Assessing the Impact of APCNF

[Andhra Pradesh Community Managed Natural Farming]

A Comprehensive Approach Using Crop Cutting Experiments

Final Report 2022-23

Submitted To

Rythu Sadhikara Samstha

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IDSAP

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Lead Researchers

Prof S. Galab

Dr G. Bhaskara Rao

Research Team

Prof C. Samba Murty
Dr D. Sree Rama Raju
Dr P. Prudhvikar Reddy
Prof C. Ravi
Prof J. Ramu Naidu
Dr K. Ananda Rao
Mr D Satish

IDSAP

Madhurawada, Visakhapatnam 530041; www.idsap.in

☎ +91 9949 219 613; ☎ +91 7093 219 613

✉directoridsap@gmail.com; ✉director@idsap.in

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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
FPCs	:	Farmers Producer companies
FPOs	:	Farmers Producer Organizations
FYM	:	Farm Yard Manure
GCA	:	Gross Cropped Area
GDP	:	Gross Domestic Product
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
ICWD	:	Integrated Child and Women Development Department.
IDSAP	:	Institute for Development Studies Andhra Pradesh
MF	:	Master Farmer
MGNREGS	:	Mahatma Gandhi National Rural Employment Guarantee Scheme
MPCE	:	Monthly Per Capita Expenditure
MSP	:	Minimum Support Prices

MT	:	Master Trainer
NGOs	:	Non-Governmental Organizations
NSA	:	Net Sown Area
NSO	:	National Statistical Office
NSSO	:	National Sample Survey Office
OC	:	Other Castes
PMDS	:	Pre-Monsoon Dry Sowing
PNPIs	:	Plant Nutrient and Protection Inputs
PRDS	:	Pre-Rabi Dry Sowing
RBK	:	Rythu Bharosa Kendras
RPs	:	Resource Persons
RySS	:	Rythu Sadhikara Samstha
SC	:	Scheduled Caste
S2S	:	Seed to Seed
SEHG	:	Self Employed Households in Agriculture
SHGs	:	Self-Help Groups
Sis	:	Strategic Interviews
SPSS	:	Statistical Package for Social Sciences
SRI	:	System of Root Intensification
ST	:	Scheduled Tribe
TTD	:	Tirumala Tirupati Devasthanam
Vos	:	Village Organizations
ZBNF	:	Zero Budget Natural Farming

Executive Summary

0.1. Introduction

The current study is a continuation of the "Impact Assessment" studies of APCNF conducted in 2019-20, 2020-21, and 2021-22, by IDSAP, Visakhapatnam. This is the final report of the 2022-23 study, covering both the Kharif and the Rabi 2022-23 seasons.

0.2. Objectives

The overall objectives of the annual study are to assess the impact of APCNF in terms of its economic sustainability[1], social sustainability[2] and environmental sustainability[3] and to outline the contribution of APCNF in enhancing the well-being of farmers in particular and people of Andhra Pradesh, in general. The specific objectives of this report are:

a. To estimate and compare the cost of cultivation, cost structure, crop yields, and gross and net values of output from crop cultivation under APCNF, henceforth referred to as CNF, and under chemical-based farming, referred to as non-CNF.

b. To estimate and compare the crop yields obtained under CNF and non-CNF, through crop-cutting experiments (CCEs).

c. To understand the impact of CNF on input use, especially, on the use of natural resources and the consequent environmental implications.

d. To arrive at the impact of CNF on household income.

e. To estimate the potential benefits to the state, if the entire Gross Cropped Area (GCA) were put under APCNF.

f. To know the impact of CNF on farmers' well-being.

g. To understand the issues and challenges in adoption of CNF and to offer possible solutions.

0.3. Methodology and sample size

1. The study uses 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 those of non-CNF farmers cultivating the same crop.

    a. Costs and returns data for the crops considered for the analysis were obtained from the farmers through a farmer household survey.
    b. Crop Cutting Experiments (CCEs) were conducted to assess the yields of the crops scientifically and independently.

[1]Economic sustainability means that APCNF is profitable, i.e., able to generate surpluses after covering the entire cost of cultivation

[2] Social sustainability implies that the poor and vulnerable sections are able to adopt and benefit from APCNF.

[3] Environmental sustainability implies that APCNF is environment friendly. That is, the programme is expected to halt and reverse the degradation of natural resources, especially the soil. It is also expected to make agriculture resilient to climate change.

