

Assessing the Impact of APCNF

[Andhra Pradesh Community Managed Natural Farming]
A Comprehensive Approach Using Crop Cutting Experiments
2nd Interim [Kharif] Report 2022-23

Submitted To
Rythu Sadhikara Samstha
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Government of Andhra Pradesh



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Second Interim Report 2022-23

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Acronyms

APCNF	:	Andhra Pradesh Community Managed Natural Farming
BC	:	Backward Class
CACP	:	Commission for Agriculture Costs and Prices
CCEs	:	Crop Cutting Experiments
CNF	:	Community Managed Natural Farming
CRPs	:	Community Resource Persons
CSR	:	Corporate Social Responsibility
CSs	:	Case Studies
DES	:	Directorate of Economics and Statistics
DGC	:	Days Green Cover
DPMs	:	District Project Managers
FCI	:	Food Corporation of India
FGDs	:	Focus Group Discussions
FPOs	:	Farmers Producer Organizations
FYM	:	Farm Yard Manure
GCA	:	Gross Cropped Area
GDP	:	Gross Domestic Production
GoI	:	Government of India
GPs	:	Gram Panchayats
HAT	:	High Altitude Tribal Areas
HDI	:	Human Development Index
IASRI	:	Indian Agricultural Statistical Research Institute
ICRPs	:	Internal Community Resource Persons
IDSAP	:	Institute for Development Studies Andhra Pradesh
MA	:	Mandal Anchor
MF	:	Master Farmer
NGOs	:	Non-Governmental Organizations
NSO	:	National Statistical Office
NSSO	:	National Sample Survey Organization

OC	:	Open Categories
PMDS	:	Pre-Monsoon Dry Sowing
PNPIs	:	Plant Nutrient and Plant protection Inputs
PRDS	:	Pre-Rabi Dry Sowing
RySS	:	Rythu Sadhikara Samstha
SC	:	Scheduled Caste
SHGs	:	Self-Help Groups
SIIs	:	Strategic Interviews
SRI	:	System of Root Intensification
ST	:	Scheduled Tribe
TTD	:	Tirumala Tirupati Devasthanam
VOs	:	Village Organizations
ZBNF	:	Zero Budget Natural Farming

Executive Summary

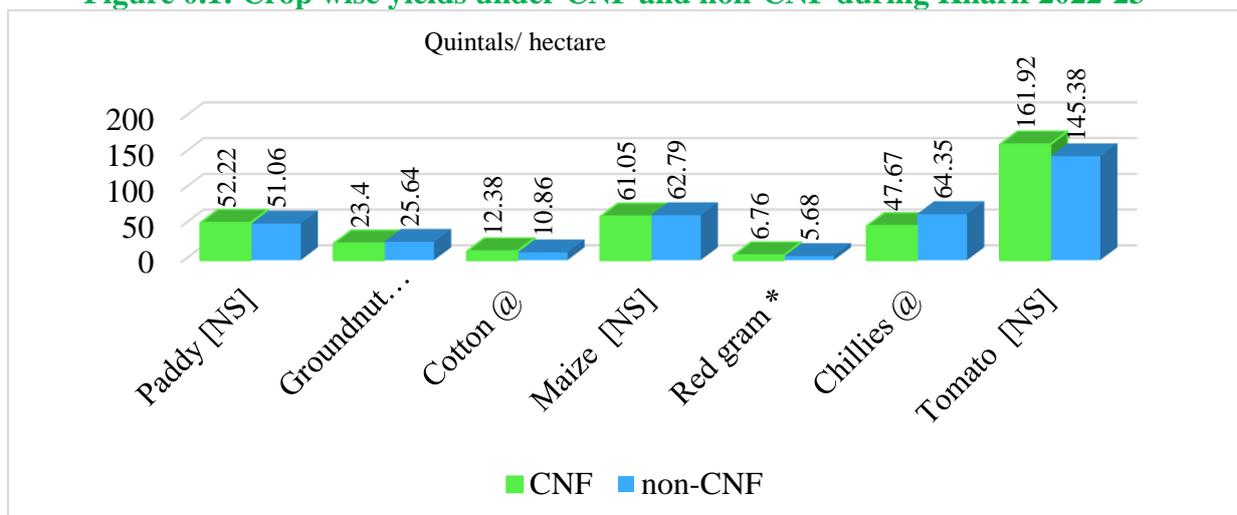
1. The report presents the results of the survey into the impact of Andhra Pradesh Community Managed Natural Farming (APCNF or CNF in short) on farming conditions in Kharif 2022-23. This is fifth in the series of similar studies conducted under the aegis of RySS, Government of Andhra Pradesh, which is set up to campaign for the spread of natural farming in the state. The study compares the performance of 1,331 farmers practicing CNF with 731 of non-CNF farmers. The sample is chosen to compare the differences in farming conditions across major crops. However, the results at agroclimatic zones, and farmers of different size-classes, tenure groups and social groups, have been provided, wherever possible. The farming conditions are judged against the parameters that reflect the costs and returns from farming. It also brings to the fore the ways in which CNF contributes to the well-being of those who practice it.

2. The study reaffirms some of the conclusions of the earlier rounds and shows that poor and weaker sections and younger persons are represented more than proportionately among those taking to CNF as compared to non-CNF. Lack of education of farmers is not inhibiting the adoption of CNF. Therefore, the objective of the CNF project of the government of AP that it should be inclusive, is well-served.

3. Seven major crops, viz., Paddy, Groundnut, Cotton, Maize, Red gram, Chillies and Tomato, which have enough observations of CNF and non-CNF have been covered in this report. Even without use of agrochemicals, CNF has given same or higher yields in majority of crops. There are no differences between CNF and non-CNF crop yields, in four crops. In the remaining three crops CNF yields are higher in Cotton and Red gram and lower in Chillies¹ (Figure 0.1).

¹ One of the major reasons for the significant lower CNF Chillies yields is use of different seed varieties by CNF and non-CNF farmers.

Figure 0.1: Crop wise yields under CNF and non-CNF during Kharif 2022-23



Note: NS indicates Not significance, @ indicates 10% and * indicates 5% significance levels
Source: IDSAP: Field Survey, 2022-23

4. The average² costs and returns of the seven crops are given in Table 0.1 below. The CNF farmers are able to save ₹.9,454 per hectare in plant nutrient and protection inputs (PNPIs)³. That is a 50 percent savings. This savings in PNPIs turned out to be 13 percent savings in the average paid-out cost. Because of significantly less Chillies yields, which is a very high value crop, the average gross value of CNF crop output is less than that of non-CNF by one percent. However, the average net value of CNF crop output is 10 percent higher than that of non-CNF. This has become possible, despite a lower average gross value of CNF output, due to savings in the paid-out costs. The savings obtained in the paid-out cost proved to be a critical factor in enhancing profitability during normal conditions and reducing the losses during the challenging conditions.

Table 0.1: Average costs and returns of seven crops during Kharif 2022-23

Crop	CNF	non-CNF	Difference between CNF & non-CNF	
	₹/ hectare		₹/ hectare	in percentages
PNPI	9,639	19,093	-9,454	-50
Paid-out cost	62,241	71,623	-9,382	-13
Gross value of crop output	1,42,166	1,44,180	-2,014	-1
Net value of crop output	79,924	72,556	7,368	10

Source: IDSAP: Field Survey, 2022-23

² Weighted average values of the seven crops have been worked with area under each crop in the state as weights.

³ For the sake of comparison, the biological stimulants/ inputs under CNF and agrochemicals under non-CNF, together, referred as plant nutrient and protection inputs (PNPIs)

5. Apart from benefiting farmers by lowering the cost of cultivation and improving the farm profitability, CNF has been contributing to the improvement of soil quality and optimizing the use of land and own labour. The CNF farmers have cultivated a greater proportion⁴ (82 percent) of their operational holdings vis-à-vis non-CNF farmers (75 percent) [Table 4.1]. The CNF farmers' allocation of land to CNF has increased from 0.35 hectares in 2019-20 to 0.53 hectares in 2022-23 (Table 4.2). Such shift, apart from improving the soil quality, reflects the farmers' growing confidence and trust in CNF. Because of PMDS and other initiative, the CNF fields have a longer crop cover of 167 days vis-a-vis 137 days over non-CNF fields during March to November 2022; i.e., 27 additional days 17 percent of longer crop cover (Table 4.4).

6. On average the CNF farmers have avoided the expenditure of ₹19,093 on agrochemical per every hectare of land under CNF; this includes ₹12,756 per hectare on fertilizers, ₹ 6,337 per hectare on pesticides, including weedicides⁵ (Table 5.3). Avoidance of the use of agrochemicals not only improve the soil quality and natural resources, but also resulted in improvements in the households' health outcomes.

7. On average CNF crops need 22 additional labour days, i.e., 20 percent higher number of days, compared to non-CNF crops. Compared to non-CNF crops, 25 percent of higher own labour and 15 percent of higher hired labour are used in CNF crops (Table 4.5). On average 22 percent and 16 percent of higher female labour and male labour are used respectively in CNF crops (Table 4.6). A greater number of labour days are utilized in each and every operation, under CNF over non-CNF. In absolute terms, the difference between CNF and non-CNF crops varies from minimum of zero days in nursery raising and one day each in land preparation and sowing/ transplantation to maximum of four days in weeding/ inter-cultivation and five days each in harvesting and irrigation (Table 4.7).

8. About 81 percent of CNF households and 91 percent of non-CNF households have active or current loans. Average borrowed amounts are ₹61,701 and ₹84,886 for each of CNF

⁴ One of possible reasons could be lower cost of cultivation under CNF. Another possible reason could be improvement in the soil quality and changes in characteristics of soil. Yet another possible reason could be reduction in water requirement in CNF crops.

⁵ These are actual expenditure on agrochemicals by non-CNF farmer. These are considered as the avoided expenditure by CNF farmers.

and non-CNF sample HHs respectively. Average loan amount per loanee is ₹76,112 and ₹93,032 for CNF and non-CNF households respectively (Table 4.10).

9. Development of CNF is, however, still at a nascent stage. There are severe constraints to its adoption – labour is scarce, preparation of biological inputs is not winsome, higher prices are not guaranteed for CNF output, biological inputs are scarce, extension services are inadequate, and marketing support is wanting.

Chapter 1: Context, Objectives and Methodology

1.1. Introduction

To overcome the challenges of Green Revolution (GR) or chemical-based agriculture⁶, the Government of Andhra Pradesh has adopted the natural farming, known as Andhra Pradesh Community Managed Natural Farming (APCNF, in short CNF). APCNF is an ecological agriculture, based on the evolution principles of the nature. One of the basic principles is that APCNF believes that the soil and atmosphere have all required elements and nutrients for plant growth. There is no need to provide external inputs for plant growth and protection. For example, natural forests grow profusely and perpetually without any external inputs. What is needed is to catalyse those processes. To promote the programme in the state, the Government of Andhra Pradesh have established “Rhythu Sadhikara Samstha” (RySS), an integrated institutional mechanism. Apart from implementing the program in the state, RySS is leading a large-scale action research to develop knowledge products and agriculture models in CNF. One of the major inventions by RySS is Pre-monsoon Dry Sowing (PMDS).

PMDS is a global breakthrough and the exact science of PMDS is yet to be determined. The enhancement of soil biology, through CNF practices and raising of multiple diverse crops as a mixed crop cultivation, creates some special conditions for the seed germination and plant survival during the dry seasons. In PMDS, mulching practice across the field acts as the catalyst to harness the water vapour from the atmosphere that drops to the land surface in the form of early morning dew. The material used for mulching facilitates the percolation of the dew into the soil and prevents its evaporation again. It is therefore recommended to the farmers to follow PMDS during March-May/June, followed by Kharif crops, Pre-Rabi dry sowing (PRDS) and Rabi crops, under the overall CNF programme. Farmers are expected to get multiple benefits through the crops

⁶ The challenges including higher and growing cost of cultivation, low and dwindling farm surpluses/ profits, mounting debts among farming community, health hazards for both producers and, adverse impacts of climate change, etc., have been discussed in the previous reports. The reports can be accessed from <https://www.idsap.in/reports.html> and also from <https://apcnf.in/category/reports/>

grown under PMDS and PRDS that include obtaining intermittent cash income, food items, green manure, and green fodder to animals. Thus, PMDS contributes to cropping intensity, increased agricultural incomes, and continuous green cover to the soil for 365 days in a year. In turn, these practices would result in the improvements in the soil fertility besides reducing and/ or removing greenhouse gases (GHG) emissions. Hence, RySS has made PMDS as an integral part of CNF and mandated this study to select CNF sample farmers from those farmers, who grew PMDS during March-July 2022 and grew Kharif crops in 2022-23 season.

1.2. The study and objectives

RySS has assigned the present studies - “Assessing the impact of CNF” to Centre for Economic and Social Studies (CESS) in 2018-19 to and to Institute for Development Studies Andhra Pradesh (IDSAP) since 2019-20.⁷

The major objective of these studies is to make a comparative assessment of outcomes of CNF practices of cultivation vis-a-vis non-CNF (chemical-based) practices of cultivation. The outcomes include farm income, costs, returns, etc. The specific objectives of the study are detailed below.

1. First and foremost, the study examines whether the CNF is adopted by the socially and economically weaker sections.
2. The study assesses whether costs and returns from the CNF are favorable to the farming community in relation to the non-CNF.
3. Many inputs go into the production process in agriculture; land, labour, irrigation water and credit to name a few. The study looks at the pattern of use of these inputs. We examine how widespread the use of land is under CNF, what is the intensity of use of family and hired labor under CNF, whether CNF economizes in the use of irrigation water and credit.
4. Additionally, CNF may open up new marketing channels and the output so produced may come to command higher prices. CNF is expected to contribute to the health of the adopters, add prestige to their vocation and make them stress free in their pursuit. The study examines these issues.

⁷ The same team is conducting the studies since 2018-19. While, the first-year study was based at Centre for Economic and Social Studies (CESS), Hyderabad [<https://cess.ac.in/>], IDSAP [<https://idsap.in/index.html>] has been anchoring the studies since 2019-20.

5. Finally, the study seeks to identify the challenges that CNF farming poses to its adopters.

1.3. Methodology

1.3.1. The Basic Approach

This study is a continuation of the previous studies – “assessing the impact of CNF”, conducted in 2018-19, 2019-20, 2020-2021 and 2021-22 on APCNF.⁸ The study has used the “*with and without*” method to assess the impact of CNF. In this method the outcomes of CNF farmers, cultivating a particular crop are compared with the outcomes of the non-CNF farmers cultivating the same crop, but using chemical inputs. Costs and returns data for the crops considered for the analysis were obtained from the farmers through farmer household survey. Crop Cutting Experiments (CCEs) have been conducted to assess the yields of the crops scientifically and independently.

The study focussed on 12 major crops that are identified based on the cropped area in the state. For these 12 crops, costs, yield and returns are analysed. These crops together account for more than 75% of the gross cropped area (GCA) 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) Jowar, (11) Ragi and (12) Tomato. While the first 10 are cultivated on large areas in the state, the last two were selected as the special cases.

1.3.2. Selection of sample GPs and households

The sample frame for the selection of sample CNF (treatment) Gram Panchayats (GPs) is the list of all the GPs provided by RySS, where PMDS and CNF are practiced. The rest of the GPs in the state is sampling frame for non-CNF (control) sample GPs. The CNF frame is also used for selection of partial cultivators. To optimise the resource use, all GPs with less than 10 PMDS+CNF cultivators are excluded from the treatment sample frame. However, there is no such exclusion for non-CNF frame. The sample size is fixed at 130 GPs for CNF and 65 GPs for non-CNF surveys. The total 130 of sample GPs were allocated to the 30 strata⁹ (of agroclimatic zones X districts) in proportion to the number of CNF farmers in each stratum. Similarly, total 65 non-CNF sample GPs were allocated across the 30 strata in proportion to number of CNF farmers in that stratum.

⁸ All the study reports can be accessed from <https://www.idsap.in/reports.html>

⁹ If a district falls in two zones, it is treated as two strata. In total 30 strata were found.

In the case of treatment (CNF), the sample GPs are selected using probability proportionate to size with number of cultivators as size. For non-CNF survey, the selection is based on simple random sampling without replacement.

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

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

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

A total of 1,331 CNF and 731 non-CNF farmers are selected (Table 1.1). Distribution of sample CNF and non-CNF farmers across all agroclimatic zones of the state, size-classes, tenure categories and social categories are shown in the same table. It was originally agreed to select 1,300 CNF and 650 non-CNF farmers. However, it became necessary to ultimately chose 1,331 CNF and 731 non-CNF farmers so as to ensure that at least 30 sample observations figure in respect of each crop. Distribution of the sample observations across zones is given in Table 1.1. It may be seen that we have divided the state into 6 zones and sample observations are spread across all the zones, with the southern zone accounting for the maximum number in case of CNF

farmers (with 369) and scarce rainfall zone accounting for the maximum in respect of non-CNF (318). The least number of observations is from the Godavari zone. Due representation is given to the gram panchayats/mandals while selecting the sample as in the earlier rounds.

Table 1.1 shows the distribution of sample observations by size-class of farmers. As in the universe, the marginal farmers outnumbered the others. They are 784 in number among CNF farmers and 534 among non-CNF ones. Table 1.1 shows data for tenure groups. As expected, tenants are few among the sample observations, as in the universe in case of CNF. Pure tenants among them are 31 and owner-tenants are 56. Since tenants cannot be sure of retaining control over the leased-in land for longer periods, and since the effect of CNF inputs on output will last for more than one year, they will not come forward to lease-in land. Table 1.1 gives the distribution of sample observations classified by social categories. Among the CNF, BCs with 512 outnumber others. SCs and STs are about the same. Among the non-CNF too, BCs are the maximum.

Table 1.1: Sample size of different categories of farmers

Geographic units & farmers; categories		CNF Number	Non- CNF	CNF Percentage	Non- CNF
State	<u>AP *</u>	1,331	731	100	100
Agroclimatic zones	HAT	215	59	16	8
	North coastal	97	51	7	7
	Godavari	83	31	6	4
	Krishna	232	92	17	13
	Southern	369	180	28	25
	Scarce rainfall	335	318	25	44
Farm size category	Marginal	784	534	59	73
	Small	387	163	29	22
	Others	160	34	12	5
Tenorial status	Tenants	31	23	2	3
	Owner cum tenants	56	21	4	3
	Owners	1,244	687	93	94
Social category	SC	238	64	18	9
	ST	231	55	17	8
	BC	512	388	38	53
	OC	350	224	26	31

Source: APCNF Field Survey 2022-23

1.4. Land particulars of the sample households

The average land owned, leased-out, leased-in by CNF and non-CNF sample farmers are given in Table 1.2. The average land owned by CNF households is 0.99 ha as in kharif 2022-23 and in case of non-CNF it is 0.74 ha. The land leased-in by the two groups of households respectively is 0.05 ha and 0.06 ha. The figures for land leased-out are respectively 0.01 ha and 0.00 ha. The operated area is therefore, 1.05 ha for CNF households and 0.80 for the non-CNF ones.

Table 1.2: Land owned, leased-in and leased-out by CNF and non-CNF households (ha)

Tenure	CNF households	Non-CNF households
1. Land owned	0.99	0.74
2. Land leased-in	0.05	0.06
3. Land leased-out	0.01	0.00
4. Land operated (1+2-3)	1.04*	0.80

* Total looks slightly different, due to rounding up.

Source: APCNF Field Survey 2022-23

1.5. Crop wise sample observations for cost and returns estimates

Crop wise sample observations for cost and returns estimates are given in (Table 1.3). Understandably, the number of Paddy observations outnumber others. There are as many as 573 CNF and 255 non-CNF Paddy sample observations. Other crops with 100 plus CNF observations are Cotton, Groundnut, Black gram and Ragi; and for the non-CNF are Cotton and Groundnut. Overall, 30 plus observations are available in nine CNF crops and in seven non-CNF farmers.

Table 1.3: Crop wise number of sample observations for costs and returns estimates (number)

Crop	CNF	Non-CNF
Paddy	573	255
Groundnut	126	138
Cotton	133	157
Maize	62	76
Red gram	70	76
Chillies	82	78
Tomato	72	52
Black gram	128	9
Green gram	3	
Jowar	6	

Crop	CNF	Non-CNF
Ragi	108	
Total	1,363	841

Source: APCNF Field Survey 2022-23

1.6. Crop Cutting Experiments

Crop Cutting Experiments (CCEs) were conducted scientifically to get an independent estimate of crop yields under CNF and non-APCNF. It is to be noted that the study has adopted standard methodology of Indian Agricultural Statistical Research Institute (IASRI), which is followed by National Statistical Office (NSO, formerly known as NSSO) and Directorate of Economics and Statistics (DES) of all states, including Andhra Pradesh, for conducting CCEs. Crop wise number of CCEs are given in Table 1.4. Altogether 1,093 and 551 crop cutting experiments are conducted for CNF and non-CNF crops respectively. These numbers are equal to 84 percent and 85 percent of agreed sample size of CNF and non-CNF farmers respectively. One of the main reasons for the short fall in CCEs is early harvesting of crops in PSR Nellore district. In this district farmers have harvested their crops during August and September, before the start of field survey. These experiments add value to the study as these are scientifically done.

