21.0 | 52.8 | 26.2 | 100.0 |
| Scarce Rainfall Zone | 41.3 | 49.0 | 9.6 | 100.0 | 21.3 | 49.1 | 29.6 | 100.0 |
| Total | 29.7 | 60.2 | 10.1 | 100.0 | 18.8 | 53.9 | 27.4 | 100.0 |
| **II. Farm-Size Composition** | | | | | | | | |
| Pure Tenant | 29.2 | 63.9 | 6.9 | 100.0 | 42.3 | 49.3 | 8.5 | 100.0 |
| Marginal | 30.7 | 59.4 | 9.8 | 100.0 | 16.3 | 57.2 | 26.5 | 100.0 |
| Small | 29.7 | 59.0 | 11.3 | 100.0 | 21.4 | 49.2 | 29.5 | 100.0 |
| Medium & Large | 18.6 | 68.4 | 13.0 | 100.0 | 19.8 | 47.9 | 32.3 | 100.0 |
| Total | 29.7 | 60.2 | 10.1 | 100.0 | 18.8 | 53.9 | 27.4 | 100.0 |
| **III. District-wise Distribution** | | | | | | | | |
| Srikakulam | 10.4 | 52.1 | 37.5 | 100.0 | 11.3 | 37.3 | 51.3 | 100.0 |
| Vizianagaram | 20.3 | 64.5 | 15.2 | 100.0 | 6.9 | 56.9 | 36.2 | 100.0 |
| Visakhapatnam | 45.2 | 52.4 | 2.4 | 100.0 | 26.4 | 47.8 | 25.8 | 100.0 |
| East Godavari | 36.4 | 60.1 | 3.5 | 100.0 | 13.9 | 58.4 | 27.7 | 100.0 |
| West Godavari | 25.9 | 65.6 | 8.4 | 100.0 | 11.3 | 88.7 | 0.0 | 100.0 |
| Krishna | 32.5 | 60.9 | 6.6 | 100.0 | 22.7 | 62.4 | 14.9 | 100.0 |
| Guntur | 28.3 | 63.7 | 7.9 | 100.0 | 30.0 | 51.0 | 19.0 | 100.0 |
| Prakasam | 50.9 | 45.1 | 4.0 | 100.0 | 14.9 | 54.6 | 30.5 | 100.0 |
| SPS Nellore | 29.9 | 58.0 | 12.1 | 100.0 | 1.0 | 68.5 | 30.5 | 100.0 |
| YSR Kadapa | 25.4 | 65.8 | 8.8 | 100.0 | 27.8 | 50.9 | 21.3 | 100.0 |
| Kurnool | 31.3 | 56.0 | 12.7 | 100.0 | 28.9 | 42.3 | 28.9 | 100.0 |
| Anantapuramu | 64.1 | 33.2 | 2.7 | 100.0 | 9.6 | 59.6 | 30.8 | 100.0 |
| Chittoor | 15.3 | 65.8 | 18.9 | 100.0 | 24.9 | 48.5 | 26.6 | 100.0 |
| Total | 29.7 | 60.2 | 10.1 | 100.0 | 18.8 | 53.9 | 27.4 | 100.0 |

Source: IDSAP Field Survey, 2020-21

**Annexure Table 2.5 Agroclimatic zone wise, Farm-Size wise and District-wise distribution of PMDS+CNF and non-CNF farmers according to Education level of the Farmer Households (in Percentages)**

| | Illiterates | Up to Primary | Upto Secondary | Higher Secondary/ Diploma | Graduation & above | Total |
|---|---|---|---|---|---|---|
| **I. Agroclimatic Zone** | | | | | | |
| PMDS+CNF Farmers | | | | | | |
| | | | | | | |
| High Altitude Zone | 50.6 | 8.8 | 21.6 | 12.5 | 6.6 | 100.0 |
| North Coastal Zone | 49.3 | 14.4 | 24.9 | 8.0 | 3.5 | 100.0 |
| Godavari Zone | 38.1 | 21.0 | 27.1 | 7.0 | 6.8 | 100.0 |
| Krishna Zone | 36.4 | 18.7 | 25.2 | 8.3 | 11.4 | 100.0 |
| Southern Zone | 37.8 | 13.1 | 36.3 | 5.4 | 7.3 | 100.0 |
| Scarce Rainfall Zone | 55.1 | 5.7 | 22.2 | 9.2 | 7.8 | 100.0 |
| Total | 42.1 | 14.4 | 28.8 | 7.5 | 7.2 | 100.0 |
| Non-CNF Households | | | | | | |
| High Altitude Zone | 65.5 | 14.7 | 10.2 | 5.5 | 4.1 | 100.0 |
| North Coastal Zone | 61.7 | 5.5 | 22.7 | 7.9 | 2.2 | 100.0 |
| Godavari Zone | 35.4 | 19.0 | 35.1 | 5.9 | 4.6 | 100.0 |
| Krishna Zone | 49.7 | 20.2 | 21.3 | 5.5 | 3.4 | 100.0 |
| Southern Zone | 27.9 | 38.2 | 29.0 | 3.3 | 1.6 | 100.0 |
| Scarce Rainfall Zone | 47.4 | 24.8 | 14.0 | 13.1 | 0.8 | 100.0 |
| Total | 48.2 | 21.1 | 21.3 | 6.9 | 2.5 | 100.0 |
| **II. Farm-Size Composition** | | | | | | |
| PMDS+CNF Farmers | | | | | | |
| Pure Tenant | 42.4 | 21.9 | 27.9 | 4.2 | 3.6 | 100.0 |
| Marginal | 40.8 | 13.5 | 31.3 | 7.0 | 7.4 | 100.0 |
| Small | 42.9 | 16.1 | 22.6 | 10.6 | 7.8 | 100.0 |
| Medium & Large | 52.4 | 5.4 | 29.0 | 5.2 | 8.1 | 100.0 |
| Total | 42.1 | 14.4 | 28.8 | 7.5 | 7.2 | 100.0 |
| Non-CNF Households | | | | | | |
| Pure Tenant | 57.4 | 8.6 | 12.7 | 21.3 | 0.0 | 100.0 |
| Marginal | 50.8 | 21.7 | 20.7 | 5.2 | 1.7 | 100.0 |
| Small | 44.3 | 21.5 | 23.8 | 7.7 | 2.8 | 100.0 |
| Medium & Large | 40.8 | 19.8 | 19.6 | 11.4 | 8.3 | 100.0 |
| Total | 48.2 | 21.1 | 21.3 | 6.9 | 2.5 | 100.0 |
| **III. District-wise Distribution** | | | | | | |
| PMDS+CNF Farmers | | | | | | |
| Srikakulam | 44.8 | 14.6 | 30.0 | 5.8 | 4.9 | 100.0 |
| Vizianagaram | 50.3 | 18.8 | 21.3 | 5.4 | 4.2 | 100.0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Visakhapatnam | 50.5 | 6.8 | 24.0 | 13.8 | 4.8 | 100.0 |
| East Godavari | 35.9 | 27.4 | 25.2 | 3.8 | 7.7 | 100.0 |
| West Godavari | 39.7 | 16.3 | 28.5 | 9.4 | 6.1 | 100.0 |
| Krishna | 46.6 | 16.6 | 21.4 | 8.1 | 7.3 | 100.0 |
| Guntur | 23.6 | 30.5 | 20.5 | 10.6 | 14.8 | 100.0 |
| Prakasam | 21.7 | 13.7 | 38.8 | 6.9 | 18.9 | 100.0 |
| SPS Nellore | 48.8 | 5.8 | 36.7 | 4.4 | 4.3 | 100.0 |
| YSR Kadapa | 49.9 | 5.9 | 33.3 | 4.8 | 6.1 | 100.0 |
| Kurnool | 69.2 | 7.1 | 12.6 | 8.9 | 2.1 | 100.0 |
| Anantapuramu | 23.2 | 2.4 | 43.8 | 9.9 | 20.7 | 100.0 |
| Chittoor | 8.1 | 31.4 | 41.8 | 7.2 | 11.4 | 100.0 |
| Total | 42.1 | 14.4 | 28.8 | 7.5 | 7.2 | 100.0 |
| Non-CNF Households | | | | | | |
| Srikakulam | 49.2 | 16.5 | 15.6 | 11.9 | 6.9 | 100.0 |
| Vizianagaram | 58.1 | 7.6 | 23.4 | 5.1 | 5.7 | 100.0 |
| Visakhapatnam | 75.4 | 5.2 | 14.7 | 4.8 | 0.0 | 100.0 |
| East Godavari | 53.9 | 19.7 | 16.0 | 8.8 | 1.6 | 100.0 |
| West Godavari | 29.2 | 18.8 | 41.7 | 5.1 | 5.1 | 100.0 |
| Krishna | 74.5 | 0.0 | 15.8 | 8.7 | 0.9 | 100.0 |
| Guntur | 34.2 | 50.0 | 15.8 | 0.0 | 0.0 | 100.0 |
| Prakasam | 38.2 | 20.4 | 28.6 | 5.8 | 7.1 | 100.0 |
| SPS Nellore | 54.5 | 10.0 | 29.6 | 3.0 | 3.0 | 100.0 |
| YSR Kadapa | 51.3 | 5.8 | 24.0 | 13.6 | 5.3 | 100.0 |
| Kurnool | 48.9 | 32.5 | 8.1 | 9.9 | 0.6 | 100.0 |
| Anantapuramu | 45.0 | 13.0 | 23.0 | 18.0 | 1.0 | 100.0 |
| Chittoor | 11.8 | 57.6 | 30.5 | 0.0 | 0.0 | 100.0 |
| Total | 48.2 | 21.1 | 21.3 | 6.9 | 2.5 | 100.0 |

Source: IDSAP Field Survey, 2020-21

# Chapter 3: Impact of PMDS+CNF on the farming conditions

## 3.1. Introduction

This chapter assesses the impact of natural farming which includes pre monsoon dry sowing (PMDS+CNF) practice, on the cost of cultivation, crop yields and monetary values for selected crops in the Kharif season of 2020-21. As mentioned in the first chapter, the terms "PMDS+CNF", "PMDS+CNF" and "CNF" are used interchangeably in this chapter and report. Similarly, the terms "non-CNF" and "non-APCNF are used interchangeably. It is already well established, in the previous studies, that Community Managed Natural Farming (CNF) has been resulting in a substantial reduction in the expenditure on plant nutrients and protection inputs (PNPIs). The reduction in turn results in a significant savings in the paid-out costs for the CNF farmers. Despite the discontinuation of the agri-chemicals, the yield level remained unchanged or increased for most of the crops, with a few exceptions. It was also found that CNF is less effective in yield improvement in a few mono-crops, particularly Paddy, especially, in the delta areas. To address this issue, RySS has initiated pre-monsoon dry sowing (PMDS) cultivation, to enhance the soil fertility. This study covers only PMDS plots, i.e., plots which were put under PMDS cultivation before Kharif season. and cultivated the selected crops of the study, during Kharif. PMDS is expected to improve the yields of all crops. On the other hand, being a little more labor-intensive process, CNF needs higher labour input vis-à-vis non-CNF, especially in the preparation of the biological inputs. Given the nature of the preparation of biological inputs, which involves a number of smaller tasks such as collection and gathering of inputs such as cow dung, cow urine, leaves, etc., cleaning, grading, storing of raw materials, soaking, drying, grinding, mixing, fermenting, etc., which spread over several days, only the family members are suited to perform them.

Apart from saving the costs and maintaining or improving the yields, CNF is also fetching, albeit in small scale, premium prices for the CNF produces. All these are ensuring higher gross and net values of output to the CNF farmers. In this background, the results of Kharif 2020-21 survey are presented in this chapter. The research questions answered in this chapter are:

1. What are the changes in the expenditure on PNPIs?
2. What is the impact of CNF on the paid-out costs?

3. What are the changes in the crop yields because of PMDS+CNF?
4. What extent the CNF produce is fetching the premium prices?
5. What are the changes in gross value of output[2]?
6. What are the changes in the net value of output[3] due to PMDS+CNF?

During the study period the state has received about 26% excess rainfall[4]. Barring three north-coastal districts, the remaining ten districts received heavy rains. Rayalaseema region has received about 66% excess rainfall during south-west monsoon. Many crops were adversely affected by the heavy rains. In this scenario, the Kharif survey results may demonstrate the resilient potential of PMDS+CNF.

Out of 12 crops selected for in-depth analysis in the present yearlong study, the survey got minimum reasonable (13+) observations for seven crops. As a special case, Ragi is also included though there are not enough sample observations. Minimum number of crops cutting experiments (CCEs) of 20+ was obtained for six crops. In this chapter, the costs related analysis is conducted for eight crops. As the study is using the yield results obtained through CCEs in yield analyses and gross and net values of output analyses, only six crops are analyzed with respect to these parameters.

## 3.2. Expenditure on Plant Nutrients and Protection Inputs

The biological inputs under CNF and the chemical inputs under non-CNF, together, are referred as plant nutrients and protection inputs (PNPIs). Crop wise expenditure on PNPIs under CNF and non-CNF and their differences in absolute and percentage terms are given at Table 3.1. As expected, the farmers are able to save in the expenditure on PNPIs in each and every crop. However, the savings are negligible in one crop, moderate in a few crops and substantial in others. As hypothesized and observed in earlier reports that the 'potential for savings on PNPIs is higher in input intensive crops', once again proved to be correct in this survey also. The changes obtained in input intensive crops, such as Chilies, Cotton and Paddy stand as an

[2] Instead of referring the gross value of crop output (crop output, obtained through adjusted CCEs, multiplied by realized or locally prevailing price reported by the sample farmers plus value of by-products, reported by the farmers) as "gross returns", as the case in the earlier reports; it is referred in this report as gross value of output or gross value of crop or simply as gross value.
[3] As discussed in the previous section, the term "net returns" is replaced with "net values of output" or simply "net values" or "net values of crops".
[4] Overall, the average rainfall received in Andhra Pradesh from 01.06. 2020 to 09.03. 2021 is recorded as 1095.7 mm as against the Normal as on date of 870.6 mm; showing by Excess 25.9 percent. https://apagrisnet.gov.in/2020/weekly/June/weekly_report_(Rabi)_21_09-03-2021.pdf

evidence to this. On the other hand, it is reestablished that the scope for reduction in expenditure on PNPIs is limited in less input intensive crops. Ragi and Red gram are cases in point.