2. To know the holistic impact of CNF on participating households, it was planned to fix the sample units throughout the year. That is, the same set of sample farmers have to be surveyed during PMDS, Kharif and Rabi seasons. However, it was observed that only about 50 per cent sample CNF and non-CNF farmers, selected at the beginning of the study (PMDS) were cultivating any crop during Rabi season. As a result, the study could not get adequate sample observations and CCEs for certain crops during the Rabi season. To overcome this challenge, the study included additional samples to collect only the cost of cultivation data and to conduct CCEs of the crops, which have inadequate representation in the regular sample, during the Rabi season.
3. Only 47 and 43 per cent of CNF and non-CNF sample farmers, respectively, were engaged in cultivation during the Rabi season. Hence, an additional sample of 557 HHs, including 288 CNF and 269 non-CNF HHs, have been selected exclusively for collecting the cost and returns data in the Rabi season.
4. The annual study focuses on 11 major crops identified based on the normal cropped area in the state. For these11 crops, detailed data are collected on costs, yield and returns. The crops include: (1) Paddy, (2) Groundnut, (3) Cotton, (4) Bengal Gram, (5) Black Gram, (6) Maize, (7) Red Gram, (8) Chillies, (9) Green Gram, (10) Ragi and (11) Tomato. While the first nine are cultivated in large areas in the state, the last two were selected as the special cases. These crops together account for more than 75% of the (GCA) in the state.

2. The number of sample observations varies from 51 for CNF Green Gram to 1,044 for CNF Paddy. In the case of non-CNF, the sample observations vary from 46 in Ragi to 442 for Paddy (Figure 1.1).
3. Total 3,152 CCEs have been conducted during both seasons. The results of 3,152 CCEs are utilized in this report to analyse yields. The number includes 1,979 CCEs of CNF crops and 1,173 CCEs of non-CNF crops. The number of CNF CCEs varies from a minimum of 41 for Red gram to a maximum of 631 for Paddy. The number of non-CNF CCEs varies from 37 for Tomato to 311for Paddy (Figure 1.2).
4. The additional sample was included only to conduct CCEs for select crops, which fall short of 40-50 observations and to collect the costs and returns data of such crops. Data on household income, perceptions about input use, farmers' well-being, etc., was not collected from the additional sample farmers.

0.4. Impact of CNF on farming conditions

5. On an average, CNF farmers saved ₹8,997 (50 percent) in their expenditure on PNPIs vis-à-vis non-CNF farmers (Table 3.1). As observed in the previous studies, here also, the CNF farmers have obtained larger savings in PNPIs in input-intensive crops like Chillies, Tomatoes, Cotton, Paddy and Maize.
6. Paid-out cost, considered in this study, consists of the expenditure on (1) seeds, (2) PNPI, (3) hired labour, (4) farm yard manure (FYM), (5) machinery, (6) bullocks, (7) implements, (8) irrigation and (9) miscellaneous items, including supervision and emergencies. This cost closely approximates to "Cost concept of A1".
7. Other cost items which are not included in this report are (1) actual rent paid to the land, (2) imputed rental value of own land, (3) imputed value of own labour, (4) interest paid on

borrowed funds, (5) depreciation of agricultural assets, excluding land. In a sense, the paid-out cost used is a narrow concept. All these inclusions and exclusions are common to both CNF and non-CNF farmers. On an average, the savings of CNF farmers in the paid-out cost is ₹6,303 (9 per cent) compared to non-CNF farmers. (Table 3.2). By and large, the paid-out cost structure remained the same in both CNF and non-CNF methods. The only notable difference is that the share of PNPIs is less under CNF. The shares of human and machine labour are relatively high under CNF (Table 3.3).

The expenditure on FYM under CNF is more than that of non-CNF in all crops considered (Table 3.4). In a sense, application of FYM is inevitable under CNF, because of two reasons. Firstly, the farmers store the *Jeevamrutham* in the form of *Ghanajeevamrutham* by mixing the *Jeevamrutham* with FYM. Secondly, as livestock farming becomes an integral part of CNF, the farmers automatically get the FYM (waste from the livestock sector), and apply it in their fields. The data indicates that under CNF the paid-out costs are not only less but also diversified.