Table 1.4: Crop wise number of CCEs (in number)

Crop	CNF	Non-CNF
Paddy	462	207
Groundnut	95	58
Cotton	112	97
Maize	42	35
Red gram	45	51
Chillies	57	55
Tomato	61	37
Black gram	113	7
Ragi	106	4
Total	1,093	551
Number of CCEs as % of original sample size*	84	85

* agreed sample size is 1,300 CNF and 650 non-CNF farmers

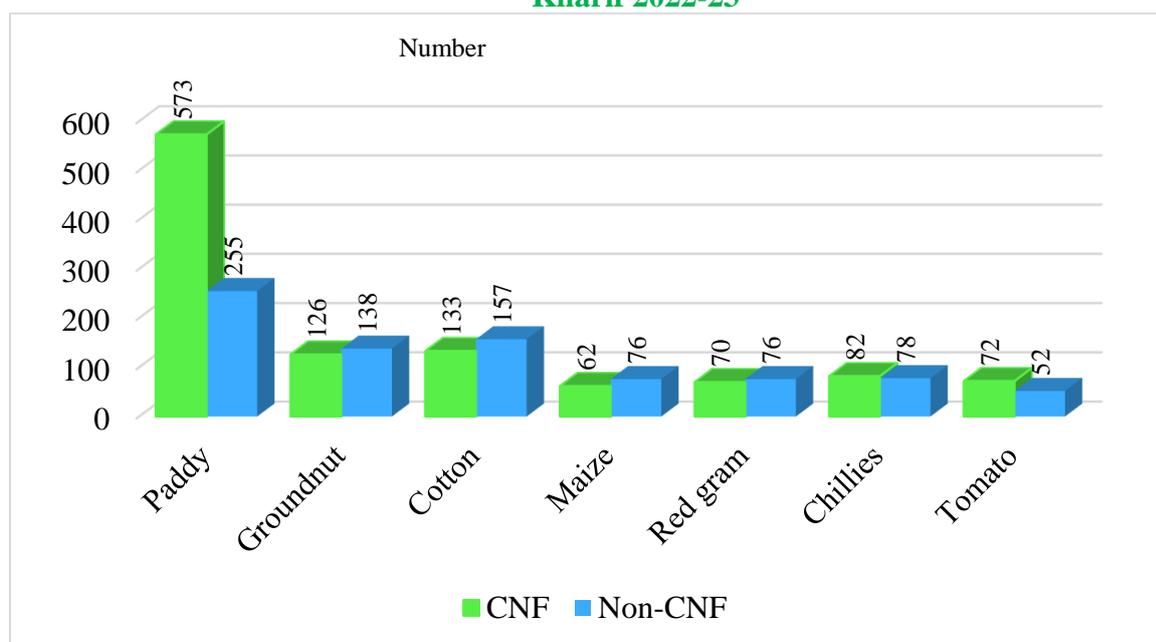
Source: APCNF Field Survey 2022-23

1.7. Crops covered in this report

Given the seasonality of the cropping pattern in the state, the study got adequate number of CNF and non-CNF sample observations for seven crops, viz., (1) Paddy, (2) Groundnut, (3) Cotton, (4)

Maize, (5) Red gram, (6) Chillies, and (7) Tomato. Hence, these seven crops are covered in this report. It is well known that Bengal gram, Black gram and Green gram are predominantly Rabi crops. Even Jowar is mostly grown in the Rabi season.¹⁰ Though Ragi is mostly grown in Kharif season, the study could not find Ragi crop cultivation in the non-CNF sample GPs during the season. In the absence of comparative data, this crop was dropped from this report.¹¹ Even though, Black gram is a Rabi crop, some CNF farmers have cultivated the crop during the Kharif season¹². But none of the non-CNF farmers cultivated Black gram during the season. Therefore, the CNF data could not be used in this report also.¹³ Crop wise available sample observations of seven crops for costs and return estimates are given at Figure 1.1. Similarly, crop wise number of CCEs of seven crops covered in this report are shown in Figure 1.2. In each crop, a minimum of 30 observations are available. Hence, the estimates in this report would be more reliable.

Figure 1.1: Crop wise number of sample observations for cost and returns estimates during Kharif 2022-23



Source: APCNF Field Survey 2022-23

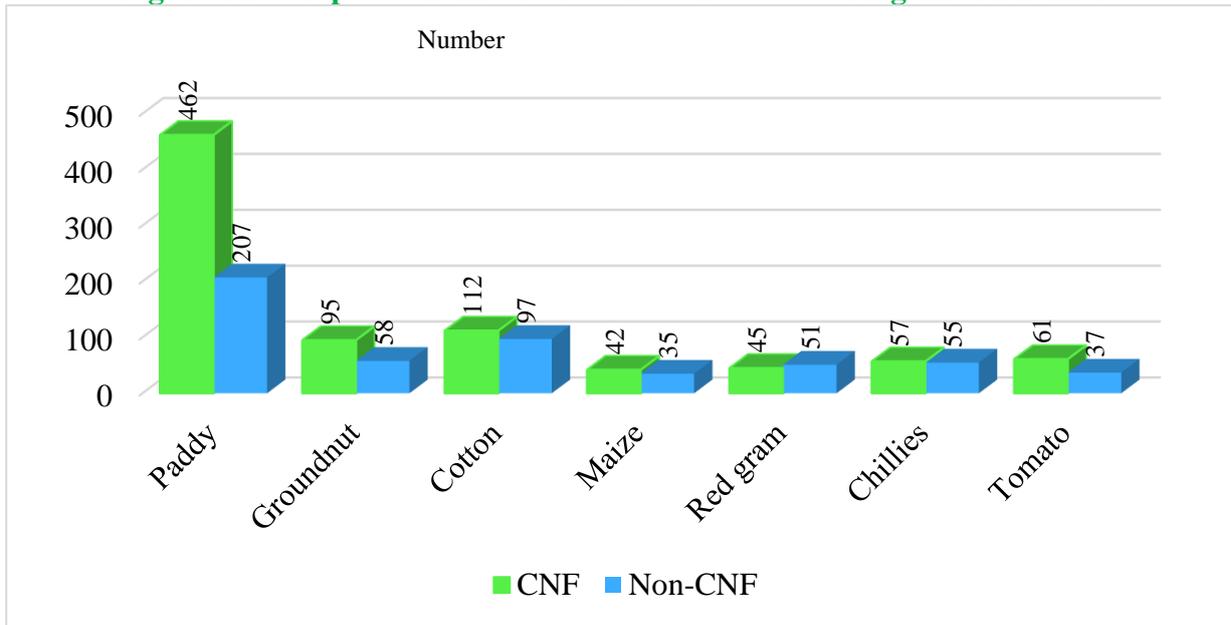
¹⁰ Another problem encountered in the field survey is that some farmers have converted their Jowar crops into the fodder crop. Such practice is quite common in the state.

¹¹ This data will be utilised in the final report 2022-23

¹² May be influenced by APCNF's 365-day green/ crop cover strategy/ campaign

¹³ The data will be used in the final report 2022-23

Figure 1.2: Crop wise number of CCEs conducted during Kharif 2022-23



Source: APCNF Field Survey 2022-23

1.8. Data Collection and Management Process

In all, eleven research tools, viz. (1) Household listing schedule for the CNF GPs, (2) Household listing schedule for the non-CNF GPs, (3) Village survey schedule for CNF GPs, (4) Village survey schedule for non-CNF GPs (5) PMDS schedule to collect the data from CNF household about PMDS details, (6) Questionnaire for CNF households, (7) Questionnaire for non-CNF households, (8) Checklist for Case Studies, and (9) Checklist for Strategic Interviews, (10) Checklist for Focused Group Discussions, (11) Schedule to record the CCE related details, were used. Further, the Kharif CNF and non-CNF households' schedules were revised for the Rabi survey. The quantitative filed-based instruments have in-built checks with appropriate skip patterns. Further, supportive field manual with instructions and clarification for all questionnaires, have been provided to the field team. The research tools were finalized through a series of brainstorming consultations. An intensive two training programs were organized to train the field investigators and supervisors at IDSAP, Visakhapatnam during the middle of July 2022 and the second half of September 2022. The field staff was placed continuously in the field in their allotted districts in order to track the farming and related activities of sample farmers throughout the year. Each sample farmer was visited about eight times by the field staff to collect data about farmer household's details and farming throughout the agriculture year (AY) 2022-23.

The household survey for the Kharif season of 2022-23, was conducted from early October 2022 till the end of April 2023. As per the design, each sample farmer was visited a minimum of two

times during the season to collect household and farming data and to conduct the Crop Cutting Experiments (CCEs). Senior team members, known as Regional Supervisors (RS), have visited the field and cross-checked the information filled and participated in data collection processes; conducted strategic interviews (Sis) with DPMs and a few field staff of RySS; and participated in the focussed group discussions (FGDs), and visited fields, especially the model farmers, innovative farm practices and social entrepreneurs, to prepare the case studies. The field data was digitalized with the support of “i for Development (i4D) Parishkaar Technologies Ltd”, Hyderabad. Each field staff was given a Tab to enter the data, through the exclusively developed Android based Application (App). The data was processed with R and excel software. In this report only household data collected and the results of CCEs conducted during the Kharif season have been used. Descriptive statistics such as averages, percentages, etc., have been worked out. Cross tables have been prepared and used in the report. The data is analyzed at the state level, agroclimatic zones¹⁴ wise and farmers categories¹⁵ wise.

1.9. 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 CNF (PMDS+CNF) and non-CNF households. Chapter 3 consists of the comparative analyses between the CNF and non-CNF farmers with regard to the changes in expenditure on plant nutrient and protection inputs (PNPIs)¹⁶, paid-out costs, crop yields, gross and net values of output. The impact of CNF on the Paddy, Groundnut and Cotton cultivation across the agroclimatic zones, and farmers categories are also covered in this Chapter. Changes in agriculture inputs use, consequent changes in the input markets, due to adoption of CNF practices are analyzed in Chapter 4. The impact of CNF on the farmers wellbeing is covered in Chapter 5. The issues and challenges in adoption of CNF are discussed in Chapter 6. Apart from these six chapters, an Executive Summary is also presented at the beginning of the Report.

¹⁴ A list of agroclimatic zones and their demarcations are shown at the appendix 1 below.

¹⁵ Farmers are organized in three different categories, viz., **farm size categories** consist of marginal, small and other (consist of medium and large farmers) farmers; **tenurial categories** consist of pure or landless tenants, owner-cum-tenants and owner farmers; and **social categories** consists of SC, ST, BC and OC categories.

¹⁶ For the sake of comparison, the biological stimulants/ inputs under CNF and agrochemicals under non-CNF, together, referred as plant nutrient and protection inputs (PNPIs)

Appendix 1: List of Agroclimatic zones and their demarcation

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

¹⁷ Information was provided by Associate Director of Research (ADR), Chintapalle.

Chapter 2: Profiles of CNF and non-CNF farmers

2.1. Introduction

This chapter compares the profiles of the sample farmers of CNF with those of non-CNF. The profile is characterized through parameters such as social categories of farmers [Scheduled Castes (SC), Scheduled Tribe (ST), Backward Castes (BCs), and Other Castes (OC)], gender categories of farmers (male and female), farm size category of farmers (marginal farmers, small farmers, and other category of farmers including medium and large farmers), and tenurial categories of farmers (pure tenants, owner-cum-tenants and owner farmers). The profile includes literacy levels of the farmers (illiterate and educated farmers with different levels of education) and age of the farmers (young, middle, and old age farmers).

As shown in Table 1.1 in chapter1, the sample comprises of 1,331 CNF and 731 non-CNF households. They are spread across all the agroclimatic zones and farmers categories. In this chapter, we analyse the characteristic features of the CNF and non-CNF households with a view to identify if the former set of households distinguish themselves in any special way as compared to the latter set. In this chapter, the profiles of CNF and non-CNF farmers are analysed using three sets of indicators, viz., social indicators, economic indicators and demographic indicators. It may be noted that RySS is encouraging the women and young persons to take up cultivation. To know the impact of such initiatives, the study has analysed the profiles all members of sample households, who reported cultivation as their occupation. While certain indicators such as social category and land cultivation are analysed at the household level, certain indicators such as age, gender, education are analysed at individual cultivators' level.

2.2. Social indicators

Under this section, two indicators, viz., social composition of sample households and gender composition individual cultivators in CNF and non-CNF households, have been analysed.

2.2.1. Social categories wise distribution of sample households

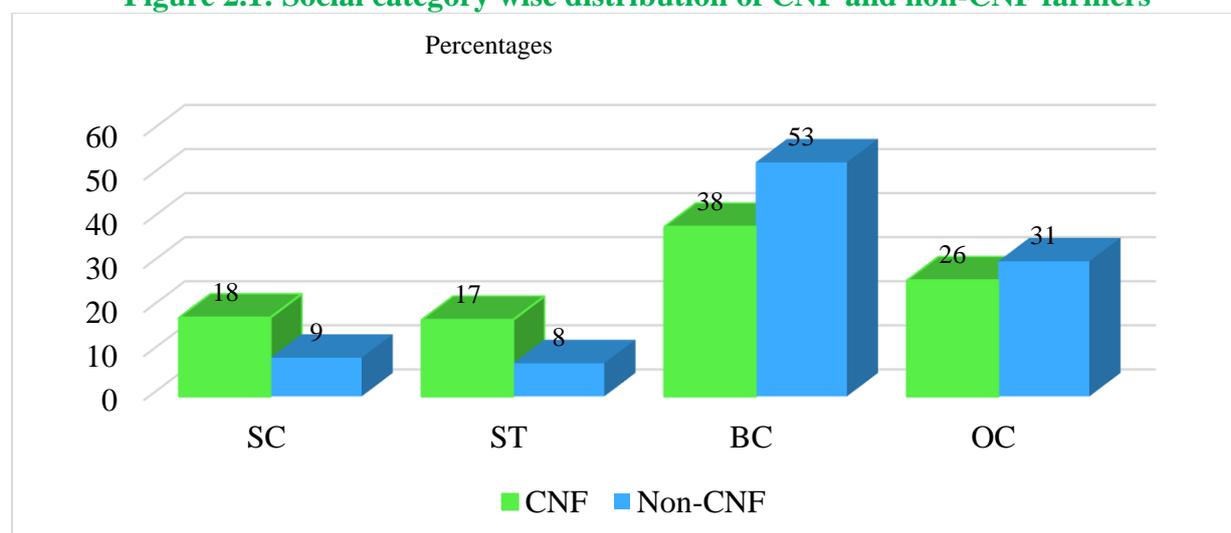
A comparison of the social categories' wise distribution of CNF farmers with that of non-CNF farmers is shown in Table 2.1. The representation of SCs, and STs is two times higher in CNF compared to their percentage in non-CNF. SCs among CNF households form 18 per cent compared to 9 per cent among non-CNF households and the corresponding figures for STs are 17 per cent and 8 per cent respectively. On the other hand, BCs and OCs constitute relatively a higher percentage among non-CNF compared to CNF farmers (Figure 2.1). This data once again confirm that CNF is socially sustainable with the proactive focus on poor and socially disadvantage sections in the society. It is worth mention here that similar trends were also observed in the previous reports also.

Table 2.1: Social category wise distribution CNF and non-CNF farmers

Social Category	CNF	Non-CNF	CNF	Non-CNF
	Number		Percentage	
SC	238	64	18	9
ST	231	55	17	8
BC	512	388	38	53
OC	350	224	26	31
All	1,331	731	100	100

Source: APCNF Field Survey 2022-23

Figure 2.1: Social category wise distribution of CNF and non-CNF farmers



Source: APCNF Field Survey 2022-23

2.2.2. Gender composition

The study has collected details of all members of sample households. The details of household members, whose major occupation is cultivation are analysed in this chapter. The RySS effort in encouraging cultivation, in general, and women farmers, in particular, is clearly visible in the

number of farmers and composition of farmers in the sample households. Among all sample households, the number of *farmers, i.e., the household members, who devote most of their working days/ hours on cultivation*, were identified and analysed. Each sample family may have more than one farmer or cultivator. In total, there are 1,884 cultivators in the 1,331 CNF sample households and 987 cultivators in 731 non-CNF sample households. It implies that there are 142 and 135 cultivators for every 100 CNF and non-CNF sample households respectively. Out of 1,884 CNF cultivators, 607 or 32 percent are female farmers. The same is 30 percent among the non-CNF cultivators. There 46 female farmers for every 100 CNF sample households. The same is 40 for non-CNF households (Table 2.2). The data is clearly indicating that CNF families have relatively a greater number of farmers and also a greater number of female farmers vis-à-vis non-CNF households.

Table 2.2: Number of female farmers in CNF and non-CNF sample households

Indicator	CNF	Non-CNF
Number of sample households	1,331	731
Number of farmers in sample households*	1,884	987
Total farmers as percentage of sample families	142	135
Number of female farmers in sample households	607	295
Female farmers as % of all farmers	32	30
Female farmers as percentage of sample households	46	40

* *Farmers as reported by the respondent. Farmer here mean, a person, who devote most of his/her working days/ hours on cultivation. Each sample family may have more than one farmer or cultivator.*

Source: APCNF Field Survey 2022-23

2.3. Economic indicators

In this section, farm size wise distribution and tenurial categories wise distribution of sample households and average are operated by CNF and non-CNF households, are covered. Needless to say, the analysis, in this section, is conducted at the household level.

2.3.1. Distribution of sample households by farm size and tenure

A large majority of the sample households are marginal in size. To be specific, 59 per cent of the CNF households and 73 per cent of the non-CNF ones are belong to the marginal size-class. Small farmers are also none too few among the households of the two classes (Table 2.3). In total, the marginal and small farmers together account for 88 percent in CNF sample and 95 percent in non-CNF sample. However, in the previous surveys, the proportion of small and marginal farmers was

relatively higher among CNF vis-à-vis non-CNF samples. Further, the gap was much less in the past surveys. But this year the gap is relatively high and in opposite direction.

Table 2.3: Farm-size categories distribution of CNF and non-CNF households

Farm size categories	Number		Percentage	
	CNF	Non-CNF	CNF	Non-CNF
Marginal	787	535	59	73
Small	387	162	29	22
Others	157	34	12	5
All	1,331	731	100	100

Source: APCNF Field Survey 2022-23

One of the misplaced allegations about CNF is that CNF may not be suitable to leased in farmers. It claims that the positive effect of CNF inputs on yield will be felt for more than one year, that is, since the yield improving effect of CNF inputs will not exhaust in one year, no tenant will be inclined to take land on lease and adopt CNF, for the reason the lease may be terminated by the landlord even before the positive effect of the CNF inputs exhausts. But the data presented in Table 2.4 indicate that there is no difference between CNF and non-CNF households in lease in of land. In the previous surveys also no such differences were observed. It was clearly established in all previous reports that CNF reduce the cost of cultivation and enhances the net values of crop output. It implies that lease-in famers/ tenants can get higher profits under CNF compared to non-CNF in the first year itself. As per the data in Table 2.4, little over 6.5 percent CNF households have leased-in. The same is little less than 6 percent in non-CNF households.

Table 2.4: Tenurial categories wise distribution of CNF and non-CNF sample households

Tenurial categories	Number		Percentage	
	CNF	Non-CNF	CNF	Non-CNF
Pure tenants	31	23	2.33	3.15
Owner-tenants	56	21	4.21	2.87
Owner farmers	1,244	687	93.46	93.98
All	1,331	731	100	100

Source: APCNF Field Survey 2022-23

Though only 6 to 6.5 percent farmers leased-in at the state level, the same is varying widely across the state and agroclimatic zones. In Godavari and Krishna zones, most of leasing-in are concentrated. In Godavari zone, 11 percent CNF sample households are pure tenants and another 13 percent are owner-cum-tenants. The same is 8 and 12 percent in Krishna zone (Table 2.5). Out of total 31 CNF pure tenants, 27 are from Krishna and Godavari zones. Out of 56 CNF owner-

cum-tenant farmers, 39 are from Krishna and Godavari zones. In the past surveys also, similar trends were observed. For example, in 2021-22, as many as 18 percent and 23 of sample CNF households, in Godavari zone, are pure tenants and owner-cum-tenant farmers respectively. In the same zone and year, 22 percent and 4 percent of non-CNF households are pure tenants and owner-cum-tenants respectively (IDSAP, 2022).

Table 2.5: Agroclimatic zone wise and Tenurial categories wise distribution of CNF and non-CNF households during Kharif 2022-23

Agroclimatic zones	Unit	CNF				NON-CNF			
		Tenants	Owner-tenants	Owners	All	Tenants	Owner - tenants	Owners	All
HAT	Number	-	1	214	215	-	1	58	59
	Percentage	-	0	100	100	-	2	98	100
North coastal	Number	-	2	95	97	-	1	50	51
	Percentage	-	2	98	100	-	2	98	100
Godavari	Number	9	11	63	83	6	2	23	31
	Percentage	11	13	76	100	19	6	74	100
Krishna	Number	18	28	186	232	13	13	66	92
	Percentage	8	12	80	100	14	14	72	100
Southern	Number	2	7	360	369	1	2	177	180
	Percentage	1	2	98	100	1	1	98	100
Scarce rainfall	Number	2	7	326	335	3	2	313	318
	Percentage	1	2	97	100	1	1	98	100
AP	Number	31	56	1,244	1,331	23	21	687	731
	Percentage	2	4	93	100	3	3	94	100

Source: APCNF Field Survey 2022-23

2.3.2. Average operational area

The average operational (operated) area for CNF households is 1.04 hectare; and 0.80 hectare is for non-CNF households. On average, the CNF households have over 30 percent higher operational area over non-CNF farmers. In each agroclimatic zone the CNF farmers have larger operational holdings in the range of 12 percent in Krishna zone to 75 percent in North coastal zone. In most of farmers categories, the CNF households have larger operational areas over non-CNF households, in the range of 5 percent for small farmers to 53 percent for ST farmers. The exception are marginal farmers (1 percent), pure tenants (17 percent) and owner-tenants (28

percent) (Table 2.6). One of the possible reasons for relatively larger operational areas for CNF farmers could be lower cost of cultivation.¹⁸

Table 2.6: Agroclimatic zone & farmers' categories wise average operated area of CNF and non-CNF sample households

Agroclimatic zone & farmers' categories		Average operated area (in hectares)		Percentage difference between CNF and non-CNF
1	2	CNF	non-CNF	5= ((3-4)/4)*100
State	AP	1.04	0.80	30
Agroclimatic zones	HAT	0.94	0.61	55
	North coastal	0.83	0.48	75
	Godavari	1.00	0.76	30
	Krishna	1.00	0.89	12
	Southern	1.14	0.71	59
	Scarce rainfall	1.09	0.92	19
Farm size categories	Marginal	0.54	0.55	-1
	Small	1.35	1.29	5
	Others	2.79	2.50	12
Tenurial categories	Pure tenants	0.74	0.89	-17
	Owner-tenants	1.41	1.95	-28
	Pure owners	1.03	0.76	35
Social categories	SC	0.85	0.77	10
	ST	0.93	0.61	53
	BC	1.04	0.78	33
	OC	1.25	0.90	38

Source: APCNF Field Survey 2022-23

2.4. Demographic indicators

Under this section, the indicators considered are age and education levels of all cultivators in CNF and non-CNF sample households. As mentioned above the number of cultivators are different from the number of sample households (see Table 2.2 above).