**Table 3.1: Crop-wise expenditure on PNPIs under CNF and non-CNF and their differences**

***(in ₹/ hectare)***

| Crop | PMDS+CNF | Non-CNF | Difference in ₹ | Difference in % |
|---|---|---|---|---|
| Paddy | 5,132 | 12,948 | -7,817 | -60.37 |
| Groundnut | 4,027 | 7,101 | -3,075 | -43.30 |
| Cotton | 4,764 | 14,683 | -9,919 | -67.56 |
| Black gram | 4,725 | 9,299 | -4,574 | -49.19 |
| Maize | 3,866 | 8,506 | -4,640 | -54.55 |
| Red gram | 2,944 | 4,353 | -1,409 | -32.36 |
| Chillies | 6,203 | 29,571 | -23,368 | -79.02 |
| Ragi | 3,953 | 4,016 | -63 | -1.57 |

*Source: IDSAP Field Survey, 2020-21*

## 3.3. Paid-out costs of cultivation

Apart from expenditure on PNPIs, the survey has also collected the data about the costs of: (1) seeds, (2) human labour, (3) machine labour, (4) bullock labour, (5) implements, (6) farm yard manure (FYM), and (7) Irrigation. In almost all items, the values of purchased items and own items are also collected. The values of all these purchased and own items used in the crop cultivation, together, are referred as paid-out costs and presented at Table 3.2. As the case in PNPIs, the paid-out costs are less under CNF for each of eight crops considered here. The savings are substantial in Chilies (₹.52,515 per ha), followed by Paddy (₹.15,176), Cotton (₹.14,155 per ha), Ragi (₹.13,107 per ha) and Maize (₹.12,643 per ha). In percentage terms the savings, in paid-out costs, vary from 3.94% in Groundnut to 57.93% in Chilies. Per hectare savings in paid-out costs are over Rs.10,000 in six out of eight crops analyzed. In seven out of total eight crops considered here, the savings in paid-out costs are 25% and above.

**Table 3.2: Crop wise paid-out cost of cultivation under CNF and non-CNF and their differences**

***(in ₹/ hectare)***

| Crop | PMDS+CNF | Non-CNF | Difference in ₹. | Difference in % |
|---|---|---|---|---|
| Paddy | 46,125 | 61,301 | -15,176 | -24.76 |
| Groundnut | 46,540 | 48,448 | -1,908 | -3.94 |
| Cotton | 35,797 | 49,952 | -14,155 | -28.34 |
| Black gram | 17,705 | 25,186 | -7,481 | -29.70 |
| Maize | 28,123 | 40,765 | -12,643 | -31.01 |
| Red gram | 13,305 | 23,489 | -10,184 | -43.36 |
| Chillies | 38,136 | 90,652 | -52,515 | -57.93 |
| Ragi | 23,840 | 36,947 | -13,107 | -35.47 |

*Source: IDSAP Field Survey, 2020-21*

## 3.4. Crop yields

As mentioned in Chapter 1, the study is conducting CCEs to estimate the crop yields independently to know the yields of sample crops. CCEs are being conducted for both CNF and non-CNF crops. Out of eight crops considered in the cost's analysis, adequate CCE observations were not available for two crops, viz., Maize and Chilies. Hence, the yield analysis is limited to six crops only. Crop wise yields obtained under CNF and non-CNF condition during Kharif 2020-21 and the variances between them are presented at Table 3.3. Out of six crops presented in the table, five crops, viz. Ragi, Groundnut, Paddy, Cotton and Red gram, have given higher yields under CNF. Among these five crops, Ragi has recorded highest difference of 6.29 quintals per ha, followed by Groundnut (2.53 quintals per) and Paddy (2.20 quintals per ha). In percentage terms also, CNF Ragi has recorded highest yield difference of 51.26% over non-CNF, followed by Cotton (13.59%) and Groundnut (12.91%). Paddy, which has mostly recorded lower yield under CNF vis-à-vis non-CNF, in the past surveys, has recorded 2.20 quintals (4.25%) higher yields under CNF during the study period. This time, Groundnut and Cotton, the second and third most widely cultivated crops in the state, also recorded notable and decisive higher yields under CNF. The yields appeared to be positively impacted by PMDS. All CNF crops are grown in those plots, where PMDS was practiced during March-May/ June 2020, PMDS proved to be boon for CNF.

It may be noted that this year the state has received excess rainfall. Many crops are adversely affected by the heavy rains. Noteworthy higher yields obtained, in some crops, under CNF indicate their resilience to heavy rains also.

**Table 3.3: Crop wise yields under CNF and non-CNF and their differences**
**(*in Quintal per hectare)***

| Crop | PMDS+CNF | Non-CNF | Difference in quintals | Difference in % |
|---|---|---|---|---|
| Paddy | 53.95 | 51.75 | 2.20 | 4.25 |
| Groundnut | 22.12 | 19.59 | 2.53 | 12.91 |
| Cotton | 12.45 | 10.96 | 1.49 | 13.59 |
| Black Gram | 9.86 | 11.27 | -1.41 | -12.51 |
| Red Gram | 7.42 | 7.33 | 0.09 | 1.23 |
| Ragi | 18.56 | 12.27 | 6.29 | 51.26 |

*Source: IDSAP Field Survey, 2020-21*

As mentioned above, this year the study has focused on PMDS, one of recent innovations and additions in the CNF. By improving the soil quality and productivity, PMDS is expected to enhance crop yields during Kharif 2020-21 season and beyond. The above yield analysis gives clear evidence about the efficacy of PMDS. Another way to know the real impact of PMDS is to compare the CNF crop yields of last three years. Because of change in the sample frame and selection process in 2020-21, the current crop yields are not strictly comparable with those of last two years. Further, the variations in rainfall during last three years make the inter-year comparison of yields more complicated. To overcome these challenges, the season-wise differences between CNF and non-CNF yields of select crops during last three Kharif seasons are compared; as rainfall effect in the same season is not different between CNF and non-CNF For all six crops, analyzed in the present report, comparable data is available for only three crops in 2018-19. Relevant data is available for four crops in 2019-20. The differences between CNF and non-CNF yields during last three Kharif seasons, in absolute and percentage terms are presented at Table 3.4. In three crops of 2018-19, presented in Table 3.4, the differences between CNF and non-CNF are large in all three crops in 2020-21 compared to those of 2018-19. In top three widely cultivated crops, viz., Paddy, Groundnut and Cotton, the CNF yields are higher than non-CNF yields during 2020-21 by 2.20, 2.53 and 1.49 quintals per ha respectively. The same are -2.47, 1.83, and 0.63 quintals per ha in 2018-19. Compared to 2019-20, the differences between the CNF and non-CNF yields are considerably high in 2020-21 in Groundnut and Cotton and less in Paddy. To sum up, the results indicate that PMDS has encouraging impact in yield enhancements and crop resilience to the weather anomalies.

**Table 3.4: Difference between CNF and non-CNF yields during last three Kharif seasons**

| | Difference in quintal per ha | | | Differences in percentages | | |
|---|---|---|---|---|---|---|
| Crop | 2018-19 | 2019-20 | 2020-21 | 2018-19 | 2019-20 | 2020-21 |
| Paddy | -2.47 | 2.81 | 2.20 | -5.18 | 5.85 | 4.25 |
| Groundnut | 1.83 | 0.15 | 2.53 | 15.90 | 0.92 | 12.91 |
| Cotton | 0.63 | -0.57 | 1.49 | 5.97 | -2.92 | 13.59 |
| Black Gram | | | -1.41 | | - | -12.51 |
| Red Gram | | 0.38 | 0.09 | | 6.24 | 1.23 |
| Ragi | | | 6.29 | | - | 51.26 |

*Source: IDSAP Field Surveys, 2018-19, 2019-20, 2020-21*

## 3.5. Prices

Prices are another important factor for the expansion of CNF in the state. Farmers expect premium prices for their CNF produces. Crop wise average prices realized/ reported by CNF and non-CNF farmers and difference between the two sets of prices are presented at Table 3.6. Out of eight crops, for which the cost and returns data is available, three CNF crops got higher prices and five got lesser than non-CNF prices. This is an unexpected and surprising outcome (Table 3.5). One of the possible reasons could be the location of project and control sample farmers. While CNF farmers are concentrated in north-coastal districts, which have relatively less market infrastructure and market, the non-CNF farmers are spread evenly across the state. There could be a few specific reasons. In case of Cotton, which got over 12% less price for CNF Cotton, the possible reason could be the alteration in the fibre-seed ratio in CNF cotton. It is believed that CNF will results in heaver and larges seeds/ grain. Heavy grain or seed need not be beneficial in all crops, especially in the fibre crops. In case of Ragi, which got over 10% lesser price, the location of CNF sample farmers could be one possible reason. Ragi is predominantly grown in the tribal areas. Some of the CNF tribal sample farmers are located on hilly areas. Because of the logistic issues, they might have got less price.

**Table 3.5: Crop wise average price realized for CNF and non-CNF crops and difference between them**

***(Rs per hectare)***

| Crop | PMDS+CNF | Non-CNF | Differences in ₹. | Differences in % |
|---|---|---|---|---|
| Paddy | 1,788 | 1,719 | 69 | 4.01 |
| Groundnut | 4,883 | 4,321 | 562 | 13.00 |
| Cotton | 4,128 | 4,698 | -569 | -12.12 |
| Black Gram | 6,376 | 6,694 | -318 | -4.76 |
| Maize | 1,415 | 1,408 | 7 | 0.47 |
| Red Gram | 5,000 | 5,053 | -53 | -1.06 |
| Chillies | 9,000 | 9,500 | -500 | -5.26 |
| Ragi | 3,204 | 3,570 | -366 | -10.25 |

*Source: IDSAP Field Survey, 2020-21*

## 3.6. Gross value of the output

The gross value of crop output (crop output, obtained through CCEs, multiplied by realized or locally prevailing price reported by the sample farmers plus value of by-products, reported by the farmers) was referred to as "gross returns".in the earlier reports. It is referred in this report as **gross value of output** or **gross value of crop** or simply as **gross value**.[5] It may be noted that the study uses the crop yields obtained through CCEs in the estimation of gross value of output. Since CCE yields are not available for all sample farmers and all selected crops cultivated by the sample farmers, the CCE yields are extrapolated for all sample farmers and their cultivated select crops. The method used is: "reported yield of X crop by a household" multiplied with "correction factor"; the "correction factor" being the ratio of "state average CCE yield of crop X" divided by "state average reported yield of crop X". As reasonable number of CCEs are available for six crops, the gross value of output is estimated for those six crops only. Crop wise gross values obtained during Kharif 2020-21 season, under CNF and non-CNF and differences between them are shown at Table 3.6. In all six crops the gross values of CNF crops are higher than those of non-CNF crops. Out of six crops, viz., Red-gram,

[5] This is suggested by one of the experts, who gone through the earlier reports. The simple reason is that the term "returns" reflects the money received by the farmer on sale of output. Many a times farmers may not sell their entire produce and normally may not sell the by-products. Hence the term value of output or just value may correctly reflect the scenario.

Groundnut, Black-gram and Ragi, the gross values of CNF crops, are higher than those of non-CNF crops by over ₹.20,500 per ha in four crops. In percentage terms, the same four crops got 40% to 92% higher gross values under CNF. Two other crops, viz., Paddy and Cotton, though recorded higher yields, did not command premium prices; therefore, got moderate higher gross values. Needless to say, that the higher gross values of CNF crops are the effect of higher yields[6] under CNF and/ or higher price realization for CNF crops. Black gram, which recorded 12% lower yields under CNF got over 46% higher gross values due to higher extrapolated yields. On the other hand, Cotton and Ragi which got over 10% lower prices got 14.40% and 49.53% higher gross values, respectively, due to higher yields.

**Table 3.6: Crop wise gross value of CNF and non-CNF output and differences between them**

***(₹ per hectare)***

| Crop | PMDS+CNF | Non-CNF | Difference in ₹. | Difference in % |
|---|---|---|---|---|
| Paddy | 99,293 | 94,693 | 4,599 | 4.86 |
| Groundnut | 96,439 | 69,051 | 27,389 | 39.66 |
| Cotton | 63,631 | 55,622 | 8,009 | 14.40 |
| Black Gram | 76,172 | 52,159 | 24,013 | 46.04 |
| Red Gram | 66,744 | 34,688 | 32,056 | 92.41 |
| Ragi | 62,236 | 41,620 | 20,616 | 49.53 |

*Source: IDSAP Field Survey, 2020-21*

## 3.7. Net value of output

As discussed in the previous section, the term "net returns" is replaced with "**net values of output**" or simply "**net values**" or "**net values of crops**". The crop wise net values of output are obtained by subtracting the paid-out cost of a crop from the gross value of that crop. As net value is also based on the CCE yields, it is calculated for six crops only. Crop wise net values of output under CNF and non-CNF and the differences between them are presented at Table 3.7. In all six crops, presented in the table, the net values of CNF crops are higher than those of non-CNF. The differences vary from ₹.19,776 per ha in Paddy to ₹.39,002 per ha in Red-gram. In percentage terms the CNF crops got 142% to 722% higher net values in five crops;

[6] Extrapolated CCE yields for all farmers and their crops.

and about 60% higher net value in one crop. The results indicate that CNF could be an effective method for doubling of the farmers income.

**Table 3.7: Crop wise net value of CNF and non-CNF output and differences between them**

***(₹. per hectare)***

| Crop | PMDS+CNF | Non-CNF | Difference in ₹. | Difference in % |
|---|---|---|---|---|
| Paddy | 53,168 | 33,392 | 19,776 | 59.22 |
| Groundnut | 49,899 | 20,602 | 29,297 | 142.20 |
| Cotton | 27,834 | 5,670 | 22,164 | 390.87 |
| Black gram | 58,467 | 26,973 | 31,494 | 116.76 |
| Red gram | 50,201 | 11,199 | 39,002 | 348.25 |
| Ragi | 38,396 | 4,673 | 33,723 | 721.68 |

*Source: IDSAP Field Survey, 2020-21*

It may be noted that higher net values of CNF crops are the upshots of (1) reduction in cost of cultivation, which in turn is the effect of the reduction in the expenditure on PNPIs, (2) increase in yields, and (3) premium prices obtained. A comparative analysis of average gross values and average net values, indicate that reduction in cost of cultivation is the major contributory factor in the increase in net value of crop output. PMDS appeared to be promising in enhancing yields in coming years. If CNF output command at least a moderate, say 10%, higher prices, farmers' incomes would double in one to two years. The Government of India should announce higher minimum support prices for CNF crops and procure CNF food items for the public distribution system (PDS).