8. The yields arrived at, based on crop cutting experiments (CCEs), turned out to be the same between CNF and non-CNF. There is no statistical difference in yields in this report's eight out of 11 crops. In the remaining three crops, viz., Bengal gram, Maize and Tomato, the yields under CNF are, statistically, higher than that of non-CNF (Table 3.5).
9. The prices obtained for CNF and non-CNF are statistically the same in eight out of 11 crops. In the remaining three crops, viz., Paddy, Groundnut and Chillies, the CNF output fetched significantly higher prices (Table 3.6).
10. The difference between the CNF and the non-CNF in respect of the gross value of output per hectare is positive in case of 10 out of the 11 crops studied in this report, except in the case of Green Gram (Table 3.7). On an average, the gross value of CNF crops is higher than that of non-CNF crops by ₹11,284 (8 percent) per hectare.
11. In two crops, the net value of output is negative under non-CNF, i.e., -10,965 and -91 per hectare in Tomato and Red Gram respectively. The net value of non-CNF Cotton output is just ₹44 per hectare. These figures reflect the status of non-CNF in the state. The non-CNF farmers cannot recover a narrowly defined cost of cultivation- (A1) paid-out costs in those three crops. On an average, the net value of CNF crop output is ₹17,587 (27 percent), per hectare, higher than that of non-CNF (Table 3.8). Out of this, ₹6,303 is due to savings in the paid-out costs (see Table 3.2) and ₹11,284 is due to higher gross value of output (see Table 3.7).

0.5. Impact of CNF on farming conditions at a disaggregated level

12. The results of the disaggregated analysis indicate that the state-level picture is reflected in the majority of Agroclimatic Zones and farmers' categories in all crops. The analysis, suggests that the resource poor Agroclimatic Zones and farmers also benefited equally from CNF in general. In other words, CNF is a scale neutral technology. The variations in the impact of CNF on farming conditions are higher across the Agroclimatic Zones.

This needs Agroclimatic Zone specific CNF packages. It was learned that RySS is aware of this issue and is working on it.

13. Another broad inference, which is somewhat related to the previous insight, is that CNF has performed better in the southern part of the state, particularly in less canal irrigation intensive areas. However, CNF needs special attention in the Scarce Rainfall Zone, which has also relatively low soil quality fields.

0.6. Impact of CNF on input use

14. On an average, 22 and 21 days of additional labour are used under CNF during the Kharif and the Rabi seasons respectively. The overwhelming part of additional labour was met from own labour in both seasons. The majority of additional labour is female labour.
15. The majority of CNF farmers of all categories have reported that the water requirement for crop cultivation has come down.
16. On an average, the CNF farmers borrowed ₹61,701 vis-à-vis ₹84,886 by non-CNF HHs for agriculture and other purposes.

0.7. Impact of CNF on Farming and Other Household Incomes

17. Apart from improving farming income, CNF is expected to have a positive impact on other sources of household income. In previous studies, it was also observed that there was a slight shift in the composition of CNF households' income from wage labour to livestock and agriculture. Both CNF and non-CNF farmers usually cultivate other crops apart from the 11 sample crops. Livestock rearing is also becoming an integral part of CNF.
18. While 100 per cent of CNF and non-CNF farmers have cultivated some of the major crops during the study period, only 31 per cent of non-CNF households cultivated other crops as compared to 68 per cent of CNF households. About 59 per cent of CNF and 50 per cent of non-CNF households have obtained income from livestock farming during the study period (Table 6.1).
19. On an average, the CNF farmers got ₹1,77,812 compared to income of ₹1,62,173 per ha from agriculture, including crop cultivation and livestock rearing. This is an improvement of ₹15,639 per household, which is 10% higher than the income of non-CNF farmers (Table 6.2). From crop cultivation alone, the CNF farmers got ₹13,061 or 9 per cent higher income compared to non-CNF farmers.
20. Unlike in previous years, this year the income of CNF farmers from major crops is lower than that of non-CNF farmers from major crops. Apart from smaller plot sizes under CNF, another possible reason is the crop-wise sample selection. Among the six high value crops, viz., Paddy, Groundnut, Cotton, Maize, Chillies and Tomato, the percentage of CNF sample is high in two crops, viz., Paddy and Tomato and the share of non-CNF sample is high in three crops, viz., Groundnut, Cotton and Chillis[4] (Table 6.3).
21. As expected, a relatively lower proportion of CNF farmers (60 per cent) reported wages as a source of income compared to 65 per cent by non-CNF farmers. Further, only 9 per cent CNF farmers reported salary income vis-à-vis 14 per cent by non-CNF farmers.

[4] This issue will be addressed in 2024-25 study.