¹⁸ In some FGDs in 2020-21, the participants said that before CNF, farmers, at times, used to leave a part of the land fallow due to higher cost of cultivation and shortage of funds. In the same FGDs, the participants said that the farmers have started cultivation of such lands under CNF, due lower cost of cultivation.

2.4.1. Age of farmers¹⁹

Younger cultivators, being more dynamic, are likely to adopt new methods of farming sooner than later. This proposition is validated by the data collected in the survey (Table 2.7). It is found that those of 40 years or below constitute 38.85 per cent of all farmers in the sample CNF households, vis-à-vis 32.62 per cent of all cultivators in the non-CNF sample households. On the other hand, those who are 61 years and above form 6.05 per cent of all cultivators in the sample CNF households; and 11.25 per cent among the heads of non-CNF. Almost equal percentage of farmers in both CNF and non-CNF households, are belong to 41-60 age group.

Table 2.7: Age wise distribution of cultivators in the CNF and non-CNF sample households in Kharif 2022-23

Age-group	Number		Percentage	
	CNF	Non-CNF	CNF	Non-CNF
Up to 40 Year	732	322	38.85	32.62
41 to 60 years	1,038	554	55.1	56.13
61 years and above	114	111	6.05	11.25
All	1,884	987	100	100

Source: APCNF Field Survey 2022-23

2.4.2. Literacy levels of farmers²⁰

As with age, education is also expected to shape the adoption of newer methods of farming – the more the level of education the easier it is to understand, appreciate, and implement improved farming practices. But this may be true when the farmer takes the initiative on his/ her own and not instructed and induced from above by a government agency to undertake a new farming practice. Our survey data shows that education has not had any significant impact on adoption of CNF. It is only the illiterate farmers who constitute a marginally larger proportion among farmers in CNF households (39percentages) as compared to 35 percent farmers in the non-CNF sample households. The difference between the percentage of CNF and non-CNF farmers became narrow, if not zero, at higher levels of education (Table 2.8).

¹⁹ In this section, all the cultivators, in the CNF and non-CNF sample households, are used. See for more details the gender section above.

²⁰ In this section, all the cultivators, in the CNF and non-CNF sample households, are used. See for more details the gender section above.

Table 2.8: Literacy levels of all farmers in CNF and Non-CNF sample households

Education level	Number		Percentage	
	CNF	Non-CNF	CNF	Non-CNF
Illiterates	740	343	39	35
Primary (1-5)	337	197	18	20
Middle (6-8)	214	139	11	14
Secondary (9-10)	335	181	18	18
Inter	153	71	8	7
Diploma	8	2	0	0
Degree and above	97	54	5	5
All	1884	987	100	100

Source: APCNF Field Survey 2022-23

2.5. Conclusions

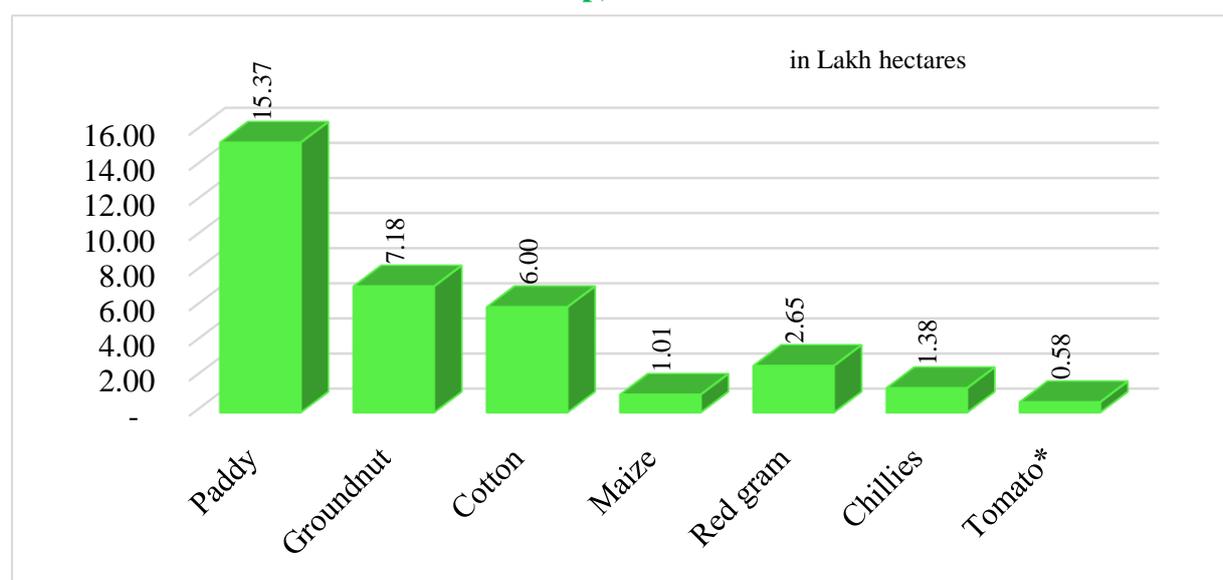
Socially weaker sections and younger cultivators are represented more than proportionately among those taking to CNF as compared to non-CNF. On the other hand, relatively less percentage of marginal and small farmers constituted the CNF sample. Data indicates that CNF may not be a constraint in leasing-in lands. CNF farmers have relatively a larger operational holding. Low cost of cultivation under CNF could be one of the reasons. Lack of education is not inhibiting the adoption of CNF.

Chapter 3: Impact of CNF on the farming conditions

3.1. Introduction

An attempt is made in this chapter to assess the impact of CNF on farming conditions in Kharif 2022-23. The farming conditions are judged against unit values of the parameters including expenditure on Plant Nutrient and Protection Inputs (PNPIs), paid-out costs, structure of paid-out costs, crop yields, prices, gross value of output, and net value of output. A comparison is made across seven major crops, viz., Paddy, Groundnut, Cotton, Maize, Red gram, Chillies, and Tomato between CNF method and non-CNF method. Further, weighted average values of these seven crops have been worked with area under each crop in the state as weights. The average area under each crop in the state is shown in Figure 3.1 below.

Figure 3.1: Average area in previous five Kharif seasons ending with 2020-21, under each crop, in the state



* Area under Tomato is that of Kharif 2021-22

Source: DES-AP (2023)

In the earlier rounds IDS reached the following conclusions with respect to the above farming conditions: that the expenditure on PNPIs under CNF is very low compared to the expenditure on fertilizers and pesticides under non-CNF across all the crops; that the paid-out costs by and large are lower under CNF over non-CNF across the crops; that the structure of paid-out costs is such that CNF is more labour absorbing and cost reducing; that the yield of crops under CNF is higher than under non-CNF in case of majority of crops; that the savings in paid-out cost in input intensive crops including Cotton, Chillies, Tomato and Paddy are more under CNF

compared to non-CNF; and that gross value of output and net value of output are both higher under CNF relative to non-CNF in respect of all the crops considered. One overarching conclusion reached in the earlier rounds is that farmers practicing CNF as also the land under CNF both benefit – farmers secure higher returns and the land is enriched – their interests coincide. This partly explains as to why CNF farmers practice the method even without subsidies and concessions unlike in case where under non-CNF subsidies have to be given for fertilizers, irrigation, power, etc., to induce farmers to use them. The above conclusions are again put to test here with fresh data covering the Kharif season of 2022-23.

3.2. Plant Nutrient and Protection Inputs (PNPIs)

In case of CNF, Plant nutrient and protection inputs means, as noted earlier, Beejamrutham, Dravajeevamrutham, Ghanajeevamrutham, Kashayam and Astras. These are prepared with Cow dung and urine, livestock products and locally available raw material such as leaves and other materials, etc. Needless to say, they cost very little. But PNPIs under non-CNF include fertilizer and pesticides and are costlier, because these are from the industrial sector. Under CNF, application of chemical inputs such as fertilizer and pesticides in growing crops is zero. The expenditure (in ₹ per hectare) on PNPIs under CNF is very low compared to that of PNPIs (Fertilizers and pesticides) under non-CNF. On average, the CNF farmers saved nearly ₹9,454 per hectare in PNPIs compared to that of non-CNF farmers. The savings are equal to 50 percent of non-CNF farmers' expenditure on PNPIs. This is true across all the major crops such as Paddy, Groundnut, Cotton, Chillies, Maize, Red gram and Tomato. But the reduction is pronounced among input-intensive crops such as Paddy, Cotton, Chillies and Tomato. Thus, it is evident that the CNF farmers could save considerable expenditure on PNPIs (Table 3.1). On the other hand, these inputs (the inoculations) act as catalysts to activate micro-biological process to enrich the soil health. Thus, this indicates the interest of the soil is met. Thus, CNF brought convergence between the interests of the farmer and the land.

Table 3.1: Crop wise expenditure on PNPIs under CNF and non-CNF and their difference during Kharif 2022-23

Crop	CNF	non-CNF	Difference between CNF & non-CNF	
	₹/ hectare	₹/ hectare	₹/ hectare	in percentages
Paddy	8,178	18,510	-10,332	-56
Groundnut	8,346	13,282	-4,936	-37
Cotton	14,180	25,136	-10,956	-44
Maize	8,331	15,082	-6,752	-45
Red gram	6,679	9,564	-2,885	-30
Chillies	16,191	48,144	-31,953	-66
Tomato	17,529	25,299	-7,770	-31
Average ²¹	9,639	19,093	-9,454	-50

Source: IDSAP Field Survey, 2022-23

3.3. Paid-out costs:

As noted above, apart from PNPIs, the farmers invest considerable amount on different inputs such as seeds, farm yard manure (FYM), including penning (Penning means keeping livestock, particularly the small ruminants, in the field for their dung/ droppings. The livestock owner gets some payment either in cash or kind for this service) human labour, bullock labour, machine labour, implements and irrigation. In this study, the monetary values of own and purchased/ hired all these and values own and purchased PNPIS are included in the paid-out costs of cultivation. But the value of family labour is not included in the paid-out costs. The paid-out cost used in the study is close to cost concept of “A” under Farm Management Surveys. The data reveals that the paid costs are invariably lower under CNF than those of under non-CNF across all the crops considered. The reduction in the paid-out costs under CNF is pronounced among the input intensive crops such as Paddy, Cotton, Maize, Chilies and Tomato. Thus, the CNF farmers have saved expenditure on paid out- costs considerably in relation to non-CNF farmers (Table 3.2).

It is therefore evident that the CNF has converted the high input intensive crops to low input intensive crops without reducing yield of crops. Moreover, the reduction in paid-out costs increases the net returns of crops. Thus, CNF farmers’ dependence on credit markets declined relatively due to lower paid-out cost. The need for mobilization of funds for cultivation of crop has also reduced relatively due to CNF. The less intensive use of inputs without reduction in

²¹ This is the weighted average of seven crops considered in the report and given in the table. The area under each crop, in the state, are used as the weights. See Figure 3.1

yields protect soil productivity. Thus, it is evident that the interest of farmers and interest of land converge.

Table 3.2: Crop wise paid-out cost under CNF and non-CNF and their difference during Kharif 2022-23

Crop	CNF	non-CNF	Difference between CNF & non-CNF	
	₹/ hectare		₹/ hectare	in percentage
Paddy	60,340	71,986	-11,646	-16
Groundnut	58,040	61,221	-3,181	-5
Cotton	68,052	76,905	-8,853	-12
Maize	41,356	52,267	-10,911	-21
Red gram	30,811	33,969	-3,158	-9
Chillies	143,664	174,046	-30,382	-17
Tomato	90,580	98,017	-7,438	-8
Average ²²	62,241	71,623	-9,382	-13

Source: IDSAP Field Survey, 2022-23

3.3.1. Structure of paid-out costs

As mentioned earlier in this chapter the study has collected data for eight major agricultural inputs. Out of these eight, four inputs, viz., seeds, PNPIs, human labour and machine labour account for the lion's share of the paid-out costs. Other four items, viz., FYM, including penning, bullock labour, implements and irrigation together account for a smaller proportion in the paid-out costs. These four items are clubbed together and referred as 'others' in this chapter. The share of PNPI is lower in paid-out cost in case of CNF compared to that of non-CNF consistently across all crops. On the other hand, the share of human labour is higher under CNF over that of non-CNF consistently (Table 3.3 and Figure 3.2).

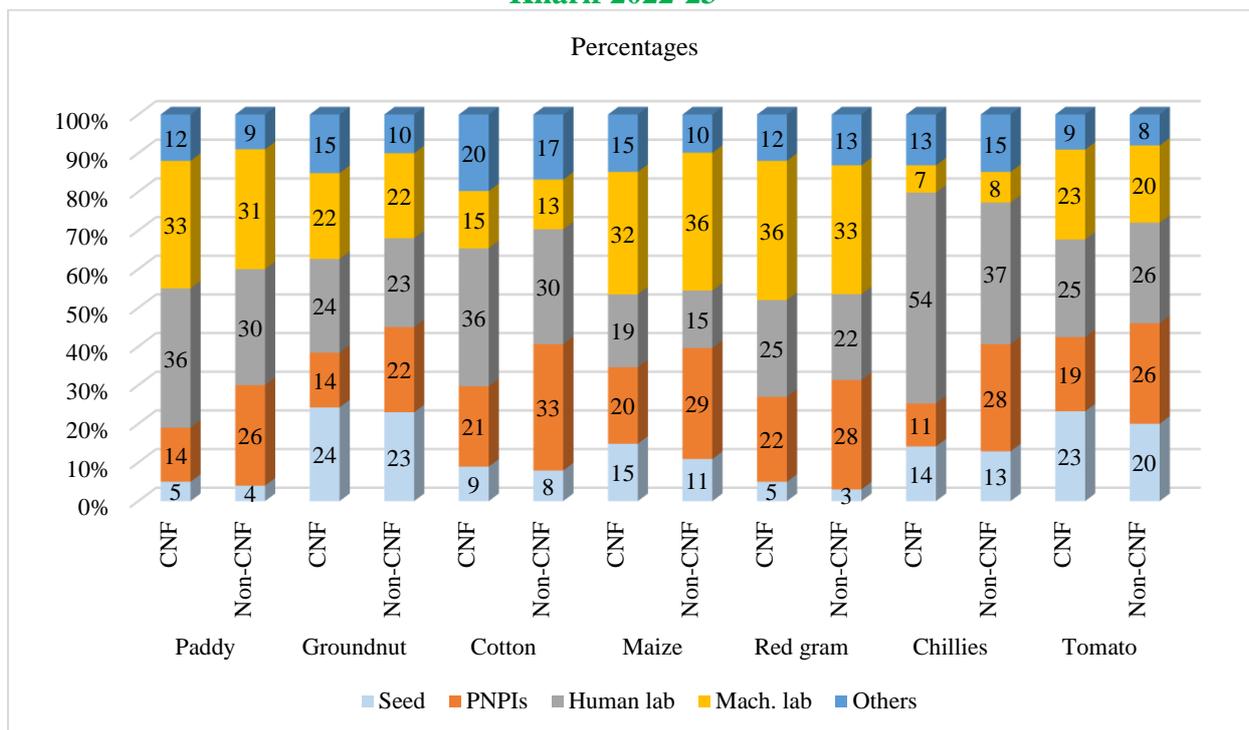
Table 3.3: Percentage share of major inputs in the paid-out costs of select crops during Kharif 2022-23

Crop/ Input	Paddy		Groundnut		Cotton		Maize		Red gram		Chillies		Tomato	
	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF
Seed	5	4	24	23	9	8	15	11	5	3	14	13	23	20
PNPIs	14	26	14	22	21	33	20	29	22	28	11	28	19	26
Human lab	36	30	24	23	36	30	19	15	25	22	54	37	25	26
Mach. lab	33	31	22	22	15	13	32	36	36	33	7	8	23	20
Others	12	9	15	10	20	17	15	10	12	13	13	15	9	8
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: IDSAP Field Survey, 2022-23

²² This is the weighted average of seven crops considered in the report and given in the table. The area under each crop, in the state, are used as the weights. See Figure 3.1

Figure 3.2: Percentage share of major inputs in the paid-out costs of select crops during Kharif 2022-23



Source: IDSAP Field Survey, 2022-23

The expenditure on different crops at a more disaggregate level is presented in Table 3.4. We have shown in the table the input-wise differences in expenditure between CNF and non-CNF for the major crops. It is in respect of PNPIs that the costs are significantly less under CNF vis-à-vis non-CNF. Thus, in case of Paddy, PNPI expenditure is 56 per cent less under CNF compared to non-CNF. The expenditure is less in respect of the other crops as follows: Groundnut 37 per cent, Cotton 44 per cent, Maize 45 per cent, Red gram 30 per cent, Chillies 66 per cent, Tomato 31 per cent. Apart from PNPI, the expenditure on machine labour, in absolute terms, is less under CNF in six out of seven crops covered. On the other hand, the expenditure on human labour, in absolute terms is higher in CNF in six out of seven crops covered here. The expenditure on other items, consists of FYM, bullock labour, irrigation and implements, is high under CNF vis-à-vis non-CNF (Table 3.4). It implies that CNF not only reduce the total cost of cultivation, it also results in diversification of input use. Thus, the CNF is relatively more labour absorbing and relatively more cost reducing production system. This production system is highly beneficial to the farmer in regard to reducing cost of cultivation and improving the fertility of soil of land and creating employment to the family labour and hired labour, and thus activating rural labour markets.

Table 3.4: Crop wise expenditure on major agriculture inputs under CNF and non-CNF during Kharif 2022-23

Crop →	Paddy				Groundnut				Cotton				Maize	
	₹/hectare		Difference		₹/ hectare		Difference		₹/ hectare		Difference			
Units →			₹/ hectare	%	CNF	non-CNF	₹/ hectare	%	CNF	non-CNF	₹/ hectare	%	CNF	non-CNF
Input ↓	CNF	non-CNF												
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Seed	3,204	3,089	115	4	14,156	14,180	-24	-0	5,951	5,818	133	2	6,069	5,827
PNPIs	8,178	18,510	-10,332	-56	8,346	13,282	-4,936	-37	14,180	25,136	-10,956	-44	8,331	15,082
Human Labour	21,460	21,330	130	1	14,145	13,828	317	2	24,606	23,148	1,458	6	7,747	7,634
Machine Labour	20,011	22,297	-2,286	-10	12,977	13,633	-656	-5	9,933	10,046	-113	-1	13,089	18,733
Others	7,487	6,760	727	11	8,416	6,298	2,119	34	13,382	12,757	625	5	6,120	4,991
Total	60,340	71,986	-11,646	-16	58,040	61,221	-3,181	-5	68,052	76,905	-8,853	-12	41,356	52,267

Source: IDSAP: Field Survey, 2022-23

Table 3.4 Cont.

Crop →	Maize		Red gram				Chillies				Tomato			
	Difference		₹/hectare		Difference		₹/ hectare		Difference		₹/ hectare		Difference	
Units →	₹/ hectare	%	CNF	non-CNF	₹/ hectare	%	CNF	non-CNF	₹/ hectare	%	CNF	non-CNF	₹/ hectare	%
Input ↓														
1	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Seed	242	4	1,573	1,143	430	38	20,775	23,200	-2,425	-10	20,931	19,506	1,424	7
PNPIs	-6,752	-45	6,679	9,564	-2,885	-30	16,191	48,144	-31,953	-66	17,529	25,299	-7,770	-31
Human Labour	114	1	7,659	7,457	202	3	77,698	63,752	13,946	22	22,999	25,827	-2,828	-11
Machine Labour	-5,645	-30	11,138	11,300	-162	-1	9,873	13,637	-3,764	-28	20,655	19,216	1,438	7
Others	1,129	23	3,763	4,506	-743	-16	19,126	25,313	-6,187	-24	8,466	8,169	297	4
Total	-10,911	-21	30,811	33,969	-3,158	-9	1,43,664	1,74,046	-30,382	-17	90,580	98,017	-7,438	-8

Source: IDSAP: Field Survey, 2022-23

3.4. Crop yields

The crop yields of CNF are statistically on par with those of non-CNF in four out of seven crops covered, viz., Paddy, Groundnut, Maize and Tomato. The CNF yields are statistically higher than non-CNF yields in Cotton and Red gram. But CNF yield is lower in Chillies (Table 3.5). In the previous surveys also, it was found that CNF crops' yields were either equal or higher than that of non-CNF in almost all crops, with one or two exceptions. But this year, the CNF yields Chilly crop is lower. The field teams reported that CNF and non-CNF farmers have used different varieties of seed. This is major reason for the yields difference between CNF and non-CNF. RySS may take note of this issue. Further, the field teams, especially in Guntur district, reported that some CNF Chilly crop was affected by the diseases and pests.

Table 3.5: Crop wise yields under CNF and non-CNF and their difference during Kharif 2022-23

Crop	CNF	non-CNF	Difference between CNF & non-CNF		
	quintals/ hectare		quintals/ hectare	in percentages	Significance
Paddy	52.22	51.06	1.16	2	NS
Groundnut	23.40	25.64	-2.24	-9	NS
Cotton	12.38	10.86	1.52	14	@
Maize	61.05	62.79	-1.74	-3	NS
Red gram	6.76	5.68	1.08	19	*
Chillies	47.67	64.35	-16.68	-26	@
Tomato	161.92	145.38	16.53	11	NS

*Note: NS indicates Not significance, @ indicates 10% and * indicates 5% significance levels*
Source: IDSAP Field Survey, 2022-23

The crop output of CNF is tastier and chemical free and has more staying capacity, compared to that of non-CNF. This has resulted in improvement in health of consumers including farmers. The PMDS has also contributed to the yields of crops under CNF. The higher yield response to lower level of CNF inputs is indication of the contribution of CNF to improvement in the fertility of soil and crops, this is evident from the focused group discussions with the farmers in the sample villages. Therefore, it once again reflects the convergence of farmers' interest and land's interest.