## 3.8. Disaggregate analyses

The above analysis clearly demonstrated the utility of CNF in reducing cost of cultivation, obtaining higher yields and higher prices, and realizing higher gross and net values of output. Further a disaggregated analysis gives policy relevant insights. The analysis is conducted at disaggregate levels, in terms of irrigation status, farm categories, and agroclimatic zones, in this section. As Paddy has adequate sample, the disaggregate analysis is limited to Paddy. In

agro-climatic zone wise also, adequate sample is not available for High Altitude Zone and Scarce Rainfall Zone. Hence, they were omitted in the analysis.

It may be noted that CCE yields are not available for all sample farmers and all selected crops cultivated by the sample farmers, the CCE yields are extrapolated for all sample farmers and their cultivated crops. The method used is: "reported yield of crop "X" by a household" multiplied with "correction factor"; the "correction factor" being the ratio of "state average CCE yield of crop "X" divided by "state average reported yield of crop "X". Without these adjustments the disaggregate analyses is not possible.

### *3.8.1. Irrigation status wise changes in Paddy cultivation due to CNF*

As mentioned above Paddy crop has adequate sample to undertake the disaggregate analyses. As observed in the aggregate analyses, the CNF farmers have saved substantial amounts in the expenditure on PNPIs, under both irrigated and rainfed conditions. The reduction in PNPI expenditure, in turn, resulted in a significant savings in paid-out costs expenditure. It is interesting to note that savings in cultivation costs are larger under rainfed conditions both in absolute and percentage terms.

As discussed in the beginning of this chapter, during the study period, the state received excess rainfall, especially in the scarce rainfall districts of Rayalaseema. Such an excess rainfall would be beneficial to rainfed Paddy and also to tank, bore-well and other irrigation sources of irrigated areas. But it could be detrimental to canal irrigated area, particularly delta areas, where drainage is a bigger challenge. This has reflected in the yields of Paddy crop under irrigation and rainfed conditions. The yields under rainfed are higher than the yields under irrigation (Table 3.8). This is true for both CNF and non-CNF crops. The CNF yields are higher than those of non-CNF under both irrigated and rainfed conditions. However, the gap is higher under irrigated conditions. It indicates the resilience potential of CNF crops under excess rains and consequent water logging conditions.

As expected, the gross and net value of CNF Paddy is higher than the values of non-CNF under both irrigated and rainfed condition. It is interesting to note that while the gap in the CNF and non-CNF yields is larger under irrigated conditions, the gap in gross value of output between CNF and non-CNF is larger under rainfed conditions. It implies that CNF Paddy from rainfed areas have fetched higher prices compared to CNF Paddy in irrigated areas and also non-CNF Paddy in rainfed areas. While reduction in costs is the dominant contributor in the higher net

value of CNF Paddy under irrigated condition, the reduction in costs and also higher gross values have sizable contributions for higher net value of CNF Paddy under rainfed conditions.

**Table 3.8: Irrigation status wise changes due to CNF in Paddy cultivation**

*Sample in numbers, area in hectares, yields in quintals per hectare and expenditure & values in ₹.*

| Indicator | CNF | Non-CNF | Difference in unit | Difference in % |
|---|---|---|---|---|
| **Irrigated** | | | | |
| No. of Sample | 594 | 416 | | |
| Area Cultivated | 365 | 316 | | |
| Expenditure on PNPI | 5,450 | 13,173 | -7,723 | -58.63 |
| Paid-out costs | 47,657 | 62,280 | -14,623 | -23.48 |
| Yields | 53.00 | 50.00 | 3.00 | 6.00 |
| Gross values | 97,819 | 94,754 | 3,065 | 3.23 |
| Net values | 50,162 | 32,474 | 17,688 | 54.47 |
| **Rainfed** | | | | |
| No. of Sample | 225 | 85 | | |
| Area Cultivated | 84 | 42 | | |
| Expenditure on PNPI | 3,170 | 11,434 | -8,264 | -72.28 |
| Paid-out costs | 36,686 | 54,712 | -18,026 | -32.95 |
| Yields | 55.00 | 54.00 | 1.00 | 1.85 |
| Gross values | 1,08,142 | 94,283 | 13,859 | 14.70 |
| Net values | 71,456 | 39,570 | 31,885 | 80.58 |

*Source: IDSAP Field Survey, 2020-21*

### *3.8.2. Farmer category-wise changes in Paddy cultivation due to CNF*

The farm category wise changes confirm the classic farm size hypothesis in Indian agriculture, i.e., small and marginal farmers invest more on agriculture, cultivate intensively and get higher yields and returns. Farmer category wise changes in principal indicators of Paddy cultivation, due to CNF are presented in Table 3.9. Pure tenants and marginal farmers are heavily investing on agri.-chemicals under non-CNF conditions. As a result, they are able to save more in the expenditure on PNPIs, due to CNF. Same is the case in the paid-out costs. Here small farmers are also saved more in the paid-out costs, compared to medium and large farmers, due to CNF. The tenant and marginal farmers got higher yields due to CNF. But the small, medium, and larger farmers got lower yields under CNF. Pure tenants and marginal farmers are able to reap three categories of benefits, viz., reduction is costs, higher yields and higher prices, due to CNF and got good net values for their crops. Despite lower yields, the medium and large farmers are

able to get higher gross value of output compared to their counterparts in non-CNF. They have benefited from reduction in costs and higher prices. But small farmers could not get higher prices. Their net gains are purely due to reduction in costs of cultivation.

**Table 3.9: Farm category wise changes in Paddy cultivation due to CNF**

*Yields are in quintals per hectare; and expenditure and values are in ₹. per hectare*

| Farm category | Expenditure on PNPI | Paid-out costs | Yields | Gross value | Net value |
|---|---|---|---|---|---|
| **Differences between CNF and Non-CNF values in units** | | | | | |
| Pure Tenant | -8,186 | -13,304 | 1.35 | 8,250 | 21,554 |
| Marginal | -9,014 | -18,564 | 2.54 | 6,895 | 25,459 |
| Small | -6,639 | -14,947 | -0.35 | -2,739 | 12,208 |
| Medium & Large | -6,535 | -11,937 | -1.35 | 4,712 | 16,649 |
| **Percentage change over non-CNF** | | | | | |
| Pure Tenant | -61.9 | -21.49 | 2.64 | 8.47 | 60.69 |
| Marginal | -62.72 | -27.66 | 4.99 | 7.3 | 92.99 |
| Small | -56.93 | -26.67 | -0.69 | -2.82 | 29.76 |
| Medium & Large | -62.16 | -23.02 | -2.89 | 5.4 | 47.00 |

*Source: IDSAP Field Survey, 2020-21*

### *3.8.3. Agro-climatic zone wise change in Paddy cultivation due to CNF*

Normally, some crops such as Paddy, Cotton, Chilies, etc., are grown with high doses of inputs; these crops are known as input- intensive crops. Similarly, some agro-climatic zones and districts grow all crops with higher doses of inputs compared to other zones and districts; these zones and districts could be called input- intensive zones. Godavari and Krishna zones are good example for resource or input intensive zones. Similarly, the High-Altitude Zone and Scarce-Rainfall zones may be good examples for less resource intensive zones. The agro-climate zone wise changes in Paddy cultivation, due to CNF are presented at Table 3.10. It appears that the scope for savings in cost of cultivation, due to CNF, is high in the input intensive zones such as Godavari and Krishna zones. Similarly, the scope for increase in crop yields, through CNF, appeared to be high in less input-intensive zones. Each of four agro-climatic zones, considered here, have experienced a reduction in the expenditure on PNPIs and paid-out costs due to CNF. However, the resources rich zones of Godavari and Krishna have saved more in costs due to CNF. The North Coastal zone and Godavari zone got first and second highest yields, gross and net values of output, due to CNF. Krishna Zone has recorded lowest Paddy yield under CNF

compared to non-CNF yields. The zone also experienced lower gross values of output, under CNF. Because a few CNF villages got very heavy rains during the early stages of the crops, which damaged crop severely. However, the Zone got higher net value of crop output, compare to non-CNF, because of savings in the costs of cultivation. On the other hand, the Southern zone could save smaller amounts in the paid-out costs, which could not compensate the losses in the yields and gross value.

**Table 3.10: Agro-climatic zone wise changes in Paddy cultivation due to CNF**

*Yields are in quintals per hectare; and expenditure and values are in ₹. per hectare*

| Agro-climatic zones | Expenditure on PNPI | Paid-out costs | Yields | Gross value | Net value |
|---|---|---|---|---|---|
| **Differences between CNF and non-CNF in absolute numbers (CNF minus non-CNF)** | | | | | |
| North Coastal Zone | -7,056 | -17,055 | 7.85 | 22,841 | 39,896 |
| Godavari Zone | -10,799 | -22,366 | 4.15 | 16,122 | 38,488 |
| Krishna Zone | -10,941 | -20,955 | -9.68 | -12,386 | 8,569 |
| Southern Zone | -5,408 | -1,444 | -2.92 | -11,035 | -9,591 |
| **Percentage of change over non-CNF values** | | | | | |
| North Coastal Zone | -70.61 | -29.26 | 14.46 | 23.55 | 103.10 |
| Godavari Zone | -60.89 | -34.47 | 7.86 | 16.17 | 110.62 |
| Krishna Zone | -68.47 | -28.47 | -19.01 | -12.65 | 35.21 |
| Southern Zone | -51.18 | -2.91 | -5.7 | -11.2 | -19.64 |

*Source: IDSAP Field Survey, 2020-21*

## 3.9. Conclusions

In this report the concepts and terminology have been changed for easy comprehension. On the advice of experts, the new terms “gross value of output” and “net value of output” have been used in place of “gross returns” and “net returns”.

The expenditure on PNPIs, paid-out costs on cultivation are low under CNF, for all the eight crops analyzed for cost related parameters in this chapter. The results have reestablished the hypothesis that higher savings in costs could be achieved in input-intensive crops.

A brief comparison of this year data with that of previous two years indicate a positive contribution of PMDS. Contrary to the expectations of higher prices for CNF output, the study got mixed results. There are a couple of general reasons, including sample selection process and a couple of crop specific reasons. The gross values of CNF crop output are higher in all

crops analyzed. Because of reduction in costs and increase in yields and better prices, five out of total six crops analyzed, got over 116% higher net values of output under CNF. In remaing one crop, the net values of CNF output is higher by 59%. The results indicate that CNF could be an effective method for doubling of the farmers income. A comparative analysis of gross values and net values, indicate that the reduction in cost of cultivation is the major contributory factors in the increase in net values of crop output. If CNF output commands at least a little, say 10%, higher prices, farmers' incomes would double in one to two years.

The disaggregate analyses indicate that the resource intensive zones and pure tenants and marginal farmers, who usually make higher investment in agriculture could save more under CNF. This year heavy rains proved to be beneficial to rainfed Paddy. The study results have demonstrated CNF's ability to withstand the heavy rains. Introduction of PMDS, apparently given a big boost to CNF. Its full impact may be known in coming years.

# Chapter 4: Utilisation of Land, Labour and Credit for Adoption of CNF Practices: An Evidence

## 4.1. Introduction

This chapter is an attempt to examine how far the factors of production have been reallocated and utilised to adopt CNF. The analysis includes key resources such as land, labour, and credit towards credit for crop production and other purposes. The chapter also elaborates the strategies used for an efficient use of scarce resources such as land and labour and credit.

Land should be utilised by farmers for CNF by withdrawing the same from non-CNF. It should be used for mixed cropping in the place of single cropping. It should be utilised to adopt all the practices such as Beejamurutham, Ghanajeevamrutham, Dravajeevamrutham, Kashyams/ Ashtrams, etc., of CNF in growing crops.

In the context of hired labour scarcity in rural areas for carrying out agricultural operations, family labour should be utilised in growing crops. However, there are alternative employment opportunities available for family labour through public employment programme interventions like MGNREGS and other employment opportunities available in non-farm sectors in rural areas as well as in urban areas. Family labour of pure tenants, marginal and small farmers look for these opportunities. They evolve labour management strategies at family level for their own agricultural activities as well as MGNREGS work available nearby in rural areas. As CNF has emerged as a relatively more remunerative activity due to the reduction in cost of cultivation CNF became an important part of livelihood strategies. Hence, the participation of family labour in CNF might have increased.

Farmers should utilise the fixed capital like machinery, farm equipment as per the requirements of principles of CNF. Data on the fixed capital used in CNF, such as bullocks, light weight tractors, pipelines to evenly distribute the liquid biological soil nutrients from the tanks to the field and so on has not been collected. Hence, it is not possible to examine the reallocation of fixed capital towards the needs of CNF. However, credit required to grow CNF kharif crops and farmers' dependency on informal institutions has been examined in this chapter. The study has noted earlier that the credit requirements have declined after the shift to CNF. Relative dependence on formal and informal Institutions will have to be examined.

## 4.2. Objectives

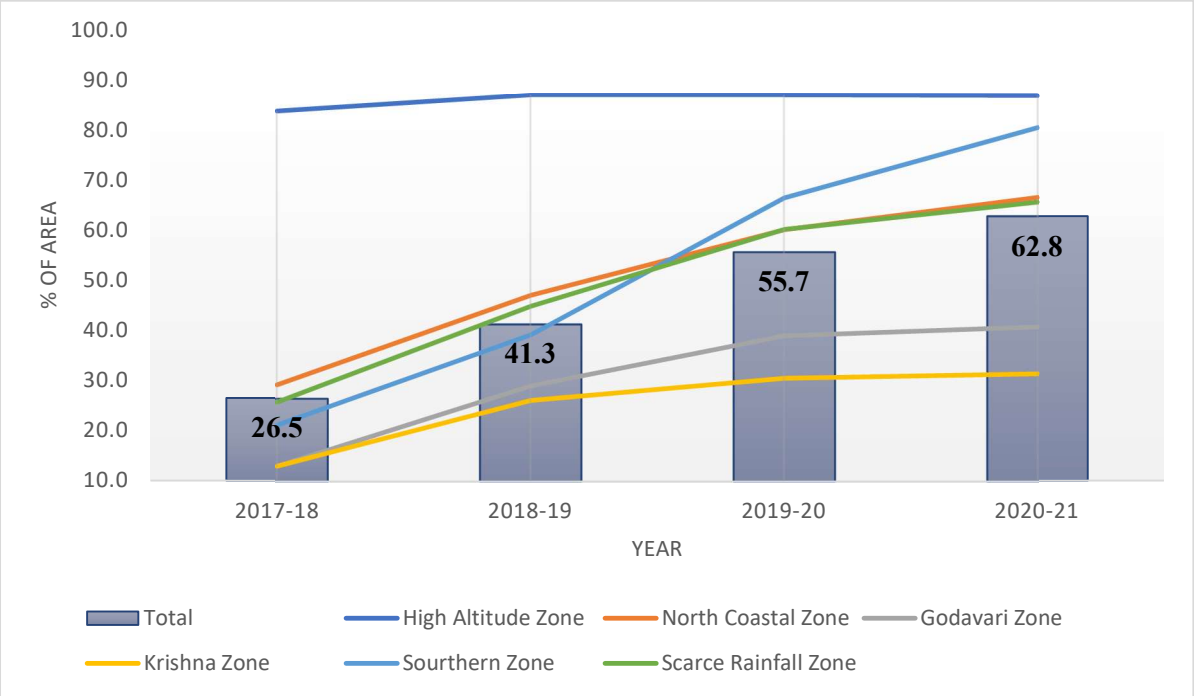
In the above background, this chapter specifically examines the following issues:

i. How far farmers have used their cultivated land to adopt CNF practices for growing crops?
ii. How far farmers have used family labour in raising crops under CNF in relation to those of non-CNF farmers?
iii. Whether dependency on informal credit institutions has declined for cultivating Kharif crops and other purposes, compared to non- CNF farmers?
iv. Whether the utilisation of these has varied across agro-climatic zones, category of farmers and districts?