22. CNF farmers got a higher income of ₹904 (88 per cent) from other sources (mostly poultry), along with agricultural income. On the other hand, non-CNF households got higher income in six out of eight sources included in the analysis (Table 6.6).
23. Non-CNF farmers got ₹6,586 (3 per cent) higher household income than CNF. This was the first time that non-CNF households got higher income.

0.8. Potential impact of APCNF on agriculture in the state

24. If the entire GCA is put under CNF, the state would have saved ₹6,636 crore (50 per cent) in PNPI, ₹4,648 crore (16 per cent) in paid-out costs; and it would have attained ₹8,823 crore (8 per cent) additional gross value of crop output and ₹12,971 crore (27 per cent) higher net value of crop output (Table 7.2).
25. Since the yield differences are not statistically significant in eight crops, the output of those eight crops would remain the same if the entire GCA is allocated to CNF. At the same time, the output of Maize, Bengal gram and Tomato would increase by 9.1 per cent, 9.5 per cent and 24.3 per cent respectively (Table 7.3).
26. If the entire GCA is put under CNF, the state would have avoided the use of 38.22 lakh tons of fertilizers in 2022-23. In the same year, the state would have avoided ₹13,197.10 crore expenditure on agrochemicals, including ₹8,069.98 crores on fertilizers and ₹5,127.12 crores on pesticides (Table 7.4).
27. Shortage of labour is often cited as one of significant constraints in the expansion of CNF. In total 5.5 (5.6) lakh persons (19 per cent) of additional labour would be required, if the entire area is put under CNF. These include 3.34 lakh persons of own labour and 2.25 persons of hired labour. On the other hand, CNF requires 4.08 lakh persons (22 per cent) of female and 1.52 lakh persons of male additional labour (Table 7.5). Given the overall size of agriculture workers, additional requirements can be met without difficulty. In addition, CNF can reduce disguised unemployment and increase the productivity of agricultural workers. As CNF is focusing on mixed cropping, crop rotation and crop diversity, the peak time demand for agriculture labour would be considerably reduced. It would enable the CNF farmers to optimize their labour use.

0.9. Wellbeing of farmers

28. Over 65 per cent of the farmers, at the state level, claimed that the stress they endure, under non-CNF, has diminished ‘considerably’ or ‘moderately’ due to CNF.
29. Over two-thirds of CNF farmers reported an improvement in their financial position. Over 72 per cent of CNF farmers reported a decrease in the requirement for funds for agriculture. Over 77 per cent farmers reported a reduction in borrowing for agriculture.
30. About 54 per cent of CNF farmers experienced a considerable or moderate increase in new market channels.
31. At the state level, over 94 per cent of farmers expressed their interest in farming due to CNF.
32. 96 per cent of farmers reported that they consume CNF food. CNF food is not only healthy, but also tasty according to about 97 per cent of these households.

33. At the state level, about 24 per cent of CNF farmers have witnessed considerable public interest in CNF food/ output. Further, 58 per cent of farmers witnessed a moderate interest in CNF output.
34. About 83 per cent of sample CNF farmers reported that they are getting respect from friends and relatives because of their adherence to CNF.
35. Over 82 per cent famers, at the state level, said that they are getting considerable or moderate respect in the markets.

0.10. Panel study

36. As mentioned in the previous reports the transformative impact of CNF needs time. The CNF itself is evolving, farmers' adoption processes of CNF are evolving, and agriculture experiences wider fluctuations from one year to another. In such conditions, a typical time series analysis may not give reliable result in a short period of four-five years.
37. Therefore, the potential and actual impact of CNF over a period are assessed by three indirect methods: (1) Comparison of farming conditions indicators of panel and CNF cross-section farmers, (2) Household incomes of the panel and CNF cross-section farmers, and (3) a vigorous analysis of changes over the period in the farming conditions of panel, CNF cross-section and non-CNF cross-section farmers.
38. According to the first two methods, the panel farmers are better off, but marginally, compared to CNF cross-section,
39. The third analysis indicates that the farmers are better off under CNF, i.e., both panel and CNF cross-section farmers are better off compared to non-CNF farmers. The crop yields, adjusted to annual fluctuations, show an increasing trend under CNF.
40. The analyses indicate that the issues related to the supply of CNF inputs/ stimulants and the marketing of CNF output need to be addressed.