3.5. Prices

The CNF farmers expect relatively higher prices for their agricultural products, compared to those of non-CNF agricultural products. Apart from the above-mentioned qualities, the production process of CNF requires more of labour, particularly the family labour. This is also one of the reasons for expecting higher prices for CNF agricultural products. The segmentation of the markets- one for CNF agricultural products and the other for non-CNF farmers enables

the CNF farmers to dispose their agricultural outputs in CNF markets at higher prices. The CNF and the non-CNF farmers if both go through the same traditional government established market channels, the CNF farmers get the same price as the non-CNF farmers. But, the same old market channels like Rythu Bazars with separate shops for CNF products, the CNF farmers will be able to sell their vegetables for higher prices. The village markets and shandies (weekly markets) also fetch higher prices for CNF products because the consumers have knowledge about the CNF products. Consumers from nearby semi-urban areas who have familiarity with farmers in villages are also picking up the CNF products in different quantities at higher prices from CNF farmers in traditional market channels. CNF farmers are also selling in women (DWACRA) melas, and also supplying required provisions to Tirumala Tirupati Devasthanam (TTD), these channels have been facilitated by RySS. Some educated CNF farmers are selling their agricultural products through online channels. These have been captured through focus group discussions. The prices of all the crops, except Chillies, are more or less the same (Table 3.6).

Table 3.6: Prices obtained for CNF and non-CNF crops' output and their difference during Kharif 2022-23

Crop	CNF	non-CNF	Difference between CNF & non-CNF	
	₹/quintal		₹/quintal	in percentages
Paddy	1,935	1,855	80	4
Groundnut	5,934	5,730	204	4
Cotton	7,155	7,000	154	2
Maize	1,904	1,914	-10	-1
Red gram	5,556	5,389	167	3
Chillies	19,542	17,248	2,294	13
Tomato	626	609	16	3

Source: IDSAP Field Survey, 2022-23

3.6. Gross value of crop output

The gross value of output has been obtained by multiplying yield with prices and adding value of by-product of the crop. Thus, yield and prices of crop are crucial in determining the gross value of output. The innovative intervention PMDS, one of the components of CNF, has led to the increase in yields of crops. The facilitation of RySS enabled CNF to link to the bulk buyers like TTD. We have also seen in the above discussion that CNF farmers are innovating new channels on their own. It is clear that out of 7 crops considered, CNF farmers have obtained higher gross value of output in case of four crops namely Paddy, Cotton, Red gram and Tomato.

But due to considerably lower gross value of CNF Chillies output, the average value is less for CNF crops than that of non-CNF (Table 3.7).

Table 3.7: Crop wise gross values of CNF and non-CNF output and their difference during Kharif 2022-23

Crop	CNF	non-CNF	Difference between CNF & non-CNF	
	₹/ hectare		₹/ hectare	in percentages
Paddy	108,882	100,562	8,320	8
Groundnut	151,013	157,792	-6,778	-4
Cotton	88,821	76,200	12,620	17
Maize	118,459	121,565	-3,106	-3
Red gram	38,964	32,130	6,833	21
Chillies	931,526	1,109,894	-178,367	-16
Tomato	101,455	88,752	12,703	14
Average ²³	1,42,166	1,44,180	-2,014	-1

Source: IDSAP: Field Survey, 2022-23

3.7. Net value of crop output

The net value of crop output is derived by subtracting paid-out costs from gross value of output. The paid-out costs play a greater role in determining net returns of crops. As we have noted above in this chapter that paid-out costs for all crops are lower under CNF. Despite this, the net value of two crops namely Groundnut and Chillies are lower under CNF compared to non-CNF (Table 3.8). The average gross value of all seven CNF crops is less than that of non-CNF (see Table 3.7), but the average net value of CNF crops is higher than that of non-CNF crops by 10 percent. This has become possible, despite a significant yield difference in Chillies crop, the highest monetary value crop. The savings obtained in the paid-out cost proved to be a critical factor in enhancing profitability during normal conditions and reducing the losses during the challenging conditions.

Table 3.8: Crop wise net values of CNF and non-CNF output and their difference during Kharif 2022-23

Crop	CNF	non-CNF	Difference between CNF &	
	₹/ hectare		₹/ hectare	in percentages
Paddy	48,542	28,576	19,966	70
	92,973	96,571	-3,598	-4
Cotton	20,769	-704	21,473	
Maize	77,103	69,298	7,806	11
Red gram	8,152	-1,839	9,991	
Chillies	787,862	935,847	-147,985	-16
Tomato	10,875	-9,265	20,141	

²³ This is the weighted average of seven crops considered in the report and given in the table. The area under each crop, in the state, are used as the weights. See Figure 3.1

Crop	CNF		non-CNF		Difference between CNF & non-CNF	
	₹/ hectare		₹/ hectare		in percentages	
Average ²⁴	79,924	72,556	7,368	10		

Source: IDSAP Field Survey, 2022-23

3.8. Disaggregate analysis and trends over the years

In this section, the variations in the crop yields over years, under rainfed and irrigation conditions, across the agroclimatic zones and farmers categories are discussed. Needless to say, that the disaggregated analysis is limited to a few crops, which have adequate number of sample observations. To be precise the trends over the years in yields of CNF and non-CNF crops is limited to only Paddy crop, which is common in all years and seasons. Further, the disaggregate analysis at irrigation status is limited to Paddy, Groundnut, Cotton and Maize. In additional the agroclimatic zones and farmers' categories level analysis is limited to Paddy, Groundnut and Cotton.

3.8.1. Trends in Paddy yields over the years

The Paddy yields obtained under CNF and non-CNF during Kharif 2018-19 to Kharif 2022-23 are presented in Table 3.9 and Figure 3.3. In the first two years, the CNF yields are less than that of non-CNF. However, CNF yields are higher than non-CNF yields in latter three years. One possible reason for higher CNF Paddy yields during last three years could be introduction PMDS as a part of CNF. As mentioned, many times in the previous reports that PMDS (living plants/ roots) not only provide shade to the soil and microbes in the soil, during hot summer months, but also provide food to the microbes in the soil through their constant photosynthesis. In turn, as one can see in the natural forests, the microbes get multiplied under longer crop cover and generate plant nutrients from the elements available in the soil and atmosphere. The turnaround in the Paddy yields can be attributed, to a large extent, to PMDS.

Table 3.9: Paddy yields under CNF and non-CNF during last five Kharif seasons

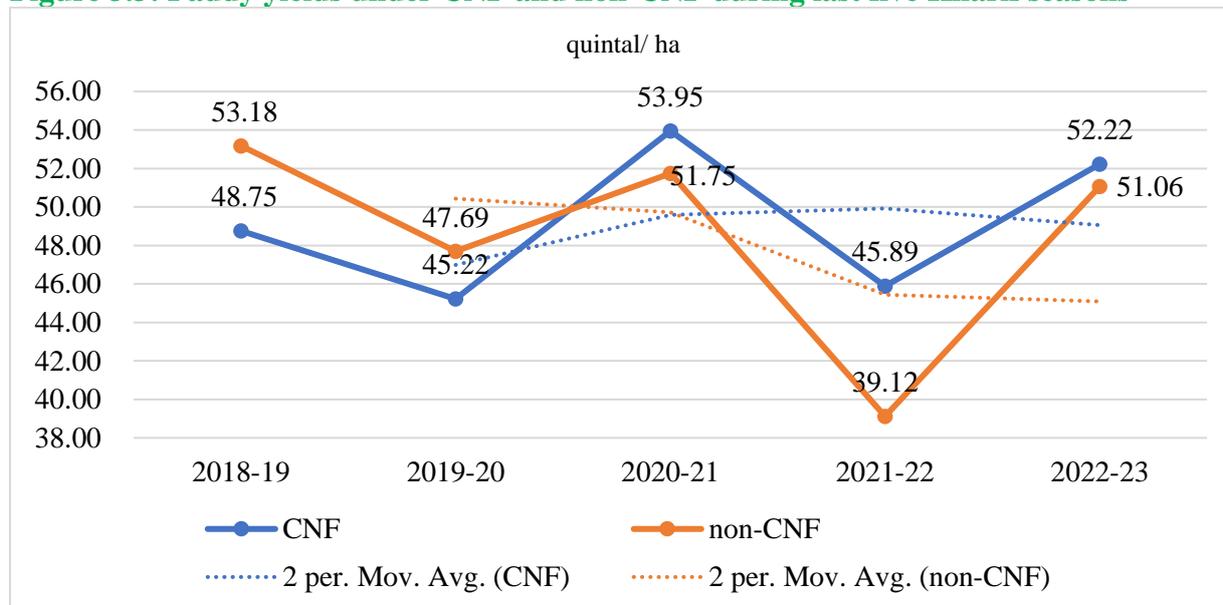
Year	Quintal/ ha		Difference between CNF & non-CNF	
	CNF	non-CNF	Quintal/ ha	in percentages
2018-19	48.75	53.18	-4.42	-8.3
2019-20	45.22	47.69	-2.47	-5.2
2020-21	53.95	51.75	2.20	4.3
2021-22	45.89	39.12	6.77	17.3
2022-23	52.22	51.06	1.16	2.3

Source: IDSAP: Field Survey, 2022-23

²⁴ This is the weighted average of seven crops considered in the report and given in the table. The area under each crop, in the state, are used as the weights. See Figure 3.1

One can see wider fluctuations in the yields of both CNF and non-CNF Paddy. That is the natural agriculture in the state and also in the country. Agriculture yields, even sowing of crops are influenced not only by the quantum of rainfall, but also by the timing of the rainfall and many other factors. However, the fluctuations are a bit less under CNF (Figure 3.3). It reflects CNF ability to with stand to the weather anomalies such as dry-spells, heavy rains, floods, strong winds, etc.

Figure 3.3: Paddy yields under CNF and non-CNF during last five Kharif seasons



Source: IDSAP: Field Survey, 2022-23

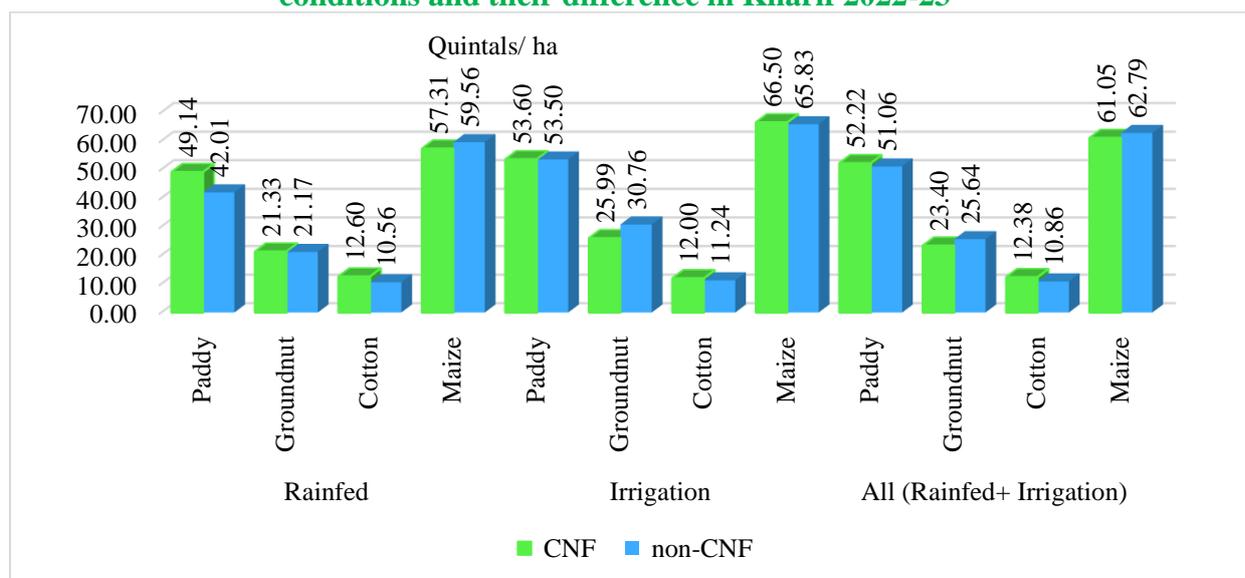
Irrigation status wise crop yields. Out of seven crops covered, in this report, Chillies and Tomato are predominantly irrigated crops and Red gram is a rainfed crop. However, other four crops are grown under rainfed and irrigation conditions. Adequate number of CCEs are available to analyse the yields of Paddy, Groundnut, Cotton and Maize under rainfed and irrigation conditions. The number of CCEs conducted for these four crops under CNF and non-CNF and under rainfed and irrigation conditions and yields obtained and their differences are presented in Table 3.10 and Figure 3.4. The number of CCEs are good enough to provide reliable estimates. Out of four crops considered here, the CNF yields of Paddy and Cotton are higher than non-CNF yield under both rainfed and irrigation conditions. But the yields of CNF Groundnut are less than non-CNF under irrigation conditions by 16 percent. These results, in turn, affected the overall yields of CNF Groundnut. In the same way, the yields of CNF Maize are less than that of non-CNF under rainfed conditions by 4 percent. These results, in turn, lowered the overall CNF Maize yields by 3 percent.

Table 3.10: Crop wise CNF and non-CNF yields obtained under rainfed and irrigation conditions and their difference in Kharif 2022-23

Irrigation status	Crop	Number of CCEs		Yields (quintals/ ha)		Difference in yields	
		CNF	non-CNF	CNF	non-CNF	quintals/ ha	in %
Rainfed	Paddy	140	44	49.14	42.01	7.13	17
	Groundnut	49	31	21.33	21.17	0.16	1
	Cotton	61	55	12.60	10.56	2.03	19
	Maize	19	17	57.31	59.56	-2.25	-4
Irrigation	Paddy	313	163	53.60	53.50	0.10	0
	Groundnut	39	27	25.99	30.76	-4.77	-16
	Cotton	35	42	12.00	11.24	0.76	7
	Maize	13	18	66.50	65.83	0.67	1
All (Rainfed+ Irrigation)	Paddy	453	207	52.22	51.06	1.16	2
	Groundnut	88	58	23.40	25.64	-2.24	-9
	Cotton	96	97	12.38	10.86	1.52	14
	Maize	32	35	61.05	62.79	-1.74	-3

Source: IDSAP: Field Survey, 2022-23

Figure 3.4: Crop wise CNF and non-CNF yields obtained under rainfed and irrigation conditions and their difference in Kharif 2022-23



Source: IDSAP: Field Survey, 2022-23

3.8.2. Agroclimatic zone wise and farmers' categories wise disaggregation

In this section, three crops, viz., Paddy, Groundnut and Cotton, which have enough number of CCEs, are considered. The results of the crop cutting experiments carried out in respect of these three crops are presented here (Tables 3.11, 3.12, and 3.13).

In respect of Paddy (Table 3.11), the difference in yields between CNF plots and non-CNF is the highest at 19.29 per cent in North-coastal AP, while it is at negative in Godavari and the Southern zone. Efforts should be made to unearth the reasons for the lower yields in those two

zones and corrective action should be taken. Farmers of all size-classes have attained higher Paddy yields under CNF compared to non-CNF, with those of the ‘other’ size-class turning out the best performance. Among the tenure categories, both the pure tenants and owner-tenants performed better than pure owners. Next, SCs performed the worst and STs performed the best under CNF. This diametrically different performance of by the two weak social categories is surprising. It may be that in the HAT zone, where STs inhabit more, the extension services work better than in the plains with SCs.

Table 3.11: Agroclimatic zone and farmers category wise Paddy yields under CNF & non-CNF during Kharif 2022-23

Agroclimatic Zones & Categories of farmers		Number of CCEs (number)		CCE yields (quintals/ hectare)		Difference between CNF & non-CNF	
		CNF	non-CNF	CNF	non-CNF	q/hectare	in percentages
Sate	Total	453	207	52.22	51.06	1.16	2.28
Agroclimatic zones	HAT	124	43	48.86	44.42	4.44	10
	North coastal	92	41	54.71	45.67	9.04	19.79
	Godavari	69	31	54	59.43	-5.43	-9.14
	Krishna	60	42	56.26	53.55	2.71	5.06
	Southern	87	30	49.78	55.21	-5.43	-9.84
	Scarce rainfall	21	20	53.88	51.94	1.94	3.73
Farm size category	Marginal	296	147	52.23	50.97	1.26	2.46
	Small	120	44	51.8	51.37	0.43	0.83
	Others	37	16	53.54	51	2.54	4.98
Farm size category	Tenants	30	15	57.4	54.11	3.29	6.09
	Owner-tenants	33	17	55.97	53	2.97	5.61
	Owners	390	175	51.51	50.61	0.9	1.77
Social category	SC	45	13	54.65	61.38	-6.73	-10.97
	ST	125	30	49.03	40.4	8.64	21.38
	BC	179	112	53.44	51.49	1.96	3.8
	OC	104	52	52.91	53.72	-0.81	-1.51

Source: IDSAP: Field Survey, 2022-23

In case of Groundnut (Table 3.12), the percentage difference between the yields of CNF and non-CNF is positive and the highest for Southern zone. The performance CNF Groundnut in Scarce rainfall zone needs special attention. Considering the performance of CNF farmers across farm size, we find the ‘other’ category, who only have enough observations, did the best. Meanwhile, it is the tenants who performed the best among the tenure categories. Given the sample size of the tenant farmers, the results may be treated as anecdotal. In respect of social classes all except the OCs performed badly. In this category also, SC and ST farmers do not have adequate sample observations.

Table 3.12: Agroclimatic zone and farmers category wise Groundnut yields under CNF & non-CNF during Kharif 2022-23

Agroclimatic Zones & Categories of farmers		Number of CCEs (number)		CCE yields (quintals/ hectare)		Difference between CNF & non-CNF	
		CNF	non-CNF	CNF	non-CNF	q/hectare	in percentages
Sate	Total	88	58	23.40	25.64	-2.24	-8.74
Agroclimatic zones	Southern	35	12	22.00	16.05	5.95	37.07
	Scarce rainfall	51	46	24.81	28.14	-3.33	-11.82
Farm size category	Marginal	44	33	20.73	22.27	-1.54	-6.92
	Small	32	16	24.51	32.08	-7.57	-23.61
	Others	12	9	30.21	26.52	3.69	13.91
Farm size category	Tenants	4	5	24.83	22.69	2.14	9.43
	Owner-tenants	7		28.26			
	Owners	77	53	22.88	25.91	-3.04	-11.71
Social category	SC	6	3	20.64	28.80	-8.16	-28.33
	ST	4	1	26.45	34.45	-8.00	-23.23
	BC	61	37	22.27	25.33	-3.05	-12.06
	OC	17	17	27.68	25.23	2.45	9.70

Source: IDSAP: Field Survey, 2022-23

In respect of Cotton (Table 3.13), both Krishna and Scarce rainfall zone, which have sizable number of observations, did better. Among the size-classes, marginal farmers did the best and the ‘others’ the worst. Next, pure tenants did the worst while owner-tenants did the best. But both these categories do not have adequate sample, hence the results are suggestive only. Among social categories all did reasonably well. In sum, we find no particular pattern across the crops in the performance of the weaker sections viz., marginal farmers, pure tenants, SCs and STs.

Table 3.13: Agroclimatic zone and farmers category wise Cotton yields under CNF & non-CNF during Kharif 2022-23

Agroclimatic Zones & Categories of farmers		Number of CCEs		CCE yields (quintals/ hectare)		Difference between CNF & non-CNF	
		CNF	non-CNF	CNF	non-CNF	q/hectare	in %
State	AP	96	97	12.38	10.86	1.52	14
Agroclimatic zones	Krishna	34	33	15.16	11.92	3.24	27
	Scarce rainfall	55	50	10.59	9.83	0.76	8
Farm size category	Marginal	50	44	13.88	10.48	3.41	33
	Small	29	31	11.51	9.94	1.57	16
	Others	17	22	9.44	12.90	-3.47	-27
Tenurial categories	Tenants	5	7	11.78	13.48	-1.70	-13
	Owner-tenants	9	12	14.00	11.37	2.63	23
	Owners	82	78	12.24	10.54	1.70	16
	SC	28	7	10.31	9.30	1.00	11

Agroclimatic Zones & Categories of farmers		Number of CCEs		CCE yields (quintals/ hectare)		Difference between CNF & non-CNF	
		CNF	non-CNF	CNF	non-CNF	q/hectare	in %
Social category	BC	41	66	12.28	10.25	2.03	20
	OC	26	23	15.09	13.38	1.71	13

Source: IDSAP: Field Survey, 2022-23

3.9. Conclusions

There are two dimensions to the CNF method: on the one hand, the expenditure on PNPIs under the method is low in case of input intensive crops, benefiting the farmer and on the other, PNPIs by enriching soil health benefit the land. If we consider the paid-out costs in toto, they too are considerably lower under CNF in relation to non-CNF. And this paves way for reduced dependence of the CNF farmer on the credit market. This comes as a great relief to the farmer. Crop yields under CNF are, about the same or higher in case of Paddy, Cotton, Red gram and Tomato. In case of Chillies CNF fares badly. In general, CNF farmers are seen to command higher prices for their output. The average gross value, of all seven CNF crops, is marginally less (1 percent) than that of non-CNF crops, owing to a significantly lower CNF Chillies yields. However, the average net value of CNF crops is higher than that of non-CNF crops by 10 percent. This is possible, despite a disruptive yield difference in Chillies crop, which is the highest monetary value crop. The savings obtained in the paid-out cost proved to be a critical factor in enhancing profitability during normal conditions and reducing the losses during the challenging conditions. The innovation of PMDS under CNF is seen to make positive contribution to the yields. However, the qualitative superiority of crops grown should not be undervalued. Thus, CNF output is tastier, free of chemical residues and healthier.

The Paddy yield data of last five Kharif seasons indicate that CNF Paddy yields have relatively improved compared to non-CNF yields. Introduction of PMDS could be the major contributory factor. The trends in Paddy yields also indicate that CNF Paddy experienced relatively lesser fluctuations during last five seasons. The irrigation status wise analysis indicates that CNF yields are higher in six out of eight scenarios (4 crops X two irrigation statuses) analysed. A significantly lower CNF Groundnut yields under irrigation conditions, not only affected the overall CNF Groundnut yields, but also the disaggregate analysis. We may add here that there is no particular pattern across the crops in the performance of the weaker sections viz., marginal farmers, pure tenants and SCs and STs.

Chapter 4: Impact of CNF on input-use

4.1. Introduction

This chapter is an attempt to compare the resource-use pattern under CNF and non-CNF. In this context, the earlier studies conducted by IDS have brought to the fore the following conclusions: that under CNF the use of land has increased, overall requirement of human labour has increased, water requirement for growing crops has declined, credit requirement for agriculture and working capital required for growing crops has declined. The present round covering Kharif 2022-23 reexamines these conclusions.