## 4.3. Land Utilisation for Adopting CNF Practices

The area allocated towards CNF as a percentage of operated area in kharif season has increased from 26.48 in 2017-18 to 62.81 in 2020-21 for all the farmers put together. This is true across all the agro-climatic zones. The increase is High Altitude Zone, followed by Southern Zone, North Coastal Zone, Scarce Rainfall Zone, Godavari Zone and Krishna Zone in that order. The Delta zones, especially Krishna Zone, lagging, though they have experienced increase in the area under CNF over time (Figure 4.1). The districts such as Vizianagaram, Visakhapatnam, Guntur, Prakasam, YSR Kadapa, Anantapuramu and Chittoor have experienced higher expansion in percentage of area under CNF, compared to state average by 2020-21. Srikakulam, East Godavari, West Godavari, Krishna, SPS Nellore and Kurnool need extra drive to expand the area under CNF. As far as category of farmers is concerned, all the categories of farmers experienced expansion of area under CNF over time. Pure tenant and medium and large farmers need to be encouraged to expand the area under CNF (Annexure Table 4.1).

**Figure 4.1: Year wise Area allocated to CNF, as a percentage of operated area in Kharif Season**



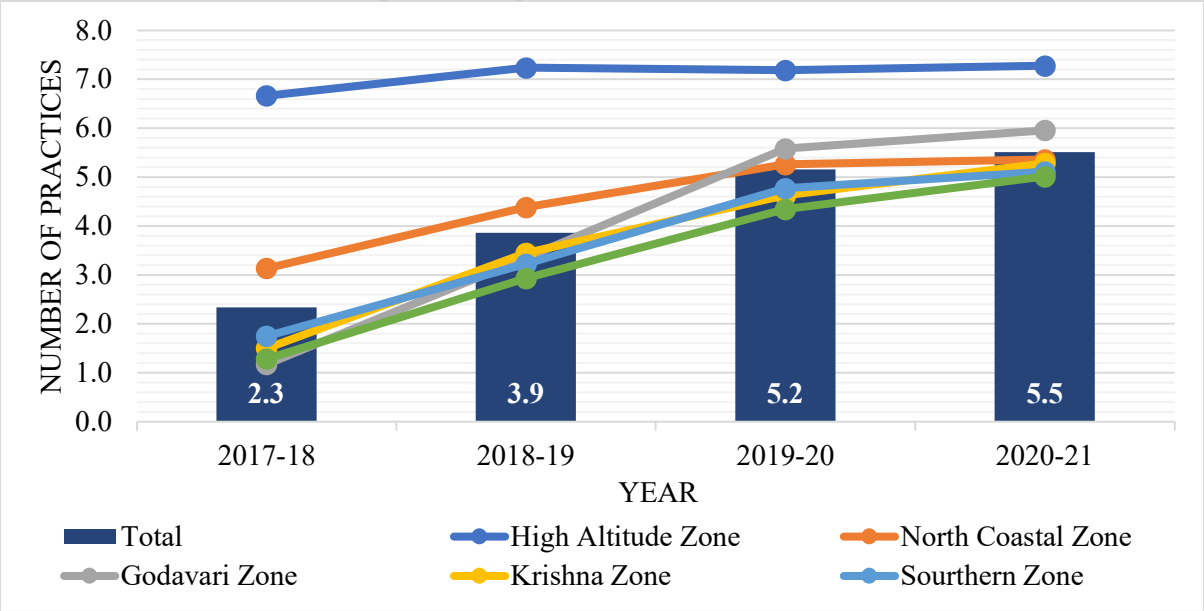

Source: IDSAP Field Survey, 2020-21

This chapter examines the use of four types of biological inputs prepared on farm, viz., Beejamrutham, Ghanajeevamrutham, Dravajeevamrutham, Kashayams/ Asthrams, and adoption of seven types of crop intensification methods viz., Inter-Cropping, Boarder Cropping, Bund Cropping, Layer Models, Integrated Farming, Pre-Monsoon Dry Sowing (PMDS) and System of Rice Intensification (SRI). These are the 11 key practices of CNF promote agro-ecological sustainability.

There is an evidence of increased adoption of these methods by CNF farmers over time from 2017-18 to 2020-21 for all the farmers put together (Figure 4.2). Increasing trend is observed across the agroclimatic zones, districts, and category of farmers. A qualitative survey of the percentage of farmers reporting adoption, and the number of recommended practices followed, indicated the zones, districts, and the category of farmers with higher intensity of natural farming in the latest year 2020-21. More than average level of adoption was found among the Farmers in High Altitude and Godavari zones and in the districts of Visakhapatnam, West Godavari, Krishna, and Chittoor. Among the farmer categories, higher percentage of marginal and small farmers reported these practices. Hence, the farmers in North coastal, Krishna, Southern Scarce Rainfall Zones among the Zones; Srikakulam, Vizianagaram, East Godavari district, Guntur, Prakasam, SPS Nellore, YSR Kadapa, Kurnool and Anantapuramu among the

districts; and pure tenant, and medium &large farmers among the category of farmers should be encouraged to adopt more CNF practices in growing crops (Annexure Table 4.2).

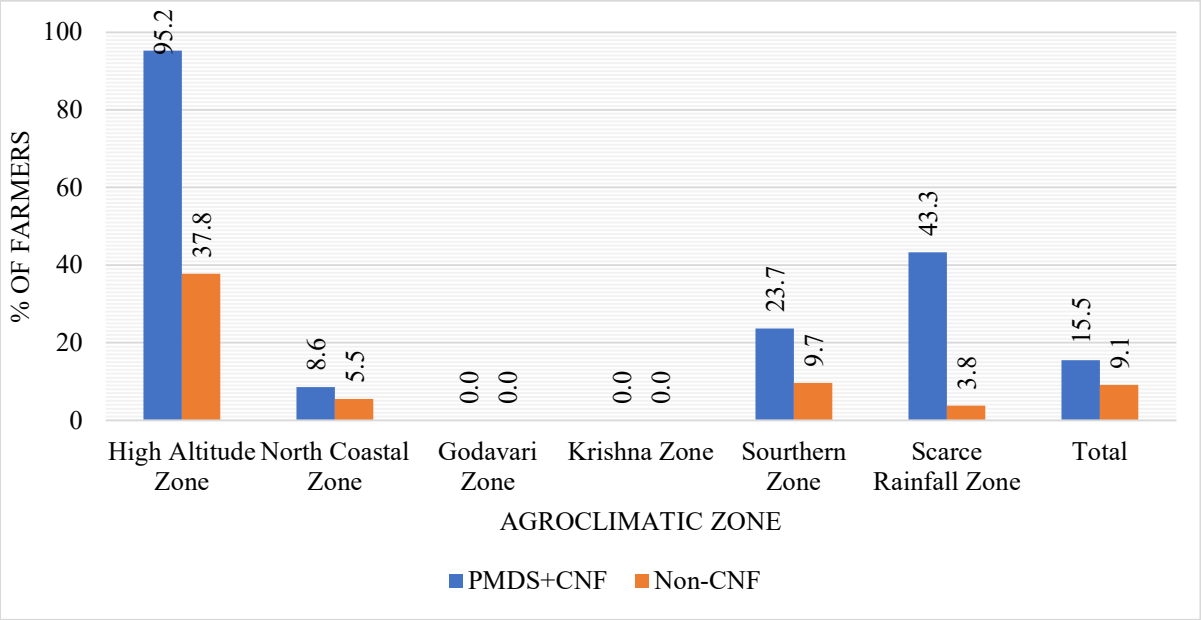
**Figure 4.2: Agro-climatic zone wise average number of CNF practices adopted by PMDS+CNF farmers during 2017-21 period**




Source: IDSAP Field Survey, 2020-21

Larger percentage of CNF farmers grow multiple crops on the same land compared to non-CNF farmers. A comparison across the agro-climatic zones between CNF and non-CNF farmers has revealed that the farmers of CNF excelled in growing mixed crops (Figure 4.3). However, it is interesting to note that the farmers have not allocated any land to mixed cropping in both Godavari and Krishna zones. The raising of mixed crops is pronounced among the CNF farmers over non-CNF farmers across all the districts. However, it is again striking to note that there are no farmers raising mixed crops in delta district-East Godavari, West Godavari, Krishna and Guntur and non-delta districts such as Prakasam and SPS Nellore in both CNF and non-CNF cultivated lands. It must be noted that the mixed cropping is more common in the High-Altitude Zone, and Visakhapatnam from North Coastal Zone. Chittoor, Anantapuramu and Kurnool in that order give importance to multiple cropping among the Rayalaseema districts. Raising of diversified crops is conspicuously absent among pure tenant farmers in both CNF and non-CNF cultivated lands. Further, Marginal and small farmers belonging CNF grow mixed crops, while medium and large non-CNF farmers grow mixed crops (Annexure Table 4.3).

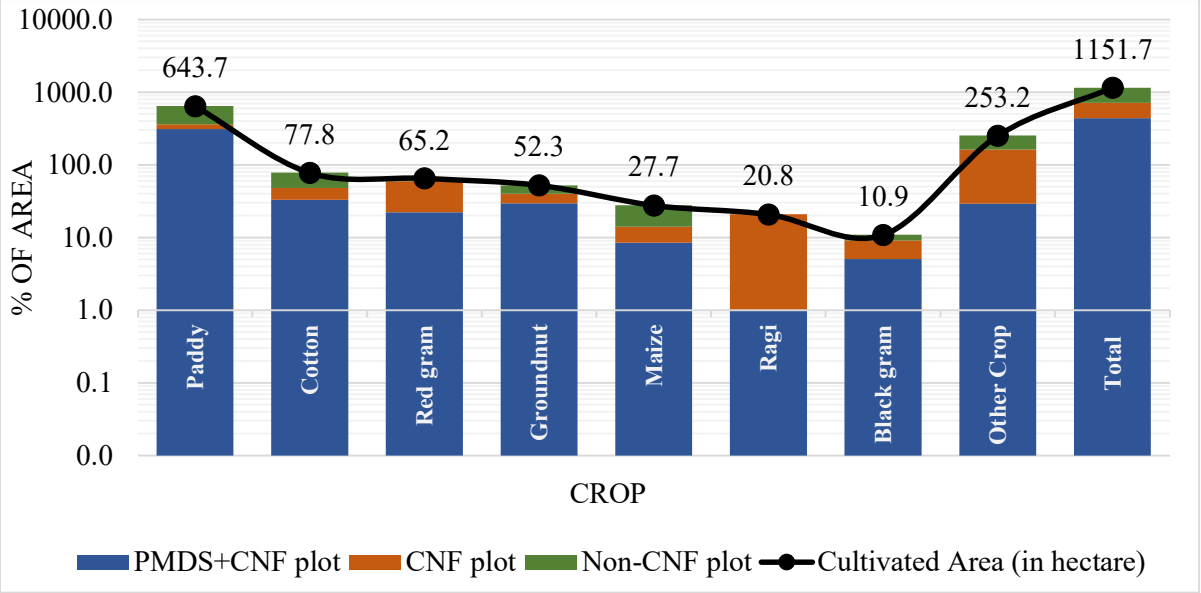
**Figure 4.3: Percentage of PMDS+CNF and non-CNF farmers growing Mixed Crop during Kharif Season**




Source: IDSAP Field Survey, 2020-21

The cultivated land should be kept more under PMDS+CNF for each crop so that the farmers can derive more benefits. The data in this regard reveal that the land used more under PMDS+CNF under all the major crops considered for the analysis, except Ragi (Figure 4.4 and Annexure Table 4.4 ).