0.11. Insights from qualitative data analysis

41. The wealth of information and insights obtained from FGDs, case studies, strategic interviews and individual farmers responses to the open-ended questions have been put in the SWOT framework. Further, frequency tables are prepared to know the widely felt issues and challenges.
42. In addition, the stakeholders' suggestions for expanding CNF and improving farmers' well-being are tabulated and presented.
43. Benefits like reduction in the cost of cultivation, improvements in cropping pattern, conservation of natural resources, increasing yields are widely experienced and revealed. But relatively fewer stakeholders experienced and remarked on improvements in marketing of CNF output and extension services.
44. Supply of CNF inputs is a major challenge stated by almost all stakeholders. Scarcity of raw materials; and also, non-availability of suitable tools for the preparation of CNF inputs is also felt widely. Over three-fourths of stakeholders mentioned about the marketing issues. As mentioned in previous reports the marketing of CNF output is not an issue, but getting higher prices is a challenge.

45. As many as 93 per cent of stakeholders suggested that the supply of CNF inputs should be augmented. Nearly 46 per cent of stakeholders asked for an improvement in the extension services. About 25 per cent have asked for improvement in marketing for CNF output.

0.12. Issues, challenges and way forward

46. Nearly 79 per cent of farmers face one or more problems, while adopting the CNF. There are regional variations and variations across farmers' categories.
47. Shortage of suitable equipment such as mixers, blenders, stirrers, drums, etc., is cited as a problem by 59 per cent of farmers. Scarcity of raw materials to make biological inputs and inadequate knowledge to prepare the biological inputs are the issues reported by 44 and 34 per cent of farmers respectively.
48. About 46 and 34 per cent of farmers have encountered scarcity of labour and scarcity of family labour, respectively.
49. Output marketing is a generic problem in Indian agriculture. In the case of CNF output, selling is not a problem, but farmers are expecting a better price, which is a real issue.
50. It is important to note that though the problems remained common in all previous surveys, the number of persons reporting each of these problems has declined significantly in this year' survey compared to the results of previous years. It reflects the improvement in the RySS's extension and support services as well as the increased ability of farmers to master the new techniques and practices of CNF.
51. Given the critical role of the field staff in the implementation and expansion of the programme, RySS has to strengthen the field staff. The vacancies need to be filled. Apart from filling the vacancies and strengthening the cadre, RySS may consider providing flexible and focussed working conditions so that the staff can use their time, resources and energy optimally, balancing their professional and personal responsibilities.

Chapter 1: Context, Objectives and Methodology

1.1. Context

To overcome the challenges of contemporary agriculture in the state, the Government of Andhra Pradesh (GoAP) adopted natural farming (NF), (now) known as Andhra Pradesh Community Managed Natural Farming (APCNF) in 2016. The Government has provided a dedicated institutional structure, Rythu Sadhikara Samstha (RySS), to implement APCNF in the state. The Government intends to cover 80 lakh hectares of gross cropped area (GCA) and all 60 lakh farmers under CNF. As per the latest information available from RySS, about 2.5 per cent of farmers in the state are adopting the complete package of CNF, known as Seed to Seed (S2S) package, i.e., growing crops with only CNF inputs and practices without applying any agrochemicals [fertilizers and biocides], at least on a part of his/ her holding; and such farmers are known as S2S farmers. Yet another 16 per cent of farmers in the state are adopting CNF inputs and practices along with agrochemicals and related practices in same plots, known as partial farmers.

APCNF is based on Dr Subhash Palekar's farming model, known as zero budget natural farming (ZBNF), which was developed on the ecological principles of forests evolution[5]. However, RySS is contextualizing and improving the original ZBNF (henceforth referred as APCNF or CNF in short) model continuously. For example, RySS recommended using any cattle dung and urine, in place of desi-cow dung and urine, as recommended by Palekar. In the recent past RySS made one of the major breakthroughs in APCNF in the form of the ***Pre-Monsoon Dry Sowing (PMDS)***, a novel method of growing crops. PMDS enables farmers to raise crops in the dry seasons – before the monsoons. It is a global breakthrough. The enhancement of soil biology through APCNF practices and with the raising of 8 to 15 diverse crops creates some special conditions, which enable seed germination with very little water/ moisture. PMDS is mostly practiced before the advent of the monsoon, during the summer and before the beginning of the Rabi season crops.[6] This system is based on the belief that land should always be covered with vegetation and farmers should not depend only on the rainy season for growing crops.