4.2. Land utilization Pattern

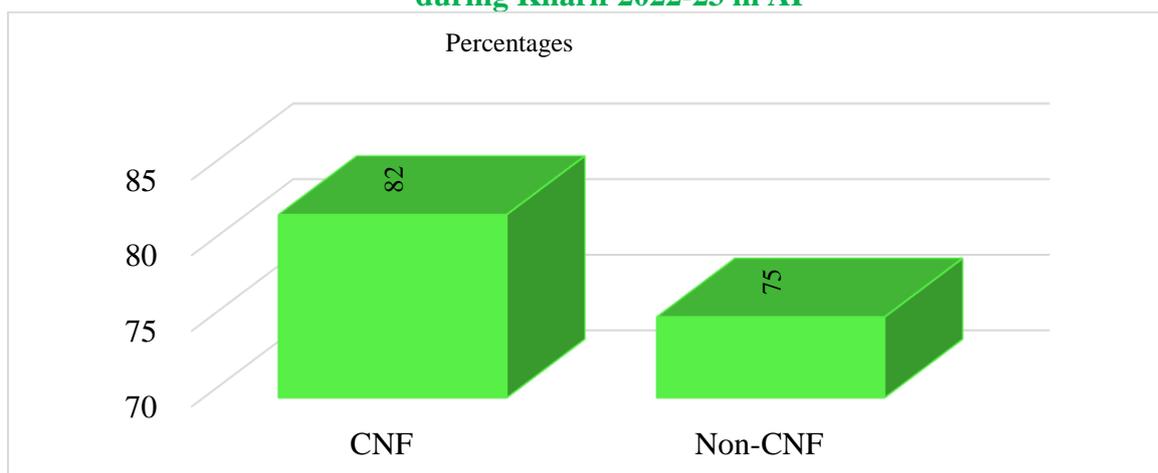
Four indicators are formulated to assess the pattern of land-use. They are: percentage of operated area cultivated during Kharif 2022-23 by CNF and non-CNF farmers; area allocated for CNF during the last four Kharif seasons, from 2019-20 to 2022-23; percentage of cultivated area allocated to CNF for the last four Kharif seasons by CNF farmers; and number of days the fields remained covered with crops under CNF and non-CNF during March to November, 2022.

4.2.1. Proportion of area cultivated during Kharif

As can be seen in Table 1.2, CNF farmers have relatively a larger operational holding (1.04 hectare) than non-CNF farmers (0.80 hectare). Further, CNF farmers have cultivated a larger proportion of their holdings during Kharif 2022-23. CNF farmers cultivated 82 percent of their operation holdings vis-à-vis 75 percent by non-CNF farmers during the study period (Figure 4.1). At times, farmers may not cultivate their entire operational area²⁵ during any particular season or year. They may leave a part of holding fallow in one season and cultivate in another season; they may leave a part of land, which may be not fit for cultivation, fallow; they may not be able to cultivate the land due to distance, shortage of family labour, shortage of funds, etc. As mentioned above that RySS is encouraging the farmers to cultivate their lands throughout the year. As CNF needs relatively less money for cultivation, farmers may be encouraged to cultivate their entire holding for longer periods. Another possible reason could be improvement in the soil quality and changes in characteristics of soil. Yet another possible reason could be reduction in water requirement in CNF crops. Because of these factors, CNF farmers might have cultivated a larger proportion of their operational holding during the season.

²⁵ Operational area is defined here as 'area owned' plus 'area lease-in' minus 'area leased-out'.

Figure 4.1: Percentage of operational area cultivated by CNF and non-CNF farmers during Kharif 2022-23 in AP



Source: IDSAP: Field Survey, 2022-23

CNF farmers have cultivated a greater percentage of their operational holdings in four out of six agroclimatic zones and seven out of ten farmers categories covering in this report. CNF farmers have cultivated a greater percentage of their operational area in Godavari, Krishna, Southern and Scarce rainfall zones. On the other hand, three categories of non-CNF farmers, viz., other farmers (consist of medium and large farmers) among farm size categories, pure tenant farmers among tenurial categories, and ST farmers among social categories, cultivated a greater percentage of their operational holdings, during Kharif 2022-23, compared to their counterparts in CNF (Table 4.1).

Table 4.1: Percentage of operational area cultivated by CNF and non-CNF farmers during Kharif 2022-23 (%)

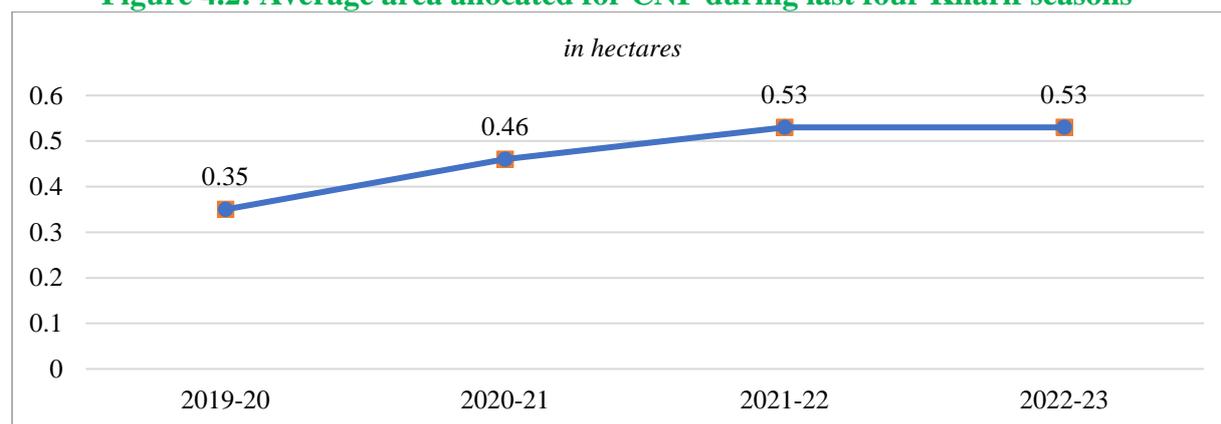
Agroclimatic zones & farmers' categories		CNF	Non-CNF
State	AP	82	75
Agroclimatic zones	HAT	82	92
	North coastal	83	91
	Godavari	100	62
	Krishna	84	75
	Southern	74	52
	Scarce rainfall	88	85
Farm size category	Marginal	91	74
	Small	76	75
	Others	60	89
Tenurial categories	Tenants	90	99
	Owner-tenants	74	70
	Owners	82	74
Social category	SC	84	71
	ST	81	89
	BC	83	79
	OC	82	69

Source: IDSAP: Field Survey, 2022-23

4.2.2. Trends in area allocation to CNF

An increase in area allocation to CNF is an important indicator about the beneficial potential of CNF. The CNF sample farmers are asked about area cultivated and area allocated to CNF during last four Kharif seasons. The area allocated to CNF by farmers during last four Kharif seasons has increase from 0.35 hectares in 2019-20 to 0.53 hectares in 2022-23 (Figure 4.2). The increasing trend holds good across all agroclimatic zones and farmers' categories (Table 4.2).

Figure 4.2: Average area allocated for CNF during last four Kharif seasons



Source: IDSAP: Field Survey, 2022-23

Table 4.2: Agroclimatic zone wise & farmers' categories wise average area allocated for CNF during last four Kharif seasons (ha)

Agroclimatic zones & farmers categories		2019-20	2020-21	2021-22	2022-23
State	AP	0.35	0.46	0.53	0.53
Agroclimatic zones	HAT	0.58	0.59	0.60	0.60
	North Coastal	0.27	0.32	0.34	0.36
	Godavari	0.4	0.4	0.41	0.41
	Krishna	0.36	0.41	0.44	0.45
	Southern	0.30	0.52	0.70	0.68
	Scarce rainfall	0.26	0.42	0.44	0.44
Farm size categories	Marginal	0.29	0.37	0.41	0.41
	Small	0.45	0.59	0.67	0.66
	Others	0.45	0.66	0.78	0.79
Tenurial categories	Tenants	0.36	0.41	0.43	0.42
	Owner-tenants	0.32	0.4	0.49	0.53
	Owner-farmers	0.35	0.47	0.53	0.53
Social categories	SC	0.31	0.39	0.44	0.46
	ST	0.57	0.58	0.6	0.6
	BC	0.28	0.40	0.46	0.47
	OC	0.34	0.53	0.63	0.61

Source: IDSAP: Field Survey, 2022-23

The area allocated to CNF as percentage of total cultivated area during last four Kharif seasons is also increasing at the state level and also across all zones and all farmers categories (Table 4.3). These clearly indicate that the area under CNF has been expanding over the years and all the categories of farmers have experienced this trend. However, the rate of increase is a bit uneven across the zones and consequently across the farmers categories. For example, CNF area as a percentage of operational area has remained almost same in the HAT zone. The same also nearly stagnated for the ST farmers, who mostly inhabitants of the HAT zone.

Table 4.3: Agroclimatic zone wise & farmers' categories wise percentage of cultivated area allocated for CNF during last four Kharif seasons (%)

Agroclimatic zones & farmers categories		2019-20	2020-21	2021-22	2022-23
State	AP	35	46	52	54
Agroclimatic zones	HAT	64	63	63	64
	North Coastal	33	36	41	43
	Godavari	41	40	41	41
	Krishna	34	43	45	46
	Southern	30	48	65	68
	Scarce rainfall	25	40	41	42
Farm size categories	Marginal	50	65	73	74
	Small	36	45	51	52
	Others	18	26	31	33
Tenurial categories	Tenant	51	56	60	59
	Owner- tenant	29	36	42	41
	Owner	36	46	53	54
Social categories	SC	36	47	52	55
	ST	63	63	65	65
	BC	29	40	47	48
	OC	29	45	53	54

Source: IDSAP: Field Survey, 2022-23

4.2.3. Green/ crop cover

A comparison is made about the number of days of green/ crops covered over CNF fields of CNF farmers and non-CNF fields of non-CNF farmers, during March to November 2022. At state level, CNF fields have 164 days of green/ crop cover; the same is 137 days over non-CNF fields. It implies that CNF fields have 27 additional days or 17 percent longer crop cover during the reference period (Table 4.4). As mentioned elsewhere in this report and many times in the previous reports, that longer crop cover on the fields, only provide shade to the soil and microbes in the soil, but also provide sugar/ food, through photosynthesis, to the microbes in the soil. The obvious reason for longer green cover on CNF fields is the PMDS. All CNF farmers have raised PMDS at least in one of his/ her plots/ fields during March -June 2022, which is normally not the cropping season in the state. As anticipated, the CNF fields have

longer green cover over non-CNF fields in five out of six agroclimatic zones and in every farmer's category. The only exception is North coastal zone, in which the non-CNF fields have longer crop cover by 5 days (3 percent). The possible reason is the longer cropping season or higher cropping intensity in the zone. The North coastal zone, which receives relatively high rainfall, has a tradition of raising green manure crops during the March-June periods. In some other parts of the zone, the farmers raise three crops in a year; usual crop cycle is – Paddy – Pulses and Sesamum. In some other parts, long duration crops like Sugarcane and tree crops like Cashew, Bamboo, Eucalyptus, etc., are grown.

Table 4.4: Agroclimatic zone wise and farmers' category wise number of days crops covered in CNF and non-CNF fields during March to Nov 2022

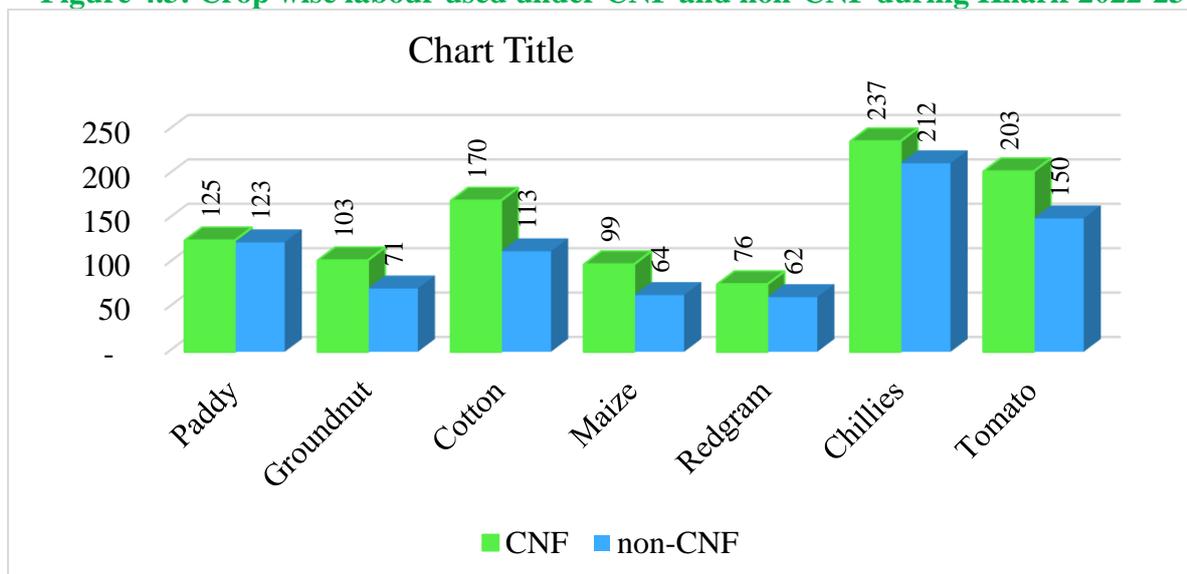
Agroclimatic zones and farmers categories		Number of days			Percentage difference between CNF and non-CNF
		PMDS+ CNF	Non-CNF	Difference between CNF & non-CNF	
AP	AP	164	137	27	17
Agroclimatic zone	HAT	174	165	9	5
	North coastal	178	183	-5	-3
	Godavari	166	141	25	15
	Krishna	162	120	42	26
	Southern	142	112	30	21
	Scarce rainfall	176	133	43	24
Farm categories	Marginal	163	139	24	15
	Small	164	130	34	21
	Others	167	129	38	23
Tenurial categories	Tenant	172	110	63	36
	Owner -tenant	164	132	32	19
	Owner	164	138	26	16
Social category	SC	160	117	43	27
	ST	173	161	12	7
	BC	168	141	27	16
	OC	152	124	28	19

Source: IDSAP: Field Survey, 2022-23

4.3. Impact of CNF on human labour utilization

The labour utilization pattern has been examined between CNF and non-CNF with regard to each major crop in terms of labour days per hectare. The human labour has been measured in terms of family (own), hired and total labour (family + hired labour). Labour utilization is also analyzed in terms of male and female labour utilization and operation wise. The total labour days per hectare are higher for CNF over non-CNF in case of all seven crops, included in this report, viz., Paddy, Groundnut, Cotton, Maize, Red gram, Chilies, and Tomato. (Figure 4.3).

Figure 4.3: Crop wise labour used under CNF and non-CNF during Kharif 2022-23



Source: IDSAP: Field Survey, 2022-23

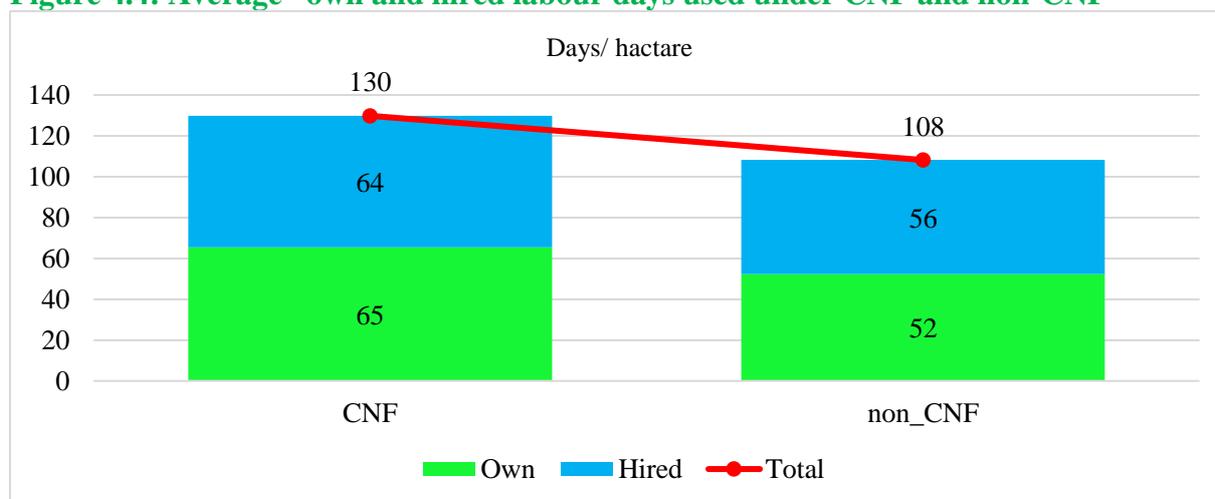
4.3.1. Utilization of own and hired labour

To get a summary understanding about the impact of CNF on labour use in crop cultivation, the weighted averages of all seven crops are worked out. The area under each crop, at the state level, are used as weights. On average 130 days labour are used under CNF vis-à-vis 108 days under non-CNF. It includes 65 days of own labour and 64 days of hired labour under CNF²⁶ and 52 days of own labour and 56 days of hired labour under non-CNF (Figure 4.4). On average, under CNF, a greater number of own labour of 65 days, compared 64 days of hired labour, is used. But a greater number of hired labour of 56 days, compared to 52 days of own labour, are used, under non-CNF. It implies that CNF not only needs a higher dose of labour for crop cultivation, but most of that labour has to come from own labour. This could be a potential constraint in the expansion of CNF in the state. As mentioned in previous reports that preparation of biological stimulants such Jeevamruthams and Kashayams, which involve a number of small tasks such as collection of raw materials, cleaning, grading, mixing, drying, soaking, fermenting, boiling, etc., spread over many days. Casual or daily labour cannot be hired for those tasks. In addition, certain CNF operation also need few hours of labour frequently, if not daily. Such operations cannot be outsourced or hired labour cannot be employed for such tasks. Furthermore, CNF is promoting and facilitating higher cropping intensity or 365 days crop cover. In such condition many agricultural operations gets scattered over a longer span of time. For example, if a farmer takes PMDS, he/ she will complete the land preparation in March instead of in June or July. In such scenarios, the CNF farmers can

²⁶ The two figures do not add up to total of 130 days, due to rounding up.

optimize their own labour use and also the use of their own agriculture machinery and implements.

Figure 4.4: Average* own and hired labour days used under CNF and non-CNF



* Weighted average of seven crops covered in this report. The area under each crop, at the state level, are used as weights.

Source: IDSAP: Field Survey, 2022-23

The family labour use per hectare is higher for CNF in relation to non-CNF in case of all crops except in Chillies.²⁷ The hired labour use is higher for CNF over non-CNF across all the crops except Paddy crop, in which case the number is equal. On average 20 percent higher labour is used under CNF vis-à-vis non-CNF. It includes 25 percent and 15 percent higher own and hired labour respectively (Table 4.5).

Table 4.5: Crop wise own and hired labour used under CNF and non-CNF during Kharif 2022-23 (days/ hectare)

Crops	CNF			non-CNF			Percentage difference		
	Own	Hired	Total	Own	Hired	Total	Own	Hired	Total
Paddy	69	57	125	66	57	123	4	-0	2
Groundnut	51	52	103	32	39	71	58	33	44
Cotton	71	100	170	37	76	113	91	31	50
Maize	65	33	99	36	28	64	83	18	54
Red gram	44	32	76	34	28	62	30	15	23
Chillies	110	127	237	113	99	212	-3	28	12
Tomato	93	110	203	59	91	150	58	21	35
Average ²⁸	65	64	130	52	56	108	25	15	20

Source: IDSAP: Field Survey, 2022-23

²⁷ One possible reason is the significantly higher non-CNF Chillies yields over CNF yields. As non-CNF farmers have a greater number of pickings, over longer periods, they can use a greater number of own labour days.

²⁸ Weighted average of seven crops covered in this report. The area under each crop, at the state level, are used as weights.

4.3.2. Impact of CNF on the use of male and female labour

Crop wise and average use of male and female labour under CNF and non-CNF is presented in Table 4.6. At the aggregate level 20 percent higher labour is used in CNF crops over non-CNF crops. In this female labour made larger contribution. On average 22 percent higher female labour is used under CNF. On the other hand, 16 percent higher male labour is used under CNF.

Table 4.6: Crop wise and average use of male and female labour under CNF and non-CNF during Kharif 2022-23 (days/ hectare)

Crops	CNF			non-CNF			Percentage difference		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Paddy	54	72	125	51	72	123	4	-0	2
Groundnut	35	68	103	24	47	71	44	44	44
Cotton	43	128	170	30	83	113	41	54	50
Maize	38	60	99	24	40	64	61	50	54
Red gram	30	46	76	23	39	62	31	19	23
Chillies	70	167	237	79	134	212	-11	25	12
Tomato	62	141	203	36	115	150	74	23	35
Average ²⁹	46	84	130	40	68	108	16	22	20

Source: IDSAP: Field Survey, 2022-23

4.3.3. Changes in labour use in different agricultural operations

The study has collected labour use details on different agricultural operations under CNF and non-CNF. The operations covered are land preparation, nursery raising, crop sowing/transplantation, weeding and inter-cultivation, irrigation, crop harvesting, threshing and supervision and others. Labour use on each of these operations under CNF and non-CNF is presented in Table 4.7. A greater number of labour days are utilized in each and every operation, under CNF over non-CNF. In absolute terms, the difference between CNF and non-CNF crops varies from minimum of zero days in nursery raising and one day in each of land preparation and sowing/transplantation to maximum of four days in weeding/inter-cultivation and five days each in harvesting and irrigation. On average (weighted average of seven crops), 22 additional days (20 percent) labour days are used under CNF vis-à-vis non-CNF.

Table 4.7: Average* labour use on different agricultural operations under CNF and non-CNF during Kharif 2022-23

Operation	Days/ hectare		Difference between CNF & non-CNF	
	CNF	non-CNF	Days/ hectare	in percentages
Land preparation	7	6	1	22
Nursery raising	4	4	0	4
Sowing/ transplantation	19	18	1	8

²⁹ Weighted average of seven crops covered in this report. The area under each crop, at the state level, are used as weights.