**Figure 4.4: Crop-wise Distribution of Total Area Cultivated by Sample PMDS+CNF Farmers for growing crops under PMDS+CNF, CNF, and non-CNF (%) during Kharif Season**

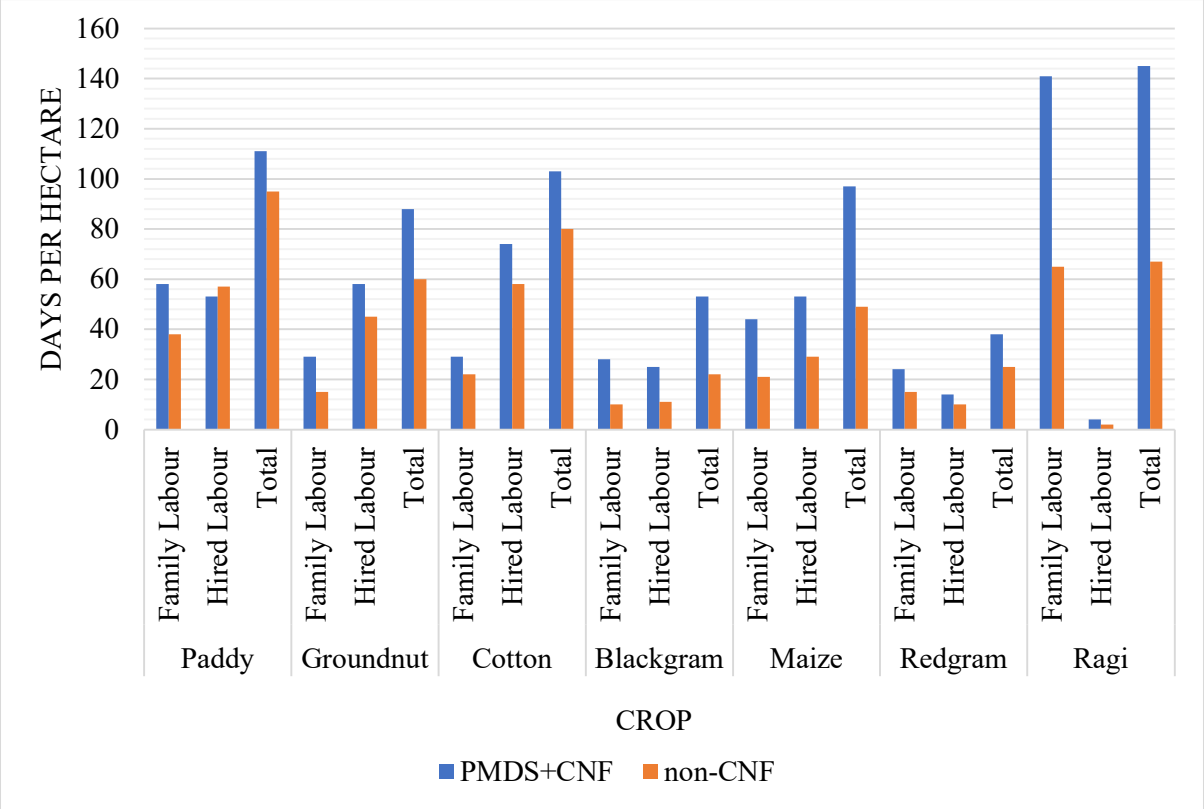



Source: IDSAP Field Survey, 2020-21

## 4.4. Labour Utilization for Adopting CNF Practices

Seven major crops have been considered to examine the utilisation of human labour for the analysis. They include Paddy, Groundnut, Cotton, Black Gram Maize, Red Gram and Ragi in kharif season. The labour use in days per hectare is found to be higher among CNF farmers over non-CNF farmers across all the crop considered for the analysis. Interestingly, the family labour use is higher across all the crop in PMDS+ CNF over non-CNF (Figure 4.5 and Annexure Table 4.5).

**Figure 4.5: Crop wise Labour use by PMDS+CNF and non-CNF farmers (days/hectare) during Kharif Season**



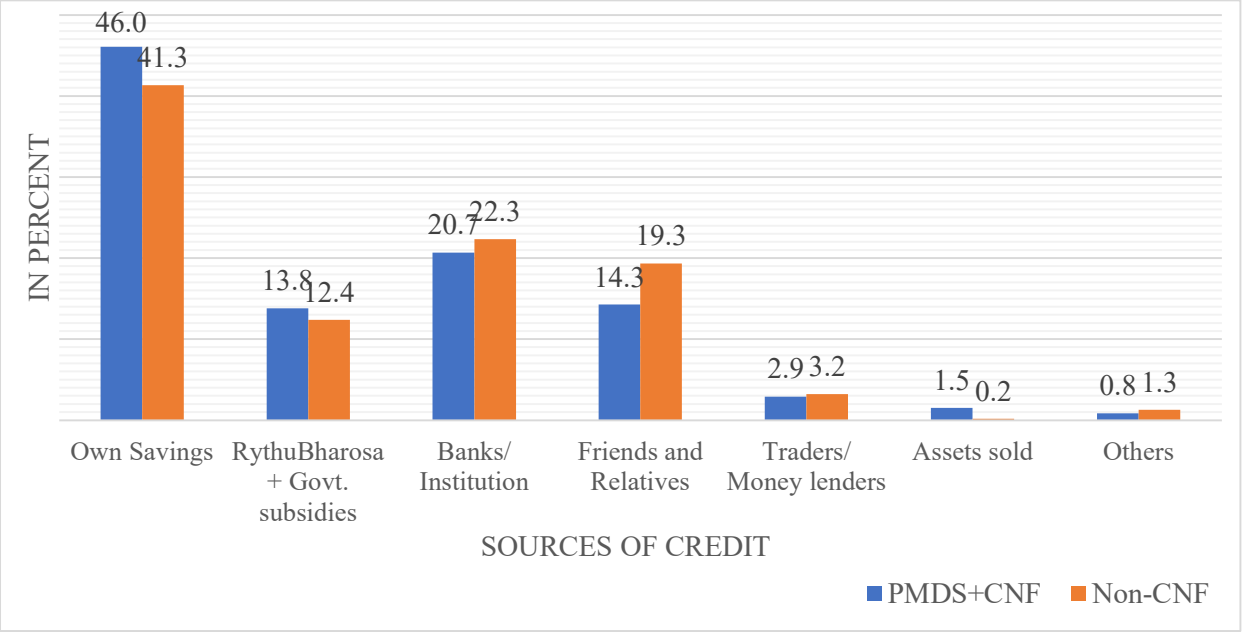

Source: IDSAP Field Survey, 2020-21

## 4.5. Utilisation of Credit for Adopting CNF Practices

Two parameters are considered to examine the dependency of both CNF and non-CNF farmers in credit requirements for raising crops and other purposes. They are percentage of farmers dependent on different sources and the percentage of the total amounts mobilised from different sources. Farmers mobilised funds from different sources. It is evident that the CNF farmers compared to non-CNF farmers have utilised their own savings by 6.5 percentage points to meet

the credit and other requirements. The dependency on friends and relatives of CNF farmers is higher by 3.6 percentage points. It is less than one percentage point on the consumers who have given advances to supply CNF products, but they are not typical traders and money lenders. Thus, it is very clear that the mobilisation of funds from typical informal sector is very low among CNF farmers. The dependency of CNF farmers compared to non-CNF farmers even based on funds mobilised reflects the earlier pattern (Figure 4.6 and Annexure Table 4.6). It shows on the average own sources and institutional borrowing is higher in Andhra Pradesh compared to informal borrowing.

**Figure 4.6: Source wise Credit mobilised for Agriculture and Other purposes (%) by PMDS+CNF and non-CNF Farmers during Kharif Season**




Source: IDSAP Field Survey, 2020-21

## 4.6. Conclusions

Converting land to CNF cultivation for growing crops with diversified cropping pattern through adopting CNF practices by CNF farmers stands as an evidence to the improved soil health and thereby the improved land productivity due to CNF.The deployment of more family labour over hired labour also implies the intensive use of family labour. This resulted in higher land productivity. The reduced dependency on informal sources for credit for raising Kharif crops and also for meeting other needs indicates the reduction in the cost of credit and thereby reduction in the cost of cultivation of growing crops to that extent under CNF. Further, this

also shows that the farmers of CNF have achieved relative autonomy from exploitative informal credit markets. These are the conclusions emerged from the analysis in this chapter**.**

## Annexure to Chapter 4

**Annexure Table 4.1: Year wise percentage of area allocated to APCNF in Kharif Season by the sample farmers (%)**

| | % Of Operational area under APNCF | | | |
|---|---|---|---|---|
| | 2017-18 | 2018-19 | 2019-20 | 2020-21 |
| **Agro-Climatic Zone** | | | | |
| High Altitude Zone | 83.75 | 86.98 | 86.98 | 86.85 |
| North Coastal Zone | 29.25 | 47.07 | 60.14 | 66.57 |
| Godavari Zone | 13.06 | 29.03 | 38.99 | 40.79 |
| Krishna Zone | 13.07 | 26.13 | 30.54 | 31.45 |
| Southern Zone | 21.23 | 39.22 | 66.47 | 80.47 |
| Scarce Rainfall Zone | 25.82 | 44.90 | 60.20 | 65.63 |
| Total | 26.48 | 41.28 | 55.66 | 62.81 |
| **Farm Category** | | | | |
| Pure Tenant | 14.37 | 31.66 | 37.40 | 42.18 |
| Marginal | 29.10 | 45.24 | 62.79 | 68.27 |
| Small | 30.23 | 45.22 | 57.54 | 64.94 |
| Medium & Large | 18.12 | 27.08 | 40.73 | 52.76 |
| Total | 26.48 | 41.28 | 55.66 | 62.81 |
| **District** | | | | |
| Srikakulam | 11.31 | 17.68 | 26.39 | 30.27 |
| Vizianagaram | 34.69 | 59.37 | 76.20 | 85.56 |
| Visakhapatnam | 75.02 | 78.58 | 79.86 | 79.70 |
| East Godavari | 22.33 | 43.72 | 52.46 | 53.55 |
| West Godavari | 8.96 | 22.34 | 32.52 | 34.63 |
| Krishna | 4.78 | 10.99 | 14.71 | 15.28 |
| Guntur | 31.69 | 59.27 | 69.06 | 76.99 |
| Prakasam | 35.35 | 60.24 | 62.42 | 63.77 |
| SPS Nellore | 22.52 | 44.28 | 61.57 | 60.75 |
| YSR Kadapa | 16.16 | 31.83 | 63.81 | 77.28 |
| Kurnool | 6.19 | 24.33 | 46.11 | 53.86 |
| Anantapuramu | 60.73 | 81.22 | 86.24 | 88.37 |
| Chittoor | 47.39 | 59.26 | 74.82 | 98.57 |
| Total | 26.48 | 41.28 | 55.66 | 62.81 |

Source: IDSAP Field Survey, 2020-21

**Annexure Table 4.2: Agro-climatic zone wise number of CNF Practices adopted by the PMDS+CNF farmers during Kharif Season**

| | 2017-18 | 2018-19 | 2019-20 | 2020-21 |
|---|---|---|---|---|
| **Argo-Climatic Zone** | | | | |
| High Altitude Zone | 6.67 | 7.24 | 7.18 | 7.28 |
| North Coastal Zone | 3.14 | 4.38 | 5.26 | 5.36 |
| Godavari Zone | 1.17 | 3.35 | 5.58 | 5.96 |
| Krishna Zone | 1.50 | 3.45 | 4.63 | 5.29 |
| Southern Zone | 1.75 | 3.23 | 4.77 | 5.11 |
| Scarce Rainfall Zone | 1.29 | 2.93 | 4.35 | 5.02 |
| Total | 2.33 | 3.86 | 5.16 | 5.51 |
| **Farm category** | | | | |
| Pure Tenant | 1.35 | 3.18 | 4.49 | 5.19 |
| Marginal | 2.33 | 3.90 | 5.26 | 5.56 |
| Small | 2.74 | 4.09 | 5.23 | 5.62 |
| Medium & Large | 1.96 | 3.42 | 4.57 | 4.91 |
| Total | 2.33 | 3.86 | 5.16 | 5.51 |
| **District** | | | | |
| Srikakulam | 2.88 | 3.40 | 4.72 | 4.64 |
| Vizianagaram | 2.57 | 4.32 | 5.06 | 5.10 |
| Visakhapatnam | 6.22 | 6.76 | 6.96 | 7.13 |
| East Godavari | 0.81 | 2.84 | 4.28 | 5.24 |
| West Godavari | 1.44 | 3.72 | 6.52 | 6.48 |
| Krishna | 1.05 | 3.09 | 4.79 | 5.89 |
| Guntur | 1.41 | 3.25 | 4.20 | 4.26 |
| Prakasam | 2.72 | 4.52 | 4.58 | 4.60 |
| SPS Nellore | 2.09 | 4.33 | 4.40 | 4.54 |
| YSR Kadapa | 1.19 | 2.17 | 3.93 | 4.38 |
| Kurnool | 0.85 | 2.73 | 4.32 | 4.95 |
| Anantapuramu | 2.28 | 3.37 | 4.41 | 5.16 |
| Chittoor | 2.61 | 4.56 | 6.60 | 6.86 |
| Total | 2.33 | 3.86 | 5.16 | 5.51 |

Source: IDSAP Field Survey, 2020-21

**Annexure Table 4.3: Distribution of PMDS + CNF and non-CNF Farmers according to Agro-climatic zones and Crop Growing Practices during Kharif Season**

| | Growing Single Crop | | Growing Mixed Crop | |
|---|---|---|---|---|
| | PMDS+CNF | Non-CNF | PMDS+CNF | Non-CNF |
| **Agro-Climatic Zone** | | | | |
| High Altitude Zone | 100.0 | 99.0 | 95.2 | 37.8 |
| North Coastal Zone | 100.0 | 100.0 | 8.6 | 5.5 |
| Godavari Zone | 100.0 | 100.0 | 0.0 | 0.0 |
| Krishna Zone | 100.0 | 100.0 | 0.0 | 0.0 |
| Southern Zone | 95.9 | 97.6 | 23.7 | 9.7 |
| Scarce Rainfall Zone | 81.4 | 96.2 | 43.3 | 3.8 |
| Total | 97.5 | 98.8 | 15.5 | 9.1 |
| **Farm category** | | | | |
| Pure Tenant | 100.0 | 100.0 | 0.0 | 0.0 |
| Marginal | 97.0 | 98.7 | 14.9 | 6.0 |
| Small | 98.3 | 98.3 | 22.9 | 14.4 |
| Medium & Large | 94.7 | 100.0 | 12.0 | 16.4 |
| Total | 97.5 | 98.8 | 15.5 | 9.1 |
| **District** | | | | |
| Srikakulam | 100.0 | 100.0 | 2.0 | 0.0 |
| Vizianagaram | 100.0 | 100.0 | 12.4 | 0.0 |
| Visakhapatnam | 100.0 | 98.9 | 58.0 | 45.3 |
| East Godavari | 100.0 | 100.0 | 0.0 | 0.0 |
| West Godavari | 100.0 | 100.0 | 0.0 | 0.0 |
| Krishna | 100.0 | 100.0 | 0.0 | 0.0 |
| Guntur | 100.0 | 100.0 | 0.0 | 0.0 |
| Prakasam | 100.0 | 100.0 | 0.0 | 0.0 |
| SPS Nellore | 100.0 | 100.0 | 0.0 | 0.0 |
| YSR Kadapa | 100.0 | 100.0 | 4.5 | 0.0 |
| Kurnool | 83.1 | 96.0 | 36.9 | 4.0 |
| Anantapuramu | 78.1 | 96.4 | 56.3 | 3.6 |
| Chittoor | 86.9 | 93.2 | 70.2 | 27.3 |
| Total | 97.5 | 98.8 | 15.5 | 9.1 |