While benign microbes are introduced into soils through biological stimulants under CNF which converts the natural elements available in the soils and atmosphere into plant nutrients, PMDS

[5]Palekar pointed out that natural forests grow profusely and perpetually without application of any nutrients from outside. He argues that plants get 98 to 98.5 required nutrients from air, water & solar energy through photosynthesis. Only 1.5 to 2.0% nutrients are taken from soil, which can be made available through microbes. According to Palekar there are four artefacts followed in natural farming: ***Beejamrutham*:** Microbial seed coating through cow urine and dung -based formulations; **Jeevamrutham:** Enhance soil microbiome through an 'inoculum' of cow dung, cow urine and other ingredients; **Achhadana:** Ground to be kept covered with crops and crop residues as mulching; and **Waaphasa:** Fast build-up of soil humus through ZBNF leading to soil aeration and water vapour harnessing. See https://zbnf.org.in/

[6] It is noticed in the field that farmers, who just cultivate Rabi crops, started covering their fields with PMDS for the entire period from April/ May to October/ November.

provides food[7] and shade to the microbes, especially during the hot summer months. Because of these reasons, PMDS became an integral part of CNF. The present study focused on CNF fields, which were put under PMDS during the pre-monsoon period of 2022. The study selected CNF farmers who have raised PMDS during 2022. More details about APCNF and PMDS can be seen at the APCNF website https://apcnf.in/about-apcnf/ and in the earlier studies, by IDSAP, which are available at https://apcnf.in/about-apcnf/ and https://www.idsap.in/reports.html.To know the impact of APCNF through a third-party assessment, RySS has been assigning these studies to Institute for Development Studies Andhra Pradesh (IDSAP or IDS in short). APCNF is being implemented with multiple objectives and strategies. Such as:

- Improvement in the profitability of crop cultivation, soil quality, crop quality, crop resistance to weather anomalies, food quality, health of farmers and consumers, etc.
- Promotion of poor people's and women's participation, integrated farming, crop diversification and intensification, community ownership, utilization of local resources, etc.

But the studies by IDS have a limited mandate, i.e., to assess the impact of CNF on farming conditions at the state level with the help of a few major crops. Over the years, the scope is being enlarged with supplementary objectives such as impact of CNF on household income, input use, non-monetary benefits (soil quality, crop quality, etc.), farmers' well-being, disaggregated analysis and wherever possible, and profiling of sample farmers.

1.2. Objectives of the present report

The current study is in continuation of the Impact studies of APCNF for 2019-20, 2020-21, and 2021-22, undertaken by IDSAP, Visakhapatnam. This is the final report of 2022-23 study, covering the data of both Kharif and Rabi seasons of 2022-23.

The overall objectives of the annual study are to assess the impact of APCNF in terms of economic sustainability[8] and to delineate its contributions in enhancing the well-being of farmers and people in Andhra Pradesh. The specific objectives of this report are:

i. To estimate and compare the cost of cultivation, cost structure, crop yields, gross and net values of output from crop cultivation under APCNF. Henceforth called CNF and under chemical-based farming, referred as non-CNF.

ii. To estimate and compare the crop yields obtained under CNF and non-CNF, through Crop Cutting Experiments (CCEs).

iii. To understand the impact of CNF on input use, especially the use of natural resources and the consequent environmental implications.

[7]It is well known that through photosynthesis, plants convert sunlight, water and carbon dioxide (CO_2) into sugar, called Glucose. Plants store about 40 percent of Glucose in above ground biomass and 30 percent in roots and the other 30 percent is exudated into the soil, for feeding vast microbial population. It is interesting to note that there is a direct relation between the diversity on above the ground and below the ground; i.e., diverse crops/ plants in the field contribute to the more diverse life in sub-soils/ below the ground.

[8]Economic sustainability means that APCNF is profitable, i.e., able to generate surplus after covering the entire cost of cultivation

iv. To arrive at the impact of CNF on household income.

v. To estimate the potential benefits to the state, if the entire GCA were put under APCNF.

vi. To know the impact of CNF on farmers' well-being.

vii. To understand the issues and challenges in the adoption of CNF and to offer possible solutions.

1.3. Methodology

This section discusses issues related to the basic approach, sample design and selection, and data collection and management. IDSAP (2023) and (2023a) provide more details about these issues.

1.3.1. The Basic Approach

The study uses the "***with and without***" method to assess the impact of CNF. In this method, the outcomes of CNF farmers[9] cultivating a particular crop are compared with the outcomes of the non-CNF farmers cultivating the same crop.