Operation	Days/ hectare		Difference between CNF & non-CNF	
	CNF	non-CNF	Days/ hectare	in percentages
Inter-cultivation	26	22	4	16
Irrigation	21	16	5	33
Harvesting	30	25	5	19
Threshing	13	9	3	38
Supervision & others	11	9	2	19
Total (all operations)	130	108	22	20

* Weighted average of seven crops covered in this report. The area under each crop, at the state level, are used as weights.

Source: IDSAP: Field Survey, 2022-23

4.4. Water utilization pattern

Another dimension of resource use is water required for irrigation in growing crops. The issue in question is whether water requirement for irrigation has come down due to practices of CNF. The qualitative data has been collected from the farmers' household survey. The question of reduction in water for irrigation is posed to all the categories of CNF farmers and all the major crops considered in the analysis. Majority of CNF farmers of all the categories have reported that the water requirement for crop cultivation has come down. This is pronounced among farmers from all the agroclimatic zones except Krishna Zone. Among the social category of farmers, large percentage of ST farmers have reported that the water requirements for irrigation have come down (Table 4.8).

Table 4.8: Agroclimatic zone and farmers categories' wise farmers response about CNF impact (reduction) on water requirement in crop cultivation (%)

Agroclimatic Zones & Categories of farmers		Yes	No	Cannot say
State	AP	54	41	4
Agroclimatic zones	HAT	72	28	1
	North coastal	66	33	1
	Godavari	62	38	-
	Krishna	30	69	1
	Southern	48	49	4
	Scarce rainfall	62	25	13
Farm size category	Marginal	56	40	4
	Small	56	40	4
	Others	44	49	6
Tenurial categories	Tenants	38	62	-
	Owner cum tenants	39	51	10
	Owners	56	40	4
Social category	SC	41	52	7
	ST	70	29	1
	BC	56	40	5

Agroclimatic Zones & Categories of farmers	Yes	No	Cannot say
OC	51	45	4

Source: IDSAP: Field Survey, 2022-23

Almost all CNF farmers, who experienced the impact of CNF on water use in crop cultivation, reported a considerable or moderate reduction in water requirement in each crop cultivation (Table 4.9). Over 82 percent Ragi cultivators reported considerable decrease in Ragi cultivation after CNF and 45 percent Paddy cultivators also perceived a considerable reduction in the cultivation of that crop. About 80 plus percentage of farmers have reported a reduction in water requirement in 11 out of 12 crops given in the table. The only exception is Green crop, which is a rainfed crop, mostly grown on residual moisture in the soil after Paddy cultivation. On the whole, the water requirement for irrigation for growing crops has come down. This might have enabled the farmers to reduce dependency on ground water.

Table 4.9: Crop wise the impact of CNF on water needs in crop cultivation (farmers in %)

Crop	Decreased considerably	Decreased moderately	No change	Increased moderately	Increased considerably
Paddy	45	52	1	3	-
Groundnut	9	81	7	3	-
Cotton	18	65	12	5	-
Bengal gram	-	80	-	20	-
Black gram	16	72	4	8	-
Maize	13	71	4	11	-
Red gram	15	70	4	11	-
Chillies	11	82	-	6	-
Green gram	-	50	50	-	-
Jowar	-	88	-	13	-
Ragi	82	14	4	-	-
Tomato	-	95	-	5	-

Source: IDSAP: Field Survey, 2022-23

4.5. Impact of CNF on households' indebtedness

Indebtedness is one of the factors for agrarian distress in the state. Higher cost of cultivation and declining farm profitability, under non-CNF, is one of the major reasons for higher farmers indebtedness. In chapter 3 of this report, we have observed that paid-out cost for growing crops is lower under CNF in relation to non-CNF. As a result, borrowings for working capital for growing crops is expected to decline for CNF farmers relatively. The farmers' response about the impact of CNF on agriculture working capital requirement and borrowing for agriculture have been discussed in the next chapter. In this section, actual borrowings details such as

number of borrowers/ loanees, loans, amount borrowed, amount outstanding, sources of credit, purpose of borrowings, etc., have been covered. The household borrowing data has been summarized in Table 4.10. Out of 1,331 sample CNF households, 1,079 have current/ active loans in 2022-23, i.e., 81 percent of CNF households have current loans. The same is 91 percent for non-CNF households (HHs). The CNF farmers have total 1,112 current loans. It implies the CNF farmers have 84 loans for every 100 sample HHs; the same is 94 per non-CNF farmers. Total amount borrowed by CNF HHs and non-CNF HHs are ₹8.21 crores and ₹6.21 crores respectively. This turns out to be an average borrowed amounts of ₹61,701 and ₹84,886 for each of CNF and non-CNF sample HHs respectively. The CNF HHs also have lower loan-outstanding. The data clearly indicates that the incidence of debt is considerably less for CNF HHs compared to non-CNF HHs.

Table 4.10: Summary of borrowings by CNF and non-CNF households in 2022-23

Indicators	Units	CNF	non-CNF
Total sample households	Number	1,331	731
Number of loanees	Number	1,079	667
Loanees as % of sample HHs.	%	81	91
Number of loans	Number	1,112	689
Loans as % of sample HHs.	%	84	94
Total loan amount	₹	8,21,24,536	6,20,52,029
Average loan amount per loanee	₹	76,112	93,032
Average loan amount per sample HH.	₹	61,701	84,886
Total loan outstanding amount	₹	6,75,51,776	5,38,86,690
Average loan outstanding per loanee	₹	62,606	80,790
Average loan outstanding per sample HH.	₹	50,753	73,716

Source: IDSAP: Field Survey, 2022-23

4.5.1. Source wise loans

In terms of number of borrowers/ loanees, commercial banks are number one source of credit for both CNF and non-CNF farmers. As many as 340 and 263 CNF and non-CNF HHs obtained loans from commercial banks, respectively. ‘Relatives and friends’ are the second most important source of credit for both CNF and non-CNF farmers, in terms of number of loanees. While SHGs is the third most important sources of credit for CNF farmers, Cooperatives are third most important sources of credit to non-CNF farmers. The average loan amount for CNF loanees is ₹76,112; the same for non-CNF loanees is ₹93,032. That is, the CNF HHs have 18 percent lower average loan amount compared to non-CNF HHs (Table 4.11). The largest average loan amount for CNF HHs is ₹1,78,125 from Other sources, including Microfinance Institutions (MFIs), Traders and Non-Government Organizations (NGOs). The Commercial

banks, Cooperatives and Others provided first, second and third largest average loans to non-CNF HHs.

Table 4.11: Credit source wise number of loanees and average loan amount by CNF and non-CNF HHs as on January 2023

Source	Number of loanees (number)		Average loan amount per loanee farmers (₹)		Difference in loan amounts between CNF & non-CNF (%)
	CNF	non-CNF	CNF	non-CNF	
Commercial ban	340	263	92,838	1,14,474	-19
Cooperatives	155	121	81,100	1,07,884	-25
SHGs	197	72	66,675	69,583	-4
Relatives & friends	286	151	57,352	62,590	-8
Money lenders	93	46	75,576	67,479	12
Others	8	14	1,78,125	94,750	88
All	1,079	667	76,112	93,032	-18

Source: IDSAP: Field Survey, 2022-23

Compared to CNF HHs, the non-CNF HHs got a greater number of loans and amount from formal institutions like Commercial banks and Cooperative society/ banks (Table 4.12). The non-CNF farmers obtained 57 percent of loans and 70 percent of loan amount from Commercial banks and Cooperatives; compared to 46 percent of loans and 53 percent of amount by CNF HHs. Thus, the CNF farmers, compared to non-CNF, have less access to formal credit institutions. One of the possible reasons could be the social composition of CNF and non-CNF HHs. As discussed in chapter 2, SCs and STs constitute more than one-thirds among CNF sample, compared to one-sixths in non-CNF sample. However, the CNF farmers have obtained larger share of loans (18 percent) and amount (16 percent) from semi-formal institutions of self-help groups (SHGs), compared 11 percent of loans and 8 percent of amount by non-CNF farmers. Relatives and friends are second largest sources of loans and amount for both CNF and non-CNF HHs (Table 4.12).

Table 4.12: Credit source wise percentage share of loanees and loan amount as on January 2023

Source	Percentage share of loanees (%)		Percentage share of loan amount (%)	
	CNF	non-CNF	CNF	non-CNF
Commercial banks	32	39	38	49
Cooperatives	14	18	15	21
SHGs	18	11	16	8
Relatives/ friends	27	23	20	15
Money lenders	9	7	9	5
Others	1	2	2	2
All	100	100	100	100

Source: IDSAP: Field Survey, 2022-23

4.5.2. Purpose of borrowing

Loan purpose wise numbers of loanees and amount borrowed is presented in Table 4.13. Obviously, agricultural working capital is major purpose in terms of number of borrowers. As many as 805 CNF famers and 565 non-CNF farmers borrowed for agriculture. The CNF farmers average loan size for agriculture is ₹77,553. *It is 19 percent less than non-CNF farmers average loan size of ₹95,904.* The CNF farmers not only have less average loan amount, but also more diversified purposes.

Table 4.13: Purpose wise number of loanees and average loan amount for CNF and non-CNF farmers as on January 2023

Purpose	Number of loanees		Average loan amount per loanee (₹)		Difference in loan amounts between CNF & non-CNF (%)
	CNF	non-CNF	CNF	non-CNF	
Agriculture	805	565	77,553	95,904	-19
Consumption	74	19	65,162	61,579	6
Life cycle events	66	30	55,545	93,400	-41
Health	49	23	65,898	56,739	16
Livestock purchase	35	8	81,857	91,875	-11
Education	28	12	1,09,607	49,500	121
Others	11	2	1,28,182	1,00,000	28
Festivals' celebration	5	2	60,000	15,000	300
Business	4	2	52,500	45,000	17
Assets/ land purchase	2	4	50,000	2,35,000	-79
All	1,079	667	76,112	93,032	-18

Source: IDSAP: Field Survey, 2022-23

Compared to 85 percent of non-CNF farmers, 75 percent CNF farmers borrowed for agriculture. While CNF farmers borrowed 76 percent of loan amount for agriculture, the non-CNF farmers borrowed 87 percent (Table 4.14). This indicates the reduction in the investment requirements in agriculture due to CNF. The data in Table 4.15 indicates that CNF farmers have borrowed less for agriculture (-11 percentage points) and more for variety of purpose; including consumption (4 percentage points), health³⁰ (2 percentage points), livestock (2 percentage points) and education (3 percentage points).

³⁰ Difference in social composition of sample HHs could be one reason for relatively higher borrowing for health by CNF farmers. Yet another possible reason could be the sources of loans. CNF farmers have borrowed sizable amount from SHGs. SHGs usually give loans, easily, often with softer conditions, for health purpose.

Table 4.14: Purpose wise percentage of loanees and loan amount as on January 2023

Purpose	Number of loanees		Average loan amount per loanee (₹)	
	CNF	non-CNF	CNF	non-CNF
Agriculture	75	85	76	87
Consumption	7	3	6	2
Life cycle events	6	4	4	5
Health	5	3	4	2
Livestock purchase	3	1	3	1
Education	3	2	4	1
Others	1	0	2	0
Festivals' celebration	0	0	0	0
Business	0	0	0	0
Assets/ land purchase	0	1	0	2
All	100	100	100	100

Source: IDSAP: Field Survey, 2022-23

4.6. Adoption of CNF practices and their impact on health of soil and crop

The adoption of CNF inputs and practices is expected to improve the health of soil as well as crops. We have considered 18 inputs and practices of CNF. They include: PMDS, Beejamrutham, Ghanajeevamrutham, Dravajeevamrutham, Khashayams, Asthrams, Mulching, Inter cropping, Boarder cropping, Bund Cropping, Multilayer crops, 36*36 model, Annapurna, Integrated farming, Kitchen gardens, and system of root intensification (SRI) model. The trends in adoption of CNF inputs and practices by farmers, during the last four years, from 2019-20 to 2022-23, are shown in Table 4.15. The first six practices are widely adopted by the farmers have shown a rapid increase in their adoption. But other practices did not show such increase. Shortage of labour, especially, family labour could be one reason for such low and slow adoption of those practices. Another possible reason could be that newly joined sample farmers may take time to master and adopt those practices. Yet another reason could be changes in RySS priorities. RySS may be focusing on certain priority areas and interventions. Local land conditions could be another reason.

Table 4.15: Percentage of farmers adopting different CNF practices and inputs during last four years

Input/ practice	2019-20	2020-21	2021-22	2022-23
PMDS	52.39	74.10	89.15	94.46
Beejamrutham	71.76	89.21	94.57	95.80
Ghanajeevamrutham	64.24	82.50	88.97	85.65
Dravajeevamrutham	66.39	84.54	92.94	94.05
Kashayams	49.42	71.41	84.36	82.96
Asthrams	48.07	66.80	81.86	83.61

Input/ practice	2019-20	2020-21	2021-22	2022-23
Mulching	16.98	22.58	26.43	26.90
Inter cropping	8.69	9.57	6.01	4.61
Border cropping	14.53	21.70	19.25	16.86
Bund cropping	12.37	16.16	12.31	7.12
Multilayer crops	0.99	0.70	0.12	0.06
36 X 36	0.00	0.06	0.06	0.06
Annapurna	0.06	0.06	0.00	0.00
Integrated farming	0.06	0.06	0.12	0.06
Kitchen gardens	16.69	22.17	23.80	15.52
SRI	0.12	0.00	0.06	0.00
Others	0.76	0.64	0.64	0.70

Source: IDSAP: Field Survey, 2022-23

4.6.1. Soil quality

The CNF, in general, and the major inputs and practices discussed above, are expected to have a positive impact on soil health. Soil health has been measured in terms of soil becoming soft, presence of earthworms in soil, a greater green cover in fields, increased moisture levels in the soil. These four dimensions have been reported widely irrespective of category of farmers (Table 4.16).

Table 4.16: CNF farmers response about improvement in soil quality indicators due to CNF during Kharif 2022-23 (in percentages)

Agroclimatic Zones & Categories of farmers	Increase of soil softness	Increase in earthworms in the soil	Increase in green cover in the fields	Increase in moisture levels in the soil	Others ³¹
Agroclimatic zones					
HAT	90.24	94.31	92.68	91.06	64.29
North coastal	97.42	82.58	86.45	82.58	0.00
Godavari	95.07	75.76	94.37	89.05	0.00
Krishna	93.50	91.95	88.24	80.50	88.24
Southern	90.73	71.52	81.64	58.98	10.87
Scarce rainfall	94.12	83.89	73.01	51.81	8.70
Total	92.92	82.88	84.01	70.67	26.40
Farm size categories					
Marginal	92.21	85.04	84.77	70.32	26.98
Small	94.20	82.26	84.00	71.77	20.93
Others	93.30	74.04	80.38	69.71	36.84
Total	92.92	82.88	84.01	70.67	26.40
Tenurial categories					
Tenants	97.62	92.86	88.10	80.95	
Owner-tenants	95.12	81.71	93.83	76.25	50.00
Owners	92.69	82.68	83.40	70.11	25.21

³¹ recharge of groundwater is reported as a major benefit under 'others' by

Agroclimatic Zones & Categories of farmers	Increase of soil softness	Increase in earthworms in the soil	Increase in green cover in the fields	Increase in moisture levels in the soil	Others ³¹
Total	92.92	82.88	84.01	70.67	26.40
Social categories					
SC	92.57	85.27	81.02	62.59	48.00
ST	90.97	91.23	91.61	86.08	47.06
BC	93.48	79.79	80.62	66.72	18.52
OC	93.71	80.09	85.92	71.33	10.34
Total	92.92	82.88	84.01	70.67	26.40

Source: IDSAP: Field Survey, 2022-23

4.6.2. Crop quality

Grain weight, grain size, stems strength, crops' tolerance to dry spells, heavy rains, strong and winds are the indicators considered to measure the health of crops. Farmers reported that all these dimensions have improved (Table 4.17). This means that crop health has increased

Table 4.17: CNF farmers response about the crop quality improvement indicators (%)

Crop quality indicator	Increased considerably	Increased moderately	No change	Decreased moderately	Decreased considerably
Grain weight	22.54	70.48	5.14	1.41	0.43
Grain size	27.79	59.45	10.55	1.90	0.31
Stems' strength	27.38	58.99	10.88	2.18	0.58
Plant tolerance to dry spells	22.58	52.52	20.53	3.77	0.60
Plant tolerance to heavy rains	18.20	61.98	15.22	3.45	1.15
Plant tolerance to strong winds	17.66	64.17	14.99	2.67	0.52
Others	7.69	50.55	37.36	3.30	1.10

Source: IDSAP: Field Survey, 2022-23

4.7. Integration of livestock with agriculture

It is well known fact that livestock used to be an integral part of Indian agriculture. However, the symbiotic relationship was forgotten or ignored and livestock rearing became an independent sector or source of income. Due to various reasons, the livestock farming has been declining in the rural and agriculture households. APCNF is being developed on the symbiotic relationship. Apart from contributing to the development of agriculture, livestock can provide additional and diversified income sources to HHs. Out of 1,331 sample HHs, 373 have purchased livestock because of CNF. As on date of survey, the average number of livestock, they have, 2 livestock meant for CNF (4.18). It does not mean that they are not getting any other benefits from livestock. It was noticed, in some villages, that the markets are developing for livestock dung and urine, due to CNF.

Table 4.18: Number of CNF farmers purchased livestock and number livestock acquired for CNF

Agroclimatic zones & farmers' categories	Number of farmers purchased livestock	Total number of livestock acquired	Average number of livestock acquired
Agroclimatic zones			
HAT	13	14	1
North coastal	10	16	2
Godavari	35	43	1
Krishna	20	31	2
Southern	160	464	3
Scarce rainfall	135	331	2
AP	373	899	2
Farm size categories			
Marginal	222	530	2
Small	110	279	3
Others	41	90	2
All	373	899	2
Tenurial categories			
Tenants	7	8	1
Owner cum tenants	20	28	1
Owners	346	863	2
All	373	899	2
Social categories			
SC	50	90	2
ST	21	38	2
BC	162	416	3
OC	140	355	3
Total	373	899	2

Source: IDSAP: Field Survey, 2022-23

4.8. Conclusions

There are indications that CNF is becoming increasingly popular. Farmers of all categories are taking to CNF in ever larger measure, though with institutional support. One significant development is that fields remained covered with crops over a longer period under CNF relative to non-CNF with far reaching effect on soil health and yield. Considering labour use we find that CNF is labour intensive. Also, own labour days are higher per hectare under CNF.

Water for irrigation is an important resource and it is claimed that CNF does bring down the water needs of farms. It also brings down the credit needs of the farmers adopting it because

paid-costs of cultivation under the method are lower. CNF adopters reported that their loans outstanding are lower. However, their access to institutional sources of finance is found to be less. Adoption of CNF practices has enriched the soils, contributed to an increase in grain weight, stem strength, tolerance of the weather anomalies, at least to some extent. CNF is also bringing back the symbiotic relationship between crop cultivation and livestock farming.

Chapter 5: Farmers Well-being and CNF

5.1. Introduction

One of the challenges of non-CNF or chemical-based agriculture is that improvement in Indian agriculture did not correspondingly benefit the farmers. Farmers are caught in the high and increasing cost of cultivation, dwindling farm profitability, degrading natural resources, health hazards in agriculture operations, toxic food, etc. In contrast the CNF is conferring perceptible non-monitory gains on its adopters, apart from tangible benefits discussed in chapters 3 and 4. This has become possible even as the soil health improved. This is a win-win situation. Now, we show below how the quality of life of those who practice CNF improved in multiplicity of ways. In trying to judge the quality of life, we employ a five-point scale, viz., decreased considerably, decreased moderately, no change, increased moderately, and increased considerably, wherever feasible.

The changes in production system on the farming conditions have been narrated in chapter 3 of this report. The implications of those changes are discussed in this chapter. These issues are captured from the farmers 'view point'. In this chapter, a number indicators relating to farmers wellbeing³², which are grouped into three themes- (1) Reduction in the farming related stress, (2) Households' health status, and (3) Farmers dignity, are discussed.

5.2. Reduction in farming related stress

It is well known fact that non-CNF farmers in the state and also in the country are distressed, due to multiple factors. Furthermore, the farming related stress would manifest as social and domestic pressures. The stress that the farmers endure, under non-CNF, has diminished under CNF for the reasons that (1) they are likely to get higher net returns from farming, (2) they command respect among their peers, (3) they are less prone to exploitation in the market place, (4) there is an improvement in their health status and that (5) the CNF standing crop is less

³² Wellbeing is a broad subject. "Compendium of OECD Well-being Indicators" by OECD [<https://www.oecd.org/sdd/47917288.pdf>] has given two sets of wellbeing indicators, viz., (I) Quality of life consists of (1) Health status, (2) Work and life balance, (3) Education and skills, (4) Social connections, (5) Civic Engagement and Governance, (6) Environmental Quality, (7) Personal Security, and (8) Subjective well-being; (II) Material Living Conditions consists of (1) Income and wealth, (2) Jobs and earnings, and (3) Housing. Further, the Report pointed out that Sustainability of Well-Being Over Time requires preserving different types of capital viz., (1) Natural capital, (2) Economic capital, (3) Human capital, and (4) Social capital. APCNF can have a positive impact on many of the above listed indicators.

likely to be subjected to the vagaries of the monsoon. Responses of farmers confirm the reduced stress faced by the farmers. Over 65 per cent of the farmers, at the state level, claimed that the stress they endure has diminished ‘considerably’ or ‘moderately’ due to CNF (Table 5.1). Similar pattern can be observed across the agroclimatic zones and farmers’ categories with some variations.

Table 5.1: CNF farmers response about changes in farming related stress after CNF, during Kharif 2022-23 (in %)

Agroclimatic zones & categories of farmers	Decreased considerably	Decreased moderately	No change	Increased moderately	Increased considerably
Agroclimatic zones					
HAT	12	46	18	7	16
North coastal	13	31	21	18	17
Godavari	22	32	25	4	17
Krishna	11	77	10	1	0
Southern	4	56	15	20	5
Scarce rainfall	5	66	26	3	-
AP	9	57	18	9	7
Farm size category					
Marginal	9	58	17	9	7
Small	10	56	18	9	7
Others	6	52	23	12	6
All	9	57	18	9	7
Tenurial categories					
Tenants	7	59	17	5	12
Owner cum tenants	5	71	15	6	3
Owners	9	56	18	10	7
All	9	57	18	9	7
Social categories		12	46	18	7
SC	9	66	18	5	3
ST	11	47	19	9	15
BC	10	56	19	10	6
OC	7	59	17	13	5
All	9	57	18	9	7

Source: IDSAP Field Survey, 2022-23.