Source: IDSAP Field Survey, 2020-21

**Annexure Table 4.4 Crop-wise Distribution of Total Area Cultivated by Sample PMDS+CNF Farmers for growing crops under PMDS+CNF, CNF and non-CNF (%) during Kharif Season**

| Sl. No | Crop | Cultivated Area (in hectare) | % Distribution | | |
|---|---|---|---|---|---|
| | | | PMDS+CNF plot | CNF plot | Non-CNF plot |
| 1 | Paddy | 643.71 | 48.1 | 8.1 | 43.8 |
| 2 | Groundnut | 52.30 | 56.3 | 19.8 | 23.8 |
| 3 | Cotton | 77.81 | 42.4 | 19.1 | 38.4 |
| 4 | Black gram | 10.87 | 46.2 | 37.0 | 16.7 |
| 5 | Maize | 27.74 | 30.6 | 19.9 | 49.5 |
| 6 | Red gram | 65.24 | 34.2 | 56.6 | 9.2 |
| 7 | Ragi | 20.85 | 4.7 | 95.3 | 0.0 |
| 8 | Other Crop | 253.16 | 11.5 | 52.5 | 36.0 |
| | Total | 1151.68 | 38.0 | 24.0 | 37.9 |

Source: IDSAP Field Survey, 2020-21

**Annexure Table 4.5 Number of Human Labour days, Family and Hired, used across Crops (per hectare) by PMDS+CNF and non-CNF farmers**

| Crop | PMDS+CNF | | | Non-CNF | | |
|---|---|---|---|---|---|---|
| | Family Labour | Hired Labour | Total | Family Labour | Hired Labour | Total |
| Paddy | 58 | 53 | 111 | 38 | 57 | 95 |
| Groundnut | 29 | 58 | 88 | 15 | 45 | 60 |
| Cotton | 29 | 74 | 103 | 22 | 58 | 80 |
| Bengal Gram | | | | 19 | 28 | 47 |
| Black Gram | 28 | 25 | 53 | 10 | 11 | 22 |
| Maize | 44 | 53 | 97 | 21 | 29 | 49 |
| Red Gram | 24 | 14 | 38 | 15 | 10 | 25 |
| Chillies | 31 | 72 | 103 | 66 | 62 | 128 |
| Green Gram | 41 | 34 | 75 | 15 | 27 | 42 |
| Ragi | 141 | 4 | 145 | 65 | 2 | 67 |
| Sugarcane | 42 | 124 | 166 | 120 | 77 | 197 |
| Horse Gram | | | | 42 | 25 | 66 |

Source: IDSAP Field Survey, 2020-21

**Annexure Table 4.6 Source wise Credit mobilised for agriculture and other purposes by PMDS+CNF and CNF by farmers**

| | PMDS+CNF | | Non-CNF | |
|---|---|---|---|---|
| | % Of Farmer | Source wise distribution of funds (%) | % Of Farmer | Source wise distribution of funds (%) |
| Own Savings | 91.7 | 46.0 | 85.2 | 41.3 |
| Rythu Bharosa + Govt. subsidies | 75.8 | 13.8 | 81.8 | 12.4 |
| Banks/ Institution | 20.4 | 20.7 | 26.4 | 22.3 |
| Friends and Relatives | 28.2 | 14.3 | 24.6 | 19.3 |
| Traders/ Money lenders | 9.6 | 2.9 | 8.8 | 3.2 |
| Others | 4.8 | 0.8 | 7.0 | 1.3 |

Source: IDSAP Field Survey, 2020-21

# Chapter 5: Indications of Environmental Sustainability of Community Managed Natural Farming with pre monsoon dry season sowing (PMDS+CNF): Evidence from Farmers' Voices

## 5.1. Introduction

The present Research Report broadly follows sustainability perspective of CNF. Three dimensions of sustainability, viz., social, economic and environmental are considered. Chapter 2 covers the social equity dimension required for social sustainability. Chapters 3 covers the sustainable livelihoods dimension, essential for economic sustainability. The analysis relating to these two dimensions has been based upon the quantitative data collected from farmers. But, the analysis of the third dimension, viz., environmental sustainability has been assessed on the basis of voices of farmers in this chapter. The reported perceptions of farmers on the sustainability parameters considered have been converted in to percentages. It has to be noted that the perceptions are collected from CNF (PMDS+CNF) farmers only.

Soil health is considered as a measure of environmental sustainability of CNF. The farmers were asked whether the soil quality/soil health has improved due to CNF practices adopted. The farmers who responded positively to this question have been asked another question in continuation as to how they perceive this. The farmers responded saying that they have come to this conclusion because of four visible changes that took place in the soils of their fields. They are soils softened; soil moisture increased; more earthworms are visible; and more green cover has come up in their fields.

In order to understand the cascading effects of improved soil health on crop health, a question was asked on the health of the crops due to improved soil health under CNF. The farmers say that they observed that the grain weights have increased, plant stems were strong, and the crops have become resilient towards weather variability- getting more resistance to dry spells, and withstanding heavy rains and strong winds.

Conversation with the farmers continued with regard to impact of improved quality of crops on their well-being. The issues like improvement in family members' health; reduction in paid-out costs on health; consumption of CNF food; taste of CNF food; improvement in family

finances; reduction in tensions in pursuing agriculture and thereby increased happiness of shifting from non-CNF to CNF. These are the dimensions of farmers well-being considered for data collection from the farmers.

This chapter is a modest attempt to assess the CNF effect on soil health/quality and its cascading effects on crop health and human well-being based on the farmers' voices. There is a need to collect quantitative data by the Soil Scientists, to provide scientific evidence of the soil health.

## 5.2. Research Questions

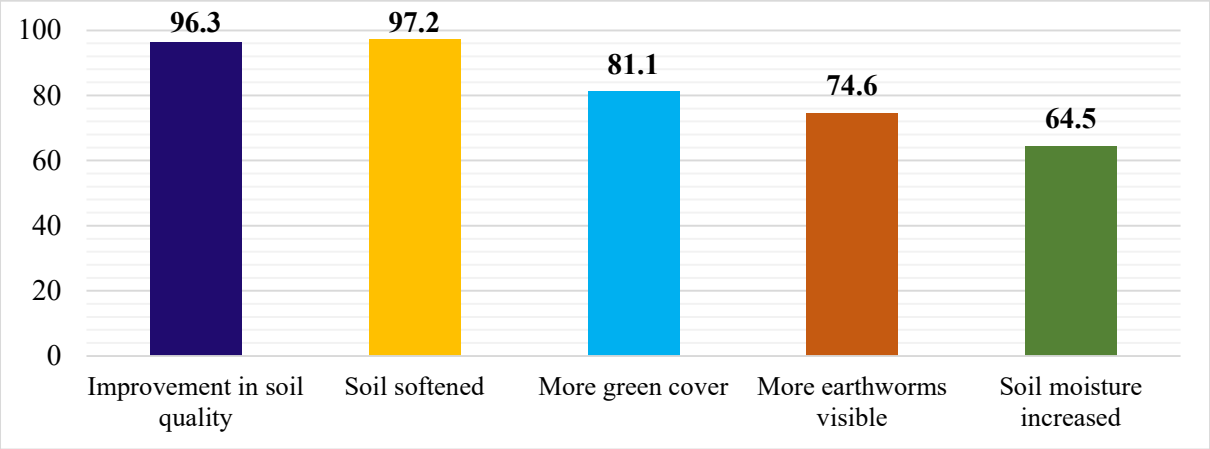
In the above backdrop, this chapter examines the following research questions:

a. Whether CNF has improved soil health/quality?
b. What is the cascading impact of improved soil health/quality on crop health?
c. What is the impact of improved crop health on Well-being of CNF farmers?
d. How far the above dimensions of environmental impact of CNF and its cascading effects vary across agroclimatic zones, districts and category of farmers?

## 5.3. Soil Heath/Quality

Improvement in the health/quality is extensively reported by 96 percent of farmers of all farmers. (Figure 5.1). This is reported widely by farmers from all agroclimatic zones, districts and category of farmers (Annexure Table 5.1). The percentage of farmers who reported softening of the soil is 97 across all the farmers put together (Figure 5.1). By and large, this is reported commonly across all the zones, districts and category of farmers (Annexure Table 5.1). This is in line with the expected improvement in soil health.

**Figure 5.1: Percentage of Farmers responded positively about increased soil quality due to APCNF farming**




Source: IDSAP Field Survey, 2020-21

The farmers who reported increased moisture in soil, visibility of more earthworms in soil, and increased green cover in fields were relatively lower percentages in relation to those who reported the softening of the soil at the aggregate level (Figure 5.1).

Among the zones, in the High Altitude and North Coastal zones higher percentage of farmers reported improvement in all the three-parameter, viz., increase of soil moisture, visibility of more earthworm in the soil, and more green cover considered for the analysis, compared to all the farmers at the state levle. But in the Scarce Rainfall Zone lower percentage of farmers reported improvement in these three parameters of soil health. The rest of the zones have lagged behind in one or two of the three parameters. Vizianagaram, Visakhapatnam, West Godavari, Krishna, and Chittoor districts have higher percentage of farmers reporting improvements in all these parameters, while YSR Kadapa, Kurnool and Anantapuramu have lagged in all these three parameters with lower percentage of farmers reporting improvement. The rest of the five districts have lagged behind the state performance in one or two parameters. Interestingly, a low percentage of the medium and large farmers, among the category of farmers, reported improvement in the dimensions of soil health. while relatively larger percentage of marginal farmers reported improvement in all these parameters. Among the pure tenants and small farmers lower percentage of farmers reported improvement in one or two parameters of the three (Annexure Table 5.1).

## 5.4. Crop Health

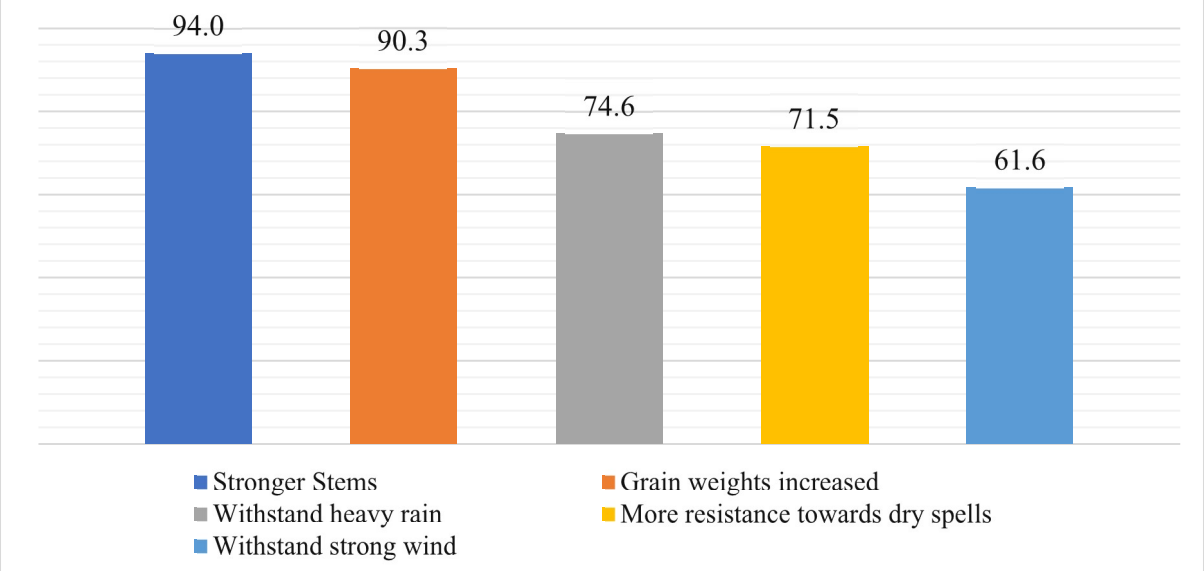
As noted earlier, cascading impact of improvement in soil health on crop health has been perceived by farmers in terms of ‘increased Grain Weights; ‘Stronger Stems’; ‘More

Resistance towards 'Dry Spells'; Withstanding Heavy Rain'; and 'Withstanding Strong Winds'. The last three parameters are related to resilience of crops towards weather variability.

The farmers have widely reported 'increased Grain Weights and 'Stronger Stems 'at the state level. But relatively lower percentage of farmers have reported positive aspects with regard to the three parameters considered for assessing the heath of crops in terms of resilience (Figure5.2).

Increased grain weights and Stems becoming stronger were reported by minimum of 80 per cent of farmers across zones, category of farmers and districts (Except Guntur and SPS Nellore).

**Figure 5.2: Farmers' Response about Increased Crop health due to APCNF farming (%)**




Source: IDSAP Field Survey, 2020-21

The High altitude and North Coastal zones have performed extremely well compared to all other zones in all the three parameters of resilience of crops to weather variability considered to assess the resilience of crops towards weather variability, as per the reporting of farmers. The other four zones have not enabled the crops to be resilient to weather variability in one or two parameters of resilience. The Southern Zone was found to lag behind in performance, as per the reporting of farmers, in all the three parameters of resilience. The districts such as Srikakulam, Vizianagaram, Visakhapatnam, West Godavari, Krishna, and Chittoor have performed extremely well in regard to all the three parameters of resilience, as per the reporting of farmers. But, the districts namely SPS Nellore, YSR Kadapa, and Anantapuramu have

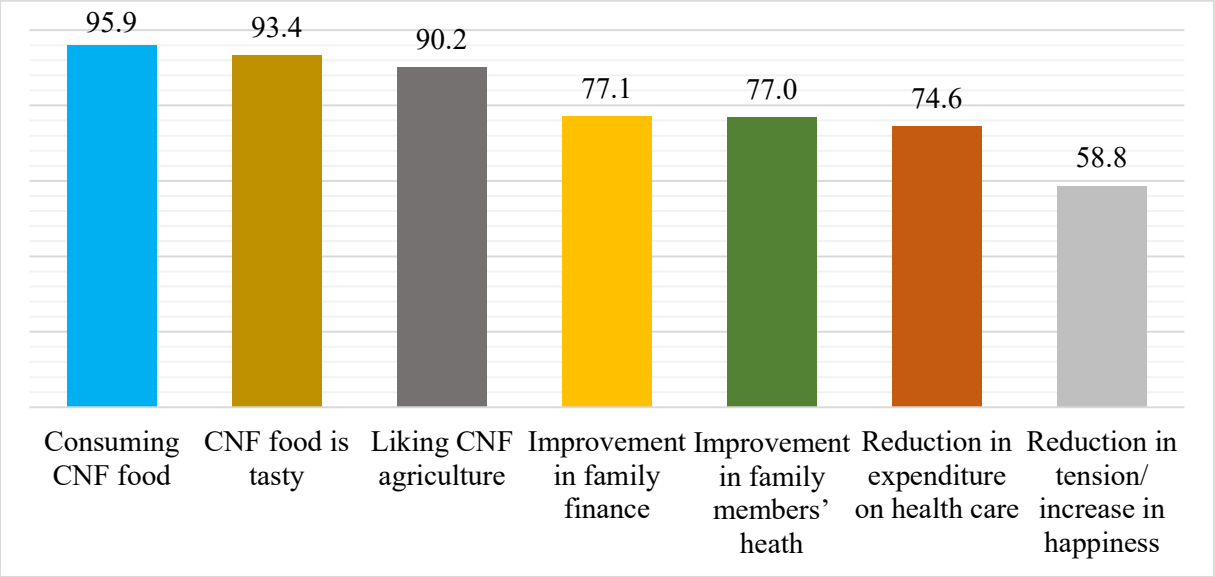
lagged behind in all the three parameters of resilience of crops to weather variability according to farmers. The other four districts have lagged behind in one or two parameters of crop resilience, as per the reporting of farmers. Marginal farmers performed better than the other category of farmers in regard to these resilience parameters. But the medium and large farmers have met with failure relatively in all the three parameters according to the reporting of farmers. All the other category of farmers were with relatively lower performance in one or two parameters of resilience, as per the reporting of farmers (Annexure Table 5.2).

## 5.5. Farmers' Well-being

Around 75 percent of the farmers at the aggregate level reported improvement in family members' health and reduction in paid-out costs towards health care (Annexure Table 5.3). These gains are pronounced among higher percentage of farmers in High Altitude, Godavari, and Scarce Rainfall zones. Visakhapatnam, East Godavari, West Godavari, Guntur, Prakasam, SPS Nellore, Kurnool and Chittoor have relatively higher percentage of farmers reporting improvement in the health of family members and reduction in out- of- pocket expenditure towards health care. Pure tenants and Marginal farmers have reported health improvements and reduced expenditure on health care in higher percentages, among the category of farmers (Annexure Table 5.3).

In addition to these, there are another five parameters considered for capturing perceptions on farmers' well-being. They are: Consuming CNF food; superior taste of CNF foods; Liking CNF agriculture; improvement in family finances; and reduction in tension and increase in happiness (Figure 5.3 and Annexure Table 5.4). The farmers have reported widely the parameters of well-being such as 'consuming CNF food, 'CNF food being tasty' and 'Liking CNF Agriculture' in relation to other dimensions at the aggregate state level., (Figure 5.3).

**Figure 5.3: Farmers' Response in Increasing Human Well-being due to APCNF Farming (%)**




Source: IDSAP Field Survey, 2020-21

Around a minimum of 50% of the farmers across agroclimatic regions, size classes of farmers and districts reported consuming CNF foods which were perceived as tasting better and enjoyed natural farming. However, the percentage of positive response of farmers to improved family finances and decrease in tensions widely varied across agroclimatic regions, farmer categories and districts. In Chittoor district all farmers in the sample 100% reported improvement in finances but only 14% of farmers reported to be free from tensions. In Prakasam district 98% reported improved family finances but as few as 5.6 %.are reported to be free from tensions. In Srikakulam district 12.8 % reported improved finances and only 3% are free from tensions. Non-improvement in family finances, causes unhappiness as in Srikakulam. In the other two districts of Chittoor and Prakasam farmers are unhappy even with improved finances. Improvement in finances did not make them happy. This may necessitate further probe as to why so many are not happy (Annexure Table 3.4).

It is striking to note that the percentage of farmers reported that the CNF food is tasty and those who reported that they have consumed CNF food is the same and the percentage is around 94 per cent. This is in line with the percentage of farmers reported that the health of family members has increased. This means that the chemical free food produced under CNF through improvement in soil health and thereby improvement in crop health has improved the health of farmers and their family members. Thus, it is evident that the environmental sustainability is

facilitating quality of human resources. Further, the relatively high percentage of farmers reporting that they like CNF agriculture indicates that farmers have converted to CNF agriculture due to the improvement in environmental sustainability. In totality, the environmental improvements brought in agriculture due to CNF have led to higher level of dependence on agriculture. Hence, it is clear that the indicators in environmental sustainability have contributed to indicators of social sustainability in terms of equity as analysed in chapter 2. It is also striking to note that a large percentage of farmers (about 77%) reported improvement in their financial position and about 59% reported reduction in the tensions in organising agriculture and being happy. These conditions are more reflected in High Altitude and Krishna zones; and Visakhapatnam. On the whole, there are indications of environmental sustainability and their cascading effects on well-being of farmers (Appendix Tables 5.3 and 5.4).

**Annexure to Chapter 5**

**Annexure Table 5.1: Agroclimatic zone, Farm category and District wise percentage of PMDS+CNF farmers' response about an improvement in soil quality**

| Agroclimatic zone/ Farm category/ District | Parameters of improvement in Soil quality | | | | |
|---|---|---|---|---|---|
| | Improvement in soil quality | Soil softened | Soil moisture increased | More earthworms visible | More green cover |
| **Agro-Climatic Zone** | | | | | |
| High Altitude Zone | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| North Coastal Zone | 99.4 | 95.4 | 79.9 | 82.7 | 86.1 |
| Godavari Zone | 100.0 | 98.9 | 60.7 | 93.2 | 67.9 |
| Krishna Zone | 95.1 | 98.6 | 64.1 | 94.4 | 79.7 |
| Southern Zone | 92.2 | 96.3 | 53.0 | 55.2 | 84.8 |
| Scarce Rainfall Zone | 100.0 | 95.2 | 38.2 | 29.4 | 53.1 |
| Total | 96.3 | 97.2 | 64.5 | 74.6 | 81.1 |
| **Farm Category** | | | | | |
| Pure Tenant | 98.9 | 99.3 | 56.0 | 79.0 | 74.8 |
| Marginal | 94.8 | 97.5 | 68.9 | 78.9 | 82.0 |
| Small | 98.9 | 96.1 | 59.2 | 67.5 | 83.4 |
| Medium & Large | 97.4 | 95.2 | 52.4 | 49.6 | 71.1 |
| Total | 96.3 | 97.2 | 64.5 | 74.6 | 81.1 |
| **District** | | | | | |
| Srikakulam | 99.1 | 100.0 | 38.0 | 81.0 | 53.8 |
| Vizianagaram | 99.2 | 92.3 | 86.1 | 77.3 | 91.3 |
| Visakhapatnam | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| East Godavari | 100.0 | 100.0 | 12.2 | 86.6 | 23.8 |
| West Godavari | 100.0 | 98.0 | 96.1 | 98.0 | 100.0 |
| Krishna | 93.4 | 100.0 | 77.8 | 100.0 | 98.2 |
| Guntur | 94.2 | 99.7 | 90.4 | 97.9 | 23.6 |
| Prakasam | 100.0 | 94.6 | 9.9 | 78.2 | 82.0 |
| SPS Nellore | 96.7 | 100.0 | 91.7 | 86.5 | 48.3 |
| YSR Kadapa | 86.6 | 93.1 | 24.7 | 16.7 | 89.7 |
| Kurnool | 100.0 | 100.0 | 44.5 | 21.7 | 62.1 |
| Anantapuramu | 100.0 | 84.5 | 23.9 | 46.9 | 32.5 |
| Chittoor | 100.0 | 99.2 | 76.9 | 100.0 | 98.3 |
| Total | 96.3 | 97.2 | 64.5 | 74.6 | 81.1 |

Source: IDSAP Field Survey, 2020-21

**Annexure Table 5.2: Agroclimatic zone, Farm category and District wise percentage of PMDS+CNF farmers reported improvement in crop quality**

| Agroclimatic zone/ Farm category/ District | Parameters of Crop Quality | | | | |
|---|---|---|---|---|---|
| | Grain weights increased | Stronger Stems | More resistance towards dry spells | Withstand heavy rain | Withstand strong wind |
| **Agro-Climatic Zone** | | | | | |
| High Altitude Zone | 100.0 | 100.0 | 100.0 | 100.0 | 99.0 |
| North Coastal Zone | 95.0 | 95.7 | 97.3 | 84.2 | 77.6 |
| Godavari Zone | 97.2 | 95.3 | 64.5 | 79.7 | 67.2 |
| Krishna Zone | 92.2 | 86.8 | 87.0 | 80.8 | 60.7 |
| Southern Zone | 80.9 | 94.2 | 45.3 | 58.2 | 45.2 |
| Scarce Rainfall Zone | 95.3 | 94.3 | 79.6 | 75.6 | 43.2 |
| Total | 90.3 | 94.0 | 71.5 | 74.6 | 61.6 |
| **Farm Category** | | | | | |
| Pure Tenant | 88.3 | 89.1 | 60.6 | 76.6 | 58.3 |
| Marginal | 89.3 | 94.9 | 73.9 | 75.8 | 64.4 |
| Small | 93.2 | 94.6 | 70.4 | 73.1 | 58.1 |
| Medium & Large | 91.2 | 88.2 | 64.7 | 65.0 | 48.5 |
| Total | 90.3 | 94.0 | 71.5 | 74.6 | 61.6 |
| **District** | | | | | |
| Srikakulam | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Vizianagaram | 91.7 | 92.9 | 95.6 | 73.7 | 62.8 |
| Visakhapatnam | 100.0 | 100.0 | 100.0 | 100.0 | 99.3 |
| East Godavari | 93.3 | 88.9 | 19.3 | 51.8 | 23.6 |
| West Godavari | 100.0 | 100.0 | 97.5 | 100.0 | 99.0 |
| Krishna | 100.0 | 100.0 | 96.6 | 76.4 | 69.1 |
| Guntur | 62.7 | 40.0 | 44.6 | 81.2 | 54.2 |
| Prakasam | 98.2 | 94.6 | 100.0 | 91.4 | 45.2 |
| SPS Nellore | 46.8 | 87.7 | 61.4 | 64.3 | 41.0 |
| YSR Kadapa | 81.8 | 93.2 | 11.3 | 34.3 | 17.7 |
| Kurnool | 97.9 | 100.0 | 85.5 | 95.2 | 47.6 |
| Anantapuramu | 89.5 | 81.5 | 66.2 | 31.4 | 33.1 |
| Chittoor | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Total | 90.3 | 94.0 | 71.5 | 74.6 | 61.6 |

Source: IDSAP Field Survey, 2020-21

**Annexure Table 5.3: District wise percentage of farmers reportioning improvement in health outcomes**

| Agroclimatic zone/ Farm category/ District | Parameters of Health outcomes | |
|---|---|---|
| | Improvement in family members' heath | Reduction in expenditure on health care |
| **Agro-climatic Zone** | | |
| High Altitude Zone | 100.0 | 100.0 |
| North Coastal Zone | 58.3 | 75.1 |
| Godavari Zone | 90.5 | 100.0 |
| Krishna Zone | 96.6 | 66.3 |
| Southern Zone | 62.1 | 58.4 |
| Scarce Rainfall Zone | 97.5 | 90.5 |
| Total | 77.0 | 74.6 |
| **Farm category** | | |
| Pure Tenant | 83.9 | 63.0 |
| Marginal | 77.8 | 76.4 |
| Small | 77.0 | 74.1 |
| Medium & Large | 55.9 | 72.3 |
| Total | 77.0 | 74.6 |
| **District** | | |
| Srikakulam | 31.1 | 64.3 |
| Vizianagaram | 52.3 | 69.8 |
| Visakhapatnam | 100.0 | 100.0 |
| East Godavari | 93.6 | 100.0 |
| West Godavari | 88.2 | 100.0 |
| Krishna | 94.8 | 42.7 |
| Guntur | 100.0 | 100.0 |
| Prakasam | 98.2 | 96.5 |
| SPS Nellore | 100.0 | 100.0 |
| YSR Kadapa | 31.2 | 30.7 |
| Kurnool | 100.0 | 100.0 |
| Anantapuramu | 91.9 | 68.9 |
| Chittoor | 97.7 | 85.7 |
| Total | 77.0 | 74.6 |

Source: IDSAP Field Survey, 2020-21

**Annexure Table 5.4: District wise percentage of PMDS+CNF farmers who reported improvement in well-being**

| Agroclimatic zone/ Farm category/ District | Parameters of Well-being | | | | |
|---|---|---|---|---|---|
| | Consuming CNF food | CNF food is tasty | Liking CNF agriculture | Improvement in family finance | Reduction in tension/ increase in happiness |
| **Agro-climatic zone** | | | | | |
| High Altitude Zone | 100.0 | 97.0 | 100.0 | 100.0 | 100.0 |
| North Coastal Zone | 80.7 | 98.1 | 70.2 | 66.5 | 57.1 |
| Godavari Zone | 100.0 | 94.6 | 100.0 | 60.7 | 89.1 |
| Krishna Zone | 100.0 | 97.3 | 99.0 | 80.0 | 74.3 |
| Southern Zone | 98.2 | 87.1 | 89.6 | 76.5 | 30.9 |
| Scarce Rainfall Zone | 99.1 | 98.4 | 91.2 | 100.0 | 54.7 |
| Total | 95.9 | 93.4 | 90.2 | 77.1 | 58.8 |
| **Farm Category** | | | | | |
| Pure Tenant | 98.5 | 95.9 | 97.5 | 76.6 | 82.0 |
| Marginal | 95.5 | 92.5 | 88.5 | 74.3 | 60.0 |
| Small | 95.8 | 95.7 | 91.1 | 85.5 | 50.9 |
| Medium & Large | 96.6 | 90.3 | 95.5 | 72.6 | 45.6 |
| Total | 95.9 | 93.4 | 90.2 | 77.1 | 58.8 |
| **District** | | | | | |
| Srikakulam | 100.0 | 99.2 | 100.0 | 12.8 | 3.1 |
| Vizianagaram | 67.9 | 97.0 | 50.5 | 71.7 | 59.2 |
| Visakhapatnam | 100.0 | 97.8 | 100.0 | 100.0 | 100.0 |
| East Godavari | 100.0 | 87.1 | 100.0 | 96.5 | 92.9 |
| West Godavari | 100.0 | 100.0 | 100.0 | 34.7 | 86.3 |
| Krishna | 100.0 | 97.9 | 98.3 | 66.0 | 92.5 |
| Guntur | 100.0 | 93.8 | 100.0 | 100.0 | 100.0 |
| Prakasam | 100.0 | 99.0 | 100.0 | 98.0 | 5.6 |
| SPS Nellore | 100.0 | 94.8 | 100.0 | 100.0 | 100.0 |
| YSR Kadapa | 99.4 | 77.9 | 91.5 | 56.6 | 14.3 |
| Kurnool | 100.0 | 100.0 | 100.0 | 100.0 | 48.6 |
| Anantapuramu | 97.0 | 94.6 | 71.3 | 100.0 | 68.4 |
| Chittoor | 94.8 | 100.0 | 79.5 | 100.0 | 20.2 |
| Total | 95.9 | 93.4 | 90.2 | 77.1 | 58.8 |

Source: IDSAP Field Survey, 2020-21

# Chapter 6: Summary, Conclusions and Policy Implications

## 6.1. Introduction

The basic premise of this Kharif study of 2020-21 is to assess the impact of Pre-Monsoon Dry Sowing (PMDS)+Community managed Natural Farming (CNF) on farming and farmers of Andhra Pradesh. PMDS is a part of CNF. It is a recent breakthrough in CNF to harness water from the water vapor in the atmosphere and channel it into soil through mulching material spread across the cultivated land of the farmer to provide water for plants to grow. It enables farmers to grow crops in non-monsoon seasons and also helps to keep the cultivated land covered with greenery (crops) 365 days in a year. The crop grown in PMDS is used ultimately as green manure, apart from some income to farmer and green fodder to animals. The PMDS crops are of various types to suit the soils. The PMDS crops improve soil fertility and productivity.