Reduction in farming distress, due to CNF, is not just a perception of the farmers. It is the results of multiple benefits accruing to CNF farmers, such as improvement in the farm profitability, as discussed in chapter 3; reduction in investment requirement in agriculture, as discussed in chapter 4; halt in the use of agrochemicals, improvement in soil quality and crop quality, as discussed in chapter 4; improvement in output marketing; improvement in family members health status; etc are discussed in this section and also in this chapter.

5.2.1. Improvement in households' financial position

Over two-thirds of CNF farmers reported an improvement in their financial position. The major reason could be the halt in purchase and application of agrochemicals, which involve a considerable amount of cash outflow. However, there are marked variations across the agroclimatic zone on this indicator, varying from less than 40 percent in HAT zone and 40 percent in North coastal zone to over 90 percent in Krishna and Scarce rainfall zones (Table 5.2).

Table 5.2: CNF farmers response about the changes in their financial position during Kharif 2022-23 (in percentages)

Agroclimatic Zones & Categories of farmers	Increased considerably	Increased moderately	No change	Decreased moderately	Decreased considerably
Zone					
HAT	9.43	29.92	55.74	3.69	1.23
North coastal	1.94	38.06	54.84	3.87	1.29
Godavari	9.92	54.96	32.06	2.29	0.76
Krishna	6.89	84.26	7.21	0.98	0.66
Southern	9.48	53.05	35.21	1.81	0.45
Scarce rainfall	9.57	81.65	6.12	1.60	1.06
Total	8.34	60.64	28.05	2.12	0.85
Farm size category					
Marginal	8.25	59.77	29.47	1.78	0.73
Small	8.33	60.98	26.83	2.64	1.22
Others	8.78	63.90	24.39	2.44	0.49
Total	8.34	60.64	28.05	2.12	0.85
Tenurial status					
Tenants	2.38	69.05	26.19	2.38	0.00
Owner cum tenants	5.00	72.50	16.25	5.00	1.25
Owners	8.68	59.79	28.72	1.96	0.85
Total	8.34	60.64	28.05	2.12	0.85
Social category					
SC	8.19	67.62	22.06	1.07	1.07
ST	8.91	34.32	50.83	3.96	1.98
BC	6.27	66.82	24.46	1.83	0.61
OC	11.30	65.38	21.15	1.92	0.24
Total	8.34	60.64	28.05	2.12	0.85

Source: IDSAP Field Survey, 2022-23.

5.2.2. Impact of CNF on farmers dependency on agrochemicals markets

The major input markets, the farmers frequently deal with, are agrochemicals and credit markets. They also deal with the labour market. But they can have some influence on labour

market. But they have little say in the agrochemical and credit markets. These two markets have a larger impact on the financial positions of farmers. CNF is able to reduce their dependency on these two markets.

On average the farmers could avoid expenditure of ₹19,093 on agrochemical per every hectare of land under CNF; this includes ₹12,756 per hectare on fertilizers, ₹ 6,337 per hectare on pesticides, including weedicides (Table 5.3). Crop-wise details show that such saving can go up to ₹48,144 per hectare in respect of Chillies. Further, these farmers use CNF inputs/ stimulants on other fields and reduce the use of agrochemical. All these reduce farmers dependency on agrochemical markets.

Table 5.3: Crop wise avoided* expenditure on agrochemicals by CNF farmers during 2022-23 (₹/ ha)

Crop	Fertilizers	Pesticides	Total
Paddy	13,570	4,940	18,510
Groundnut	8,903	4,379	13,282
Cotton	14,331	10,805	25,136
Maize	11,057	4,025	15,082
Red gram	5,789	3,774	9,564
Chillies	30,593	17,551	48,144
Tomato	14,908	10,391	25,299
Average ³³	12,756	6,337	19,093

* These are actual expenditure on agrochemicals by non-CNF farmer. These are considered as the avoided expenditure by CNF farmers.

Source: IDSAP: Field Survey, 2022-23

The CNF farmers are able to avoid considerable expenditure on agrochemicals because of their adoption of CNF. The savings in the expenditure on agrochemicals across the agroclimatic zones and farmers categories are shown in Table 5.4. The savings have widely varied across the agroclimatic zones. The savings are relatively high in Krishna and Scarce rainfall zones, which grow commercial crops like Cotton and Chillies. The variations across the farmers categories are relatively less. The only exception is ST farmers, who usually use less agrochemicals under non-CNF.

³³ This is the weighted average of seven crops considered in the report and given in the table. The area under each crop, in the state, are used as the weights. See Figure 3.1

Table 5.4: Agroclimatic zone and farmers; category wise avoided[@] average expenditure on fertilizers and pesticides during Kharif 2022-23 (in ₹/ hectare)

Agroclimatic Zones & Categories of farmers	Fertilizers	Pesticides	Total
Zone			
HAT	10,649	2,122	12,771
North coastal	10,782	3,164	13,946
Godavari	11,335	5,451	16,786
Krishna	17,781	12,234	30,015
Southern	8,867	4,349	13,216
Scarce rainfall	14,888	8,595	23,483
AP*	13,589	7,345	20,934
Farm size category			
Marginal	15,841	7,912	23,753
Small	11,981	6,652	18,633
Others	11,278	7,164	18,442
All*	13,589	7,345	20,934
Tenurial categories			
Tenants	9,058	7,466	16,524
Owner cum tenants	9,636	7,806	17,442
Owners	13,975	7,317	21,292
All *	13,589	7,345	20,934
Social category			
SC	13,628	7,897	21,526
ST	8,212	2,994	11,206
BC	13,998	7,372	21,370
OC	14,267	8,384	22,651
All*	13,589	7,345	20,934

@ These are actual expenditure on agrochemicals by non-CNF farmer. These are considered as the avoided expenditure by CNF farmers

* These figures are slightly different from the previous table due to difference in estimation methodology. While the figure in previous Table 5.3 were estimate crop wise and crop wise weighted average was calculated. In this table all crops data was simply aggregated at zone and farmers categories level.

Source: IDSAP: Field Survey, 2022-23

5.2.3. Impact of CNF on farmers dependency on credit markets

We have asked the experience of farmers in shifting to CNF production system from non-CNF production system in regard to funds required for agriculture and working capital for crop production; and output market channels. Over 72 percent of CNF farmers reported a decrease in the funds' requirement (Table 5.5). There are significant inter-zonal differences in the farmers' perceptions, with all farmers of Godavari zone reporting a decreased need of funds for CNF and a sizable number of farmers of HAT North coastal and Krishna zones stating a

moderate increase in need. Irrespective of the size-class, tenure and social category, about 70 per cent of the farmers note that there is a decrease in the requirement of funds for CNF.

Table 5.5: CNF farmers response about change in funds requirement for agriculture working capital due to CNF (%)

Agroclimatic Zones & Categories of farmers	Decreased considerably	Decreased moderately	No change	Increased moderately	Increased considerably
Zone					
HAT	2	58	7	33	0
North coastal	1	45	11	42	1
Godavari	42	58	-	-	-
Krishna	1	52	1	45	1
Southern	10	80	10	0	0
Scarce rainfall	2	75	24	-	-
<u>AP</u>	7	65	10	17	0
Farm size category					
Marginal	6	65	11	17	1
Small	7	64	11	17	0
Others	7	68	5	19	1
All	7	65	10	17	0
Tenurial status					
Tenants	5	68	-	27	-
Owner cum tenants	9	58	4	28	1
Owners	7	66	11	16	0
All	7	65	10	17	0
Social category					
SC	8	62	5	24	0
ST	5	60	6	29	0
BC	6	65	13	15	1
OC	8	73	12	8	0
All	7	65	10	17	0

Source: IDSAP Field Survey, 2022-23.

Data on the incidence of borrowings for meeting the working capital needs of CNF is obtained. It shows that less than 10 per cent of farmers report an increase in borrowings and the rest either no change or a decrease. Inter-zonal differences and the differences among the size-classes, tenure categories and social groups are sizeable, but they do not exhibit any definite pattern (Table 5.6).

Table 5.6: CNF farmers response about change in borrowings for the agriculture working capital due to CNF (in %)

Agroclimatic Zones & Categories of farmers	Decreased considerably	Decreased moderately	No change	Increased moderately	Increased considerably
Zone					
HAT	-	59	20	15	6
North coastal	1	50	21	26	2
Godavari	8	92	-	-	-
Krishna	13	61	15	10	1
Southern	4	87	8	1	0
Scarce rainfall	14	66	16	4	-
Total	7	70	14	8	1
Farm size category					
Marginal	6	73	13	6	2
Small	7	69	15	8	1
Others	14	58	16	12	0
Total	7	70	14	8	1
Tenurial categories					
Tenants	2	78	7	10	2
Owner cum tenants	9	63	20	6	1
Owners	8	70	14	8	1
Total	7	70	14	8	1
Social category					
SC	14	66	14	5	1
ST	1	62	20	13	5
BC	8	68	15	8	1
OC	6	82	8	4	-
Total	7	70	14	8	1

Source: IDSAP Field Survey, 2022-23.

5.2.4. Impact of CNF on output marketing

The existing markets do not differentiate between the CNF from non-CNF outputs and hence the CNF farmers do not get higher prices as their wish. This is the reason why the new market channels, including a few innovated by farmers themselves, have emerged and they are beneficial to CNF farmers. About 54 percent experienced or witnessed a considerable or moderate increase in new market channels (Table 5.7). There are large differences across zones. Across size-classes and across tenure categories reported differences are few. In respect of social categories, STs reported significant increase in marketing channels.

Table 5.7: CNF farmers response with respect to changes in number of marketing channels for APCNF output (in percentages)

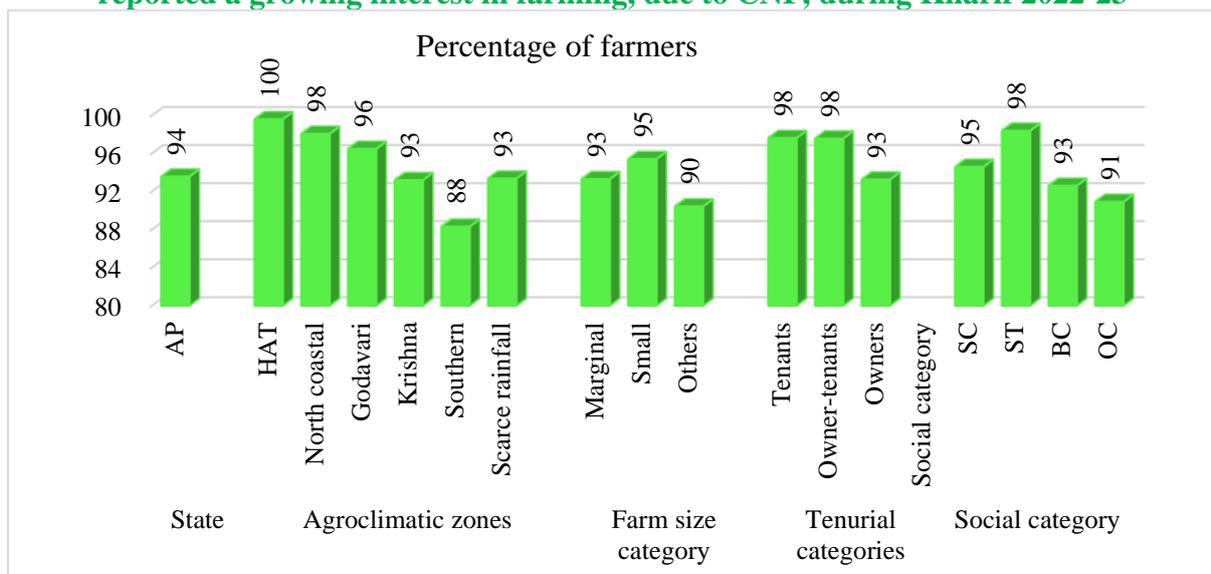
Agroclimatic Zones & Categories of farmers	Increased considerably	Increased moderately	No change	Decreased moderately	Decreased considerably
Agroclimatic zone					
HAT	13	75	11	-	0
North coastal	17	67	13	3	-
Godavari	16	9	76	-	-
Krishna	2	75	23	0	-
Southern	9	32	59	0	-
Scarce rainfall	6	16	77	1	0
AP	8	46	45	1	0
Farm size categories					
Marginal	8	46	45	1	0
Small	9	45	45	1	-
Others	9	46	44	2	-
All	8	46	45	1	0
Tenurial categories					
Tenants	3	43	54	-	-
Owner cum tenants	7	59	32	1	-
Owners	9	45	45	1	0
All	8	46	45	1	0
Social categories					
SC	6	52	41	0	-
ST	13	67	20	-	0
BC	9	38	52	2	0
OC	7	39	54	0	-
All	8	46	45	1	0

Source: IDSAP Field Survey, 2022-23.

5.2.5. Growing interest in farming

The positive outcomes, narrated above, have contributed to a growing interest among the households in farming due to CNF. Over 94 per cent of the farmers, at the state level, expressed their interest in farming, due to CNF (Figure 5.1). Overwhelming proportion of farmers across the agroclimatic zone and farmers categories confirmed their growing interest in farming, due to CNF. However, the variations across the agroclimatic zones are relatively higher than that of across the farmers' categories.

Figure 5.1: Agroclimatic zone wise farmers categories wise percentage of CNF farmers reported a growing interest in farming, due to CNF, during Kharif 2022-23



Source: IDSAP: Field Survey, 2022-23

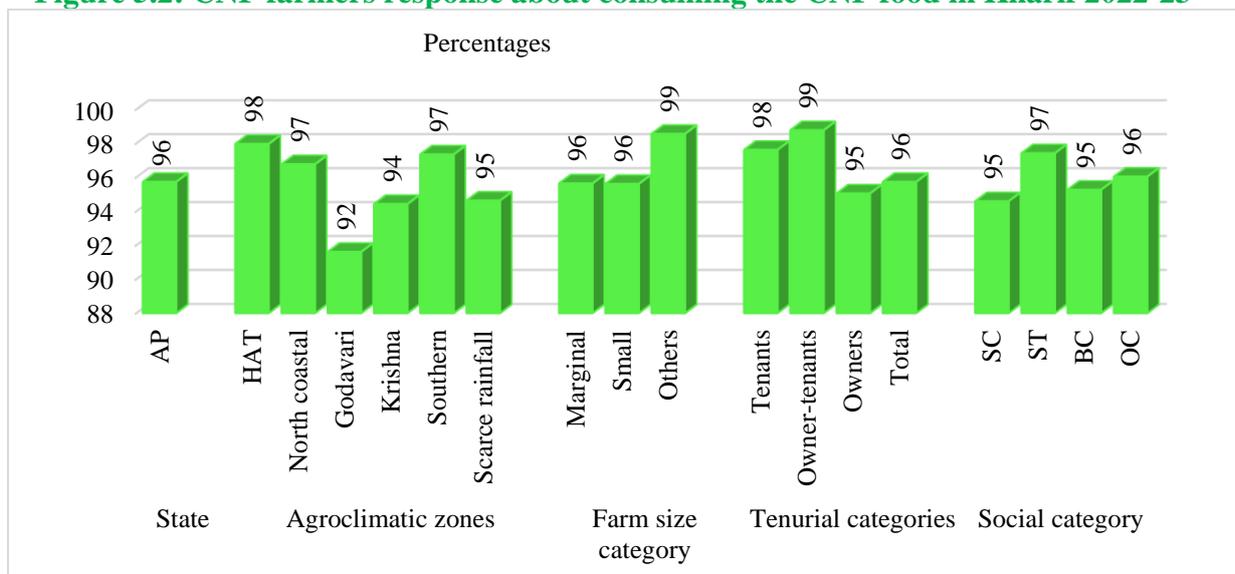
5.3. CNF production system and health of farmers' families

In this section, the CNF farmers' experiences with respect to consumption of CNF food and its impact on household health status is discussed briefly. It may be noted that consumption of non-CNF food is only one of the health hazards of non-CNF agriculture. Various operations associated with agrochemicals, such as purchasing, transporting, storing, application, etc., involves health risks of different degrees. Agrochemicals' residues, not only in the food, but also in the atmosphere and water bodies, are health hazardous to humans and other living beings.

5.3.1. Consumption of CNF food

One of the basic objectives of APCNF is to provide chemical free food to the people in general, and to the project participating HHs, in particular. As per the field data, the consumption of CNF food is widespread. At the aggregate level (state level), as high as 96 percent of farmers reported that they consume CNF food. This is true across agroclimatic zones, categories of farmers according to farm size, tenurial status and social groups (Figure 5.2).

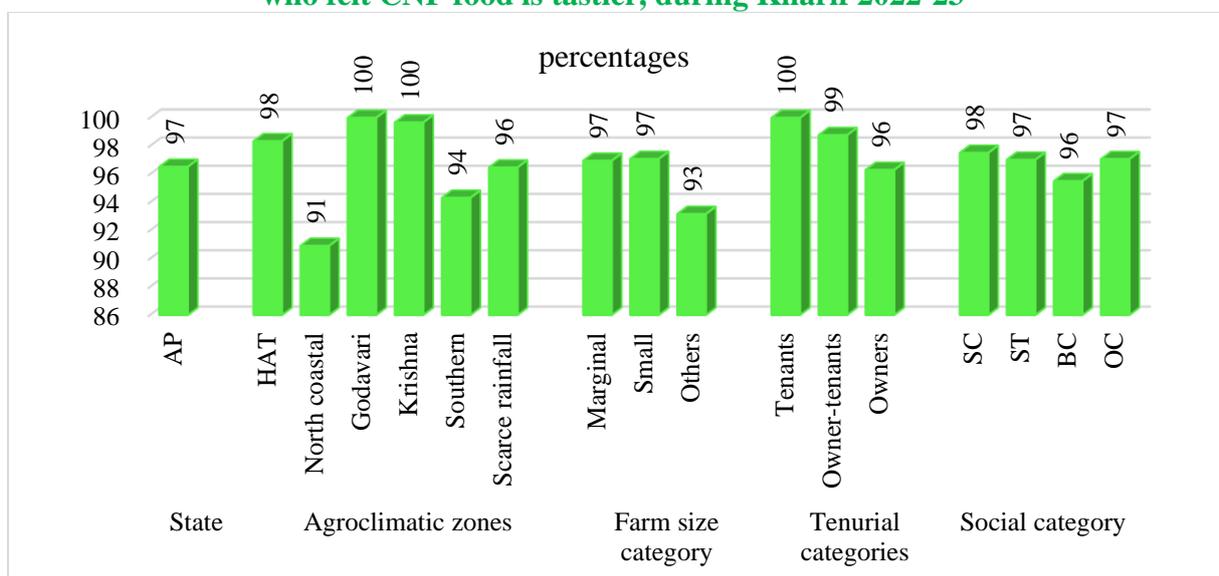
Figure 5.2: CNF farmers response about consuming the CNF food in Kharif 2022-23



Source: IDSAP: Field Survey, 2022-23

CNF food is not only healthy, but also tasty according to about 97 percent of the HHs, who consume CNF. Almost all farmers concur that the CNF food is tastier (Figure 5.3). This is true across agroclimatic zones, categories of farmers according to farm size, tenurial status and social groups. However, the variations across the agroclimatic zones are relatively higher than that of across the farmers' categories.

Figure 5.3: Agroclimatic Zones & farmers categories wise percentage of CNF farmers, who felt CNF food is tastier, during Kharif 2022-23



Source: IDSAP: Field Survey, 2022-23

5.3.2. Impact CNF on households' health

Farmers responses were sought about the changes in household members health status after CNF. It was thought that CNF will reduce the frequency of sickness in the family and number of days required to recover from each sickness. CNF food is free of chemical residues. The

consumption of tastier and chemical-free CNF food would have impact on the health of the farmers' families. We have asked the farmers whether there is improvement in health status of the farmers' families due to CNF. Minimum of 78 percent to maximum of 98 percent of farmers, across agroclimatic zones and category of farmers, have reported that their health status has improved either 'considerably' or at least 'moderately' (Table 5.8).

Table 5.8: CNF farmers response about changes in the health status of their families due to CNF during Kharif 2022-23 (in percentages)

Agroclimatic Zones & Categories of farmers	Increased considerably	Increased moderately	No change	Decreased moderately	Decreased considerably
Agroclimatic zones					
HAT	43	44	10	2	-
North coastal	27	63	7	2	1
Godavari	47	31	16	6	1
Krishna	9	89	1	0	2
Southern	16	66	13	5	0
Scarce rainfall	10	83	5	2	1
AP	21	68	8	3	1
Farm size categories					
Marginal	21	69	7	2	1
Small	21	64	10	4	1
Others	15	71	11	1	1
All	21	68	8	3	1
Tenurial categories					
Tenants	27	66	2	5	-
Owner cum tenants	16	68	6	5	4
Owners	21	68	8	3	0
All	21	68	8	3	1
Social categories					
SC	15	77	6	2	0
ST	38	48	11	3	0
BC	16	73	7	3	1
OC	19	68	9	3	0
All	21	68	8	3	1

Source: IDSAP: Field Survey, 2022-23

Improvement in households' health status, naturally, lead to a reduction in the households' expenditure on health. About 73 percent of the farmers stated that their health expenditure has decreased either 'considerably' or 'moderately' due to CNF (Table 5.9). The same varies from 50 percent in North coastal zone to 93 percent in Scarce rainfall zone. The variations are just 4

percentage points across farm size categories, 12 percentage points across the tenurial categories and 17 percentage points across the social categories.