The impact of PMDS+CNF is assessed through the comparison of PMDS+CNF farmers with non-CNF farmers in regard to different impact parameters. First, the study focusses on socio-economic inclusiveness. It examines the extent of representation of marginalised group of farmers belonging to SCs, STs, Women, pure tenants, marginal and small farmers; The study compares the age and education profiles of CNF farmers with non-CNF farmers entry. Second, it compares the costs and the returns of major crops of CNF with non-CNF to assess the impact of PMDS+CNF on farming. Third, it examines how land, labour and credit have been utilised to adopt the practices of CNF. Fourth, the impact of PMDS+CNF on environment and Farmers' well-being has been analysed. Finally, the policy implication emanating from the analysis conducted in the four chapters of the study are identified.

This study is conducted in all the 13 districts of Andhra Pradesh. It followed a stratified, multi-stage sampling scheme with Gram Panchayats (GPs) as first stage units and cultivators (households) as second stage units. A total of 1140 farmers from 107 Grama Panchayats of PMDS+CNF; and a sample of 646 non-CNF farmers from 52 Grama Panchayats from respective universes of Grama Panchayats have been selected to assess the impact of PMDS+CNF. Costs and returns for the crops considered for the analysis have been obtained from the farmers through farmer household surveys.; Also, data on utilisation of land, labour and credit to adopt CNF practices, farmers' perception on environment and farmers' well-being

has been collected from framer's household questionnaires. The data on yields of crops has been obtained through Crop Cutting Experiments (CCEs). Cost of cultivation analysis includes 8 crops. The crops are (1) Paddy, (2) Groundnut, (3) Cotton, (4) Black gram, (5) Maize, (6) Red gram, (7) Chilies and (8) Ragi. Owing to inadequate CCE data, Maize and Chilies are omitted in the analyses of yields, gross and net values of crops.

## 6.2. Summary of Main Findings

### *6.2.1. Indications of Social Sustainability*

- Representation of the most marginalized social groups such as SCs and STs in CNF is considerable, vis-à-vis non-CNF. This indicates higher social inclusiveness of CNF. Marginal farmers and pure tenant farmers are higher in CNF than that of non-CNF. The efforts of RySS to focus on the marginalized sections of the society to achieve socio-economic inclusiveness in CNF are met with success.
- The presence of young farmers and those in Middle Ages are more, in percentage terms, in CNF. Similarly, educated up to secondary level, and highly educated are seen in CNF. This is one of the greatest achievements of CNF. This indicates that the benefits of CNF have attracted the young and educated farmers into it.

### *6.2.2. Production Conditions of Crops*

- The expenditure on PNPIs, and paid-out costs on cultivation are lower under CNF, for all the eight crops analysed for costs related parameters. In case of paid-out costs, including own labour, the expenditure is lower under CNF in seven out of eight crops analysed. Only groundnut has marginally (1.31%) higher paid-out cost under CNF. The results have supported the hypothesis that higher savings in costs could be achieved in input-intensive crops.
- Five out of six crops, analysed for yields, gross and net returns, have recorded higher yields under CNF. Only Black gram recorded lesser (12.48%) yields under CNF.
- A comparison of this year's data with those of previous two years indicate a positive contribution of PMDS CNF in CNF.
- The study found higher prices for some of the CNF crops. The gross values of CNF crop output are higher for all crops analysed, including the Black gram, which recorded low yields under CNF. Because of reduction in costs and increase in yields and better

prices, three out of total six crops analysed, got over 150% higher net values of output under CNF. In two other crops, the net values of CNF outputs are higher by 79% and 97%.

- A comparative analysis of gross values and net values indicate that reduction in cost of cultivation is the major contributory factor to the increase in net values of crop output. Farmers' incomes would double in one to two years, if CNF output command at least a little, say 10%, higher prices.
- The disaggregate analysis of Paddy crop indicates that the resource intensive zones and pure tenants and marginal farmers, who usually make higher investment in agriculture have saved more under CNF.
- This year's heavy rains proved to be beneficial to rainfed Paddy. The study results have demonstrated CNF's ability to withstand the heavy rains.

### *6.2.3. Utilization of Land, Labour and Credit Mobilized*

- The area allocated towards CNF as a percentage of operated area in kharif season has increased from 26.48 in 2017-18 to 62.81 in 2020-21 for all the farmers together. Adoption of the practices of CNF, by CNF farmers has increased over time from 2.3 in 2017-18 to 5.5 in 2020-21 for all the farmers together. Relatively a higher percentage (15.5%) of CNF farmers have grown multiple crops compared to non-CNF farmers (9.1%). The variation is quite high in High Altitude Zone (57 percentage points) and Scarce Rainfall Zone (40 percentage points). The cultivated land should be kept more under PMDS+CNF for each crop so that the farmers can derive more benefits. The land used is more under PMDS+CNF for all the major crops considered for the analysis, except Ragi
- The labour use in days per hectare is found to be higher among CNF farmers over non-CNF farmers across all the major crops. Interestingly, the family labour use is higher across all the crop in PMDS+ CNF over non-CNF
- The credit from typical informal sector is very low among CNF farmers.

### *6.2.4. Environment and Farmers' Well-Being*

- Improvement in the health/quality of soil is extensively reported by 96 percent of farmers. The percentage of farmers who reported softening of the soil is 97 percent. This is in line with the expected improvement in soil health.

- The farmers have widely reported ‘increased Grain Weights and ‘Stronger Stems ‘. Considerable percentage of CNF farmers have reported improvement in three parameters of resilience to weather conditions such as Resistance towards ‘Dry Spells’ (72%); Withstanding Heavy Rain’ (75%), and ‘Withstanding Strong Winds’ (62%).,
- Around 75 percent of the farmers at the aggregate level reported improvement in family members’ health and reduction in paid-out costs towards health care. The farmers have reported overwhelming health benefits of consuming on-farm CNF foods. ‘CNF food is reported to be tasty. ’. Majority of CNF farmers enjoyed CNF agriculture, reported improvement in family finances, and reduction in tension and increase in happiness.

## 6.3. Conclusions

- The socio-economic inclusiveness of CNF ensures socio-economic equity and stability. This ultimately confirms Social Sustainability. Similarly, the entry of younger and more educated into CNF ensures sound human resource base to conduct more experimentations in growing crops and promoting innovating marketing strategies for marketing CNF products. This in turn brings vibrancy and ensures sustainability of CNF.
- The CNF farmers have excelled over non- CNF farmers with respect to all the parameters such as PNPI costs, out of pocket-expenses for growing crops, yields, gross value and net value analysed for all the crops considered.
- Resilience to heavy rains of CNF crops over non-CNF is proved beyond doubt.
- Higher price realisation by CNF farmers compared to non-CNF farmers has not been found across all the crops.
- Converting land to CNF cultivation leads to diversified cropping pattern through an adopting CNF practices. It helps soil health and land productivity.
- The deployment of more family labour over hired labour implies the intensive use of family labour. This results in higher land productivity.
- The reduced dependency on informal sources for credit mobilisation for working capital and for meeting other needs indicates the reduction in the cost of credit and thereby reduction in the cost of cultivation of growing crops to that extent under CNF. Further, this also shows that the farmers of CNF have achieved relative autonomy from the exploitative informal credit markets.
- The CNF has contributed to soil health/quality. This has implications to improved soil fertility and productivity. The improved resilience of crops to withstand the

weather variability and production of chemical free and tasty food from crops stand as evidence to the improved sustainability.

- The consumption of the CNF food improved health of the family members and thereby reduced the paid-out costs towards health care to that extent. The CNF has also improved financial status of farmers. All these three benefits enhanced farmers liking towards CNF. This has reduced the tension and thereby improved their happiness. These may induce non-CNF farmers to get into CNF.

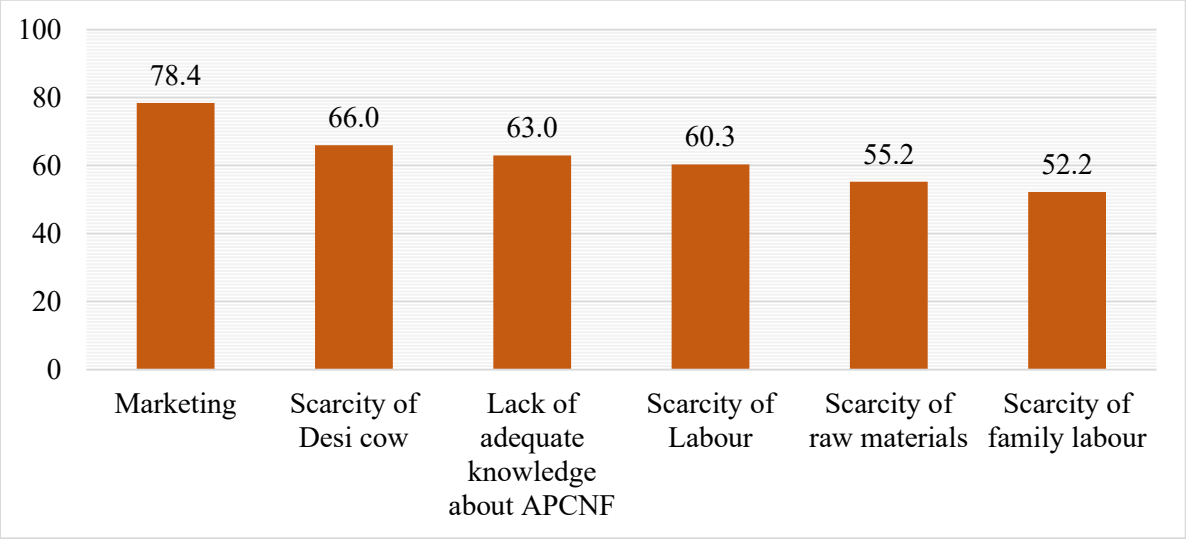
## 6.4. Challenges and Policy Implications

The analysis and the discussions with the farmers have brought out clearly four challenges to be addressed by RySS. They are: marketing support for CNF crops for obtaining higher prices compared to those of non-CNF; utilisation of land for adopting CNF practices; lack of adequate knowledge about CNF; and the scarcity of raw material for preparing biological inputs.

Though the CNF farmers realized, higher prices for their crop outputs, and earned higher the incomes this year, marketing of the crop at remunerative price remains as a major issue (Figure 6.1). This has implication for the continuation of farmers with CNF. Failure to get remunerative prices may result in a reduction of area under CNF. Thus, marketing is the biggest constraint for the expansion of CNF.

In this context, the discussions with the District Project Managers (DPMs) are found to be useful. Measures such as issuing organic certificate to the farmers who have been practicing PMDS of CNF at least for three years; encouraging young professionals to get into CNF and to introduce innovative marketing models that link up with CNF farmers, with supply chains; encouraging farmers to promote Farmer Producer Organizations with the help of NGOs; and encouraging women's self-help groups and their federations to promote marketing with the help of NGOs may address the marketing issue. Public procurement of CNF products is another option.

**Figure 6.1: Challenges faced by farmers in adopting APCNF practice (%)**




Source: IDSAP Field Survey, 2020-21

The second issue is that utilization of cultivated land for adopting CNF practices. It has two dimensions. Farmers may be encouraged to convert their land under non-CNF to PMDS+CNF across all districts. The analysis has also brought out the opportunities for shifting from single crops to mixed cropping patterns to improve the fertility and productivity of land and labour in the districts.

In the delta areas, there is more scope for practicing integrated farming in paddy fields that contributes to diversification of crop land. There is also larger scope for the implementation of 5 Layer models for raising diversified cropping pattern across the districts. The recent initiative of RySS taken up with Rural Development Department, Government of Andhra Pradesh for the promotion of 5 Layer models is a welcome step. However, the MGNREGS guidelines need to be modified to suit the requirements of RySS to accelerate implementation of these models, as evident from the discussions with DPMs. There is enough scope to encourage farmers to adopt all the practices of CNF, given the impressive improvement over time in the adoption of these practices across farmers.

The third issue is related to the extension services for the implementation of CNF practices at the village level. Considerable proportion of farmers reported that they do not have adequate knowledge about CNF. Some of these farmers may be new entrants to CNF. Extension services result in rapid expansion of area under CNF In this context, there is need to explore possibilities of reducing the non-core workload and make more time available to grassroot level field staff for attending to extension work. The Rytu Bharosa Kendras should also be utilized effectively by the field staff for educating the farmers. Promotion of Compact Blocks of CNF in each

cluster of villages as a demonstration block which is developed with all practices and models of CNF may encourage farmers to adopt CNF practices, this is evident from the discussions with DPMs.

The fourth issue is the availability of inputs for adopting CNF practices. In addition to the existing institutions which are in place to provide readymade inputs, the women self-help groups and their federations should be encouraged to run the NPM shops wherever possible through bank linkages for meeting the credit requirements. Moreover, some government land may be provided to these groups to grow plants required, as raw material, for preparing biological inputs. Provision of backward and forward linkage to prepare biological inputs may address the issues of availability of inputs. Local interest should be generated about the livelihood opportunities around CNF.