Table 5.9: CNF farmers response about the changes in their health expenditures after CNF, during Kharif 2022-23 (in percentages)

Agroclimatic Zones & Categories of farmers	Decreased considerably	Decreased moderately	No change	Increased moderately	Increased considerably
Agroclimatic zones					
HAT	15	48	23	11	3
North coastal	17	34	29	15	6
Godavari	48	30	13	5	4
Krishna	13	70	8	8	1
Southern	7	55	17	18	3
Scarce rainfall	22	71	5	2	0
AP	17	56	14	10	2
Farm size category					
Marginal	17	55	14	11	2
Small	17	58	13	10	2
Others	14	56	18	10	3
All	17	56	14	10	2
Tenurial categories					
Tenants	20	56	15	10	-
Owner cum tenants	16	67	6	8	3
Owners	17	56	15	11	2
All	17	56	14	10	2
Social category					
SC	20	60	11	6	1
ST	15	49	22	12	3
BC	19	56	12	11	2
OC	12	59	15	11	3
All	17	56	14	10	2

Source: IDSAP Field Survey, 2022-23.

5.4. Farmers dignity

Because of Covid 19 and Eluru incident, people's perceptions about immunity, importance of nutritious food, balanced food, complete food and quality food, etc., have been changing. Now people started preferring to consume the CNF food, particularly in Delta areas. People started looking CNF farmers as saviours of nature, environment, human health, traditional seeds and crops, biodiversity, innovators, model farmers, social entrepreneurs, etc. All these are resulting into an admiration and respect to the CNF farmers. Needless to say, such admiration from the

people and lessening household indebtedness will enhance the CNF farmers dignity. These issues are discussed in this section. About 24 percent of CNF farmers, at the state level, have witnessed or experienced a considerable interest among the public for the CNF food/ output. Further, 58 percent farmers witnessed a moderate interest among the public towards CNF output (Table 5.10). There are variations across agroclimatic zones, size-classes, tenure groups and social groups.

Table 5.10: CNF farmers response with respect to changes in people's interest for APCNF output vis-à-vis non-CNF output (in percentages)

Agroclimatic Zones & Categories of farmers	Increased considerably	Increased moderately	No change	Decreased moderately	Decreased considerably
Zone					
HAT	60	35	4	1	-
North coastal	42	42	14	1	1
Godavari	24	76	-	-	-
Krishna	2	52	42	3	0
Southern	19	70	10	1	0
Scarce rainfall	17	69	13	1	-
AP	24	58	16	1	0
Farm size category					
Marginal	23	61	15	1	0
Small	26	58	16	1	-
Others	24	48	24	3	1
All	24	58	16	1	0
Tenurial status					
Tenants	11	62	27	-	-
Owner cum tenants	13	54	29	3	1
Owners	25	58	15	1	0
All	24	58	16	1	0
Social category					
SC	12	52	34	2	0
ST	53	40	6	1	-
BC	20	63	16	1	0
OC	18	68	13	1	-
All	24	58	16	1	0

Source: IDSAP: Field Survey, 2022-23

As mentioned above that people started looking CNF farmers not only as saviours of nature, biodiversity, innovators, model farmers, social entrepreneurs, etc., but also as sources of quality food and output. A noticeable phenomenon is that CNF farmers have now come to command respect from friends and relatives and in the market place for their adherence to CNF practices.

About 83 percent of sample CNF farmers reported that they are getting respect from friends and relatives because of their adherence to CNF (Table 5.11). The same vary from 73 percent in Scarce rainfall zone to 100 percent in Godavari zone. The variations across farm size categories are just 2 percentage points. However, the same are 9 and 18 percentage points among tenurial and social categories respectively. In the individual interactions and FGDs, some CNF farmers said that their friends and relatives are preferring to purchase CNF output and willing to pay the money in advance; and some of them are even willing to pay higher prices for CNF output.

Table 5.11: CNF farmers response with respect to changes in respect they get from the relatives and friends due to CNF (in percentages)

Agroclimatic Zones & Categories of farmers	Increased considerably	Increased moderately	No change	Decreased moderately	Decreased considerably
Zone					
HAT	51	43	4	2	
North coastal	29	60	9	2	
Godavari	7	93	-	-	
Krishna	33	50	16	0	
Southern	26	55	17	3	
Scarce rainfall	11	63	17	10	
Total	27	56	13	4	
Farm size category					
Marginal	26	57	12	5	
Small	30	54	14	2	
Others	27	55	16	2	
Total	27	56	13	4	
Tenurial status					
Tenants	24	68	8	-	
Owner cum tenants	27	62	10	1	
Owners	27	56	13	4	
Total	27	56	13	4	
Social category					
SC	32	54	14	0	
ST	45	49	5	1	
BC	21	61	14	5	
OC	21	55	17	6	
Total	27	56	13	4	

Source: IDSAP Field Survey, 2022-23

CNF farmers are also getting respect and recognition in the markets. Some farmers said in FGDs, that they are getting priority in unloading their produces in the markets and also getting

allocations of preferred slots and shop in the markets. Individual CNF farmers responses about the respect they are getting in the markets are summarized in Table 5.12. Over 82 percent farmers, at the state level, said that they are getting considerable or moderate respect in the markets. The same vary from 81 percent Southern zone to 100 percent in Godavari zone. Among the farm size categories, 76 percent of other farmers to 84 percent of marginal farmers confirmed about getting respect in the markets. Among tenurial categories, 81 percent of owner farmer to 93 percent of owner-tenant farmers got respect from the markets. The same varies from 78 percent of SC farmers to 87 percent of ST farmers among social categories.

Table 5.12: CNF farmers response with respect to changes in the respect they get in the market (in percentages)

Agroclimatic Zones & Categories of farmers	Increased considerably	Increased moderately	No change	Decreased moderately	Decreased considerably
Agroclimatic zones					
HAT	33	58	9	0	-
North coastal	29	59	10	1	-
Godavari	10	90	-	-	-
Krishna	9	77	14	-	0
Southern	9	62	29	0	-
Scarce rainfall	13	64	21	2	-
Total	16	66	18	1	0
Farm size categories					
Marginal	15	69	16	0	-
Small	17	64	19	1	-
Others	17	58	23	1	1
All	16	66	18	1	0
Tenurial categories					
Tenants	-	84	16	-	-
Owner cum tenants	14	79	7	-	-
Owners	16	65	18	1	0
All	16	66	18	1	0
Social categories					
SC	11	67	21	0	0
ST	29	58	13	0	-
BC	15	67	16	1	-
OC	10	69	21	1	-
Total	16	66	18	1	0

Source: IDSAP Field Survey, 2021-22.

5.5. Conclusions

By improving the financial conditions of participating households, and reducing their dependency on agrochemicals and credit markets, CNF has reduced the agrarian distress. CNF contributed to the health of the households and it has contained expenditure on household

health, by making available chemical residue-free food. There arose an explicit preference for CNF over non-CNF, among general public. CNF adds prestige to farming as a vocation and farmers no longer feel that they are tied up in a frivolous agricultural activity.

The disaggregate data indicate that the variations in getting different benefits from CNF, across different farmers classes, categories and groups are much less. Further, even the poor and weaker sections got equally, if not more, benefitted from CNF.

Chapter 6: Challenges and Policy Implications

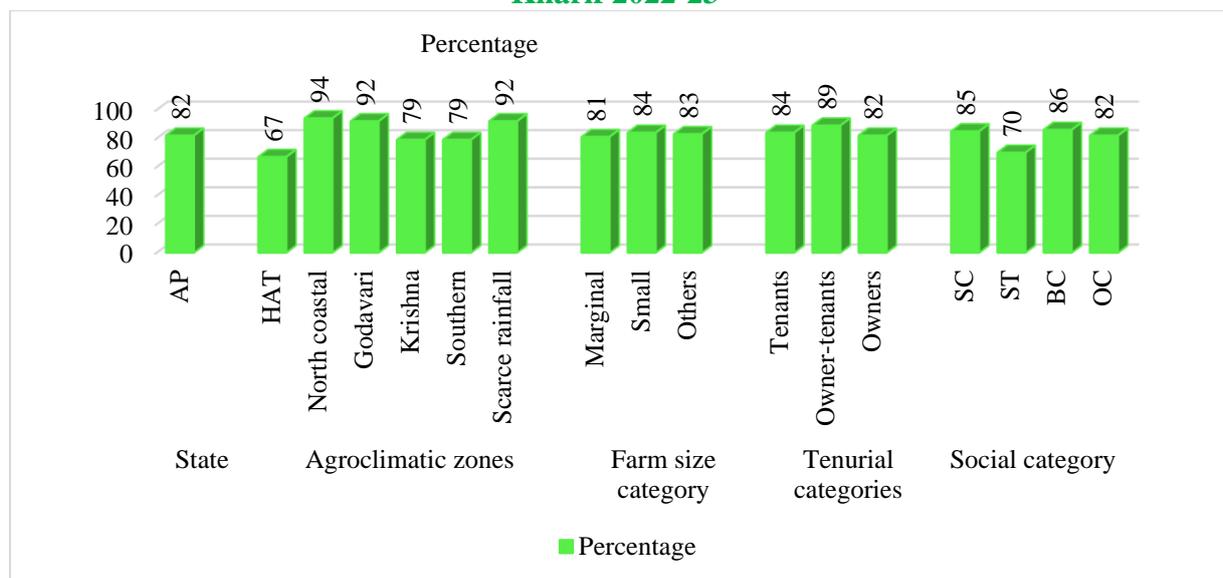
6.1. Introduction

The major challenge of RySS is to bring the entire cropped area in the State of Andhra Pradesh under CNF. It is very pertinent to note here that CNF farmers do not get subsidies, concessions and incentives for growing crops unlike chemical based non-CNF farmers. However, RySS has wide extension network at different levels to motivate, facilitate and handhold farmers to attract to CNF. In this context, the earlier studies conducted by IDS have brought to the fore that the farmers have encountered constraints in adopting CNF. In this chapter, the same issues have been examined with fresh data collected in Kharif season of 2022-23.

6.2. Problems encountered in adopting CNF

CNF farmers were asked whether they have faced any problem in adopting CNF during Kharif 2022-23. It is noted that many farmers (82 per cent), irrespective of category of farmers, have faced one problem or the other in adopting CNF (Figure 6.1).

Figure 6.1: Percentage of farmers who experienced problems in adopting CNF during Kharif 2022-23

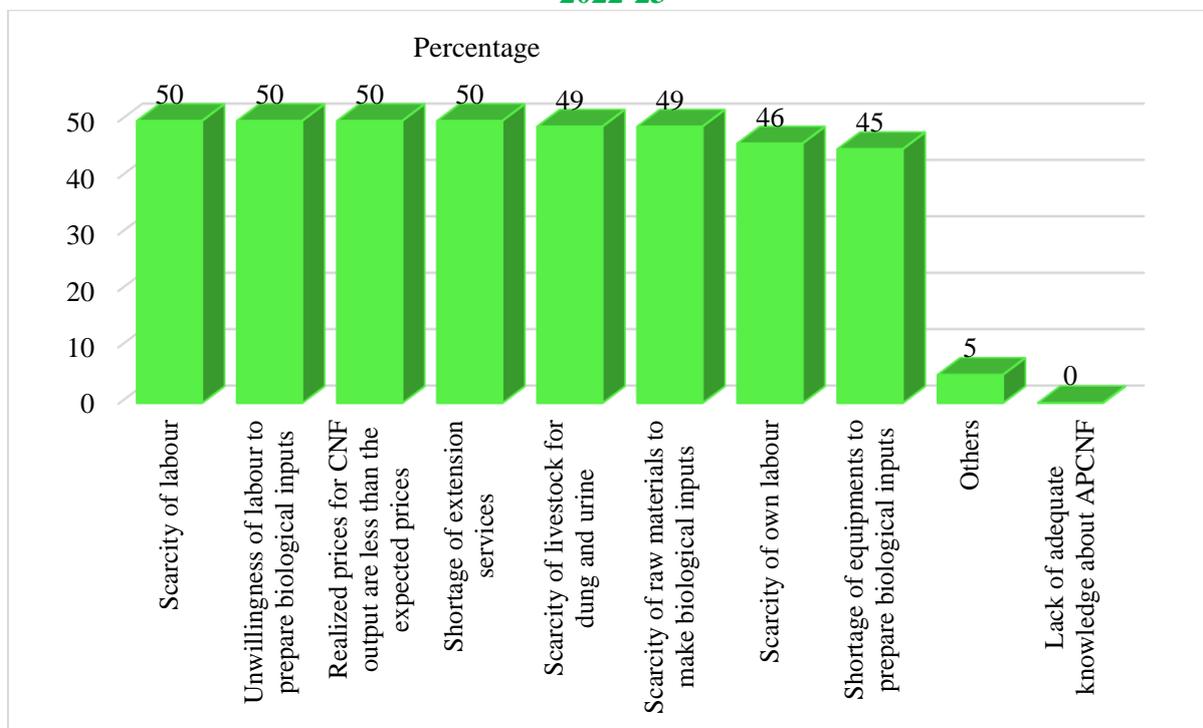


Source: IDSAP: Field Survey, 2022-23

The farmers also specified the problems faced by them in adopting the CNF (Figure 6.2). The major problems include: scarcity of hired labour; scarcity of family labour; unwillingness to prepare biological inputs by the labour; realized prices for APCNF output are less than the expected prices; scarcity of livestock for dung and urine; scarcity of raw material to make biological inputs; shortage of extension services; and shortage of implements & equipment to prepare biological inputs (like drums, grinders). About 50 per cent of the farmers claimed to

be facing each of these problems. One interesting point to note is that farmers did not say that ‘lack of knowledge to prepare the biological inputs’ as a problem. It used to be one of the widely felt problems in the previous surveys. The possible reason is that knowledge gap is filled through variety of means.

Figure 6.2: Major problems experienced by farmers in adopting CNF during Kharif 2022-23



Source: IDSAP: Field Survey, 2022-23

6.3. Problems encountered in allocating entire landholding to CNF

There has been a gradual spread of CNF over the years. In Kharif 2022-23, about 48 per cent of the sample farmers (643 out of 1,331) devoted their entire holdings to CNF in the aggregate. Complete adoption is the highest in Southern zone (67%), among marginal farmers (61%), pure tenants (61%) and OCs (54%) (Table 6.1).

Table 6.1: Number and percentage of CNF farmers, who allocated their complete holdings to CNF during Kharif 2022-23

Agroclimatic Zones & Categories of farmers	Number of farmers	Percentage of farmers
Zone		
HAT	91	42
North coastal	50	52
Godavari	38	46
Krishna	107	46
Southern	246	67

Agroclimatic Zones & Categories of farmers	Number of farmers	Percentage of farmers
Scarce rainfall	111	33
AP	643	48
Farm size category		
Marginal	484	61
Small	122	32
Others	37	24
All	643	48
Tenurial categories		
Tenants	19	61
Owner cum tenants	13	23
Owners	611	49
All	643	48
Social category		
SC	122	51
ST	101	44
BC	230	45
OC	190	54
All	643	48

Source: IDSAP: Field Survey, 2022-23

The next question pertains to the constraints that have not allowed the farmers to allocate their entire landholding towards PMDS. There are farmers who have not devoted their entire holding to PMDS and the reasons for not doing so are varied. Thus, 36 per cent complain of the shortage of biological inputs, 33 percent say suitable tools are absent, and 26 per cent complain of the shortage of seeds and so one. These are not unsurmountable hurdles and with the passage of time they can be overcome (Table 6.2).

Table 6.2: Reasons for not allocating the entire holding for PMDS during Kharif 2022-23

Reason	Number of farmers	% of farmers
Shortage of biological inputs	481	36
Non-availability of suitable tools and instruments	441	33
Protection of crops from grazing animals	348	26
Non-availability/ shortage of seeds	342	26
Not remunerative	328	25
Shortage of hired labour	317	24
Not enough extension services	315	24
Shortage of mulching materials	265	20
Shortage of family labour	166	12
May affect the Kharif and Rabi crops timings	161	12

Reason	Number of farmers	% of farmers
Non confidence	140	11
Shortage of fencing material	117	9
Challenges in maintenance of temporary fencing	50	4
Others	3	0

Source: IDSAP: Field Survey, 2022-23

A related question pertains to the reasons that prevented the farmers from allocating the entire holding to CNF. Farmers' responses are summarized in Table 6.3. Shortage of biological inputs (27%), non-availability of suitable tools (26%), shortage of hired labour (21%), shortage of family labour (19%), inadequate extension services (19%), shortage of seeds (17%) are noted as the reasons. Also, 20 per cent of the farmers stated that they are not allocating entire holding to CNF because CNF is not remunerative.

Table 6.3: Reasons for not allocating the entire holding for CNF during Kharif 2022-23

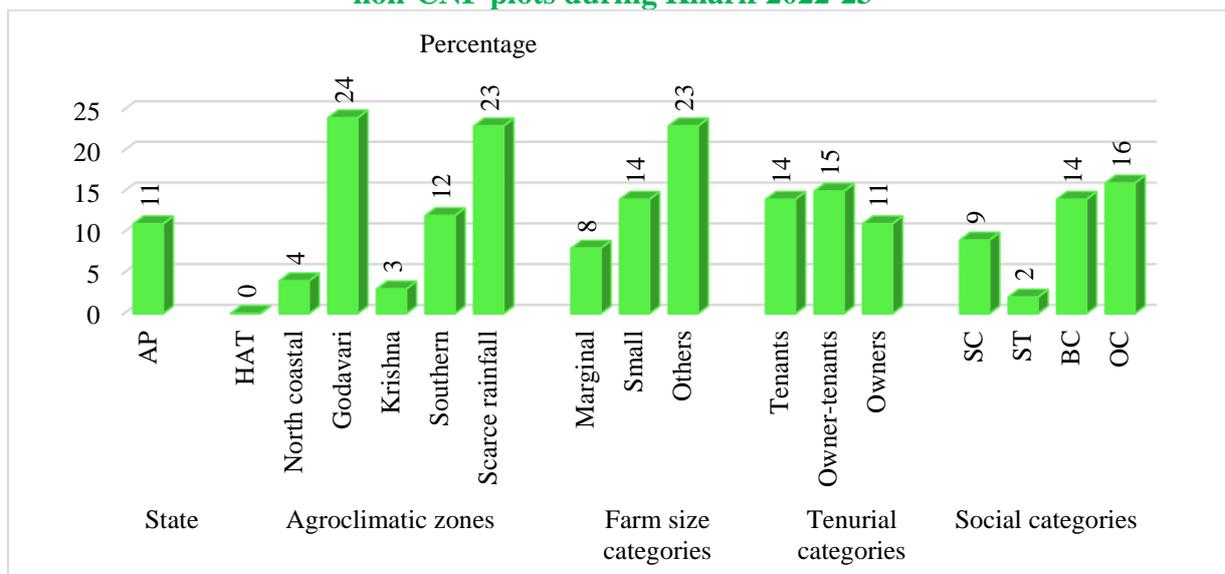
Reason	Number of farmers	Percentage of farmers
Shortage of biological inputs	365	27
Non-availability of suitable tools	340	26
Shortage of hired labour	285	21
Not remunerative	272	20
Shortage of family labour	250	19
Not enough extension services	248	19
Non-availability or shortage of seeds	226	17
Others	2	0

Source: IDSAP: Field Survey, 2022-23

6.4. Expansion of application of CNF practices in non-CNF plots

The CNF practices though not all but one or the other have been practiced by CNF farmers on their non-CNF plots in growing crops. This is reported by 11 per cent of CNF farmers at state level. This practice is being reported by farmers largely from Godavari Zone (24 per cent) and Scarce Rainfall zone (23 per cent) among the agroclimatic zones. The other farmers (medium and large farmers) among the category of farmers informed that 23 per cent are using CNF practices for growing crops on non-CNF plots. Landless tenants (14 per cent) as well as owner-cum-tenant farmers (15 per cent) are also adopting this practice. Among the social category of farmers, OCs are adopting CNF practices in large measure (Figure 6.3)).

Figure 6.3: Percentage of farmers who adopted any CNF inputs or practices in their non-CNF plots during Kharif 2022-23



Source: IDSAP: Field Survey, 2022-23

The non-CNF farmers adopting one or the other CNF practices on non-CNF plots is very low and around one percent. But farmers from Godavari Zone reported that this practice is prevalent among them at 3 per cent (Table 6.4). Thus, it is evident that CNF farmers have higher probability, compared to non-CNF farmers, in adopting one or the other practices of CNF on non-CNF plots.

Table 6.4: Percentage of non-CNF farmers, who are aware of CNF and adopted any CNF inputs or practices in their non-CNF plots during Kharif 2022-23

Agroclimatic Zones & Categories of farmers	Aware of CNF	Applied any CNF input/ practices
Agroclimatic zones		
HAT	15	2
North coastal	55	0
Godavari	13	3
Krishna	8	1
Southern	4	1
Scarce rainfall	18	1
AP	15	1
Farm size category		
Marginal	14	1
Small	16	1
Others	18	1
All	15	1
Tenurial categories		
Tenants	16	1
Owner cum tenants	9	0
Owners	0	0

Agroclimatic Zones & Categories of farmers	Aware of CNF	Applied any CNF input/ practices
All	15	1
Social category		
SC	9	2
ST	13	2
BC	16	1
OC	16	1
All	15	1

Source: IDSAP: Field Survey, 2022-23

6.5. Extension services

Farmers have faced constraints in adopting CNF due to shortage of biological inputs and raw materials required for preparing biological inputs; lack of marketing support for selling CNF crop output at higher prices in relation to non-CNF crop output; and inadequate extension services. The data on extension services (Table 6.5) has revealed the number of times interactions took place between farmers and extension workers of RySS. It appears that the quality of interactions should be improved and the number of interactions enhanced to reduce the shortage of extension services. Further, the extension services through SHG/ VOs members/leaders also should be enhanced because these networks are found to be more effective.

Table 6.5: Details of the extension services received by CNF farmers during Kharif 2022-23

Source of advice/ extension services	No. of farmers availed services	% of farmers availed services	Average Number of interactions	Satisfaction level**
Fellow farmers	1,100	83	3	3
Master farmer/ ICRP	1,284	96	6	4
RySS staff -CRP, CA, MA, etc.	1,148	86	4	4
SHG/ VO members/ leaders	500	38	2	3
Formal training by RySS	410	31	2	3
Exposure visits	131	10	1	3
NGO	85	6	5	3
Electronic media TV/ Videos	449	34	4	3
Newspapers and magazines	186	14	2	3
Booklets given by RySS and others	108	8	2	2
Others	39	3	0	1

** 5=highly satisfied; 4=; more satisfied 3=satisfied; 2=less satisfied; and 1= no use

Source: IDSAP: Field Survey, 2022-23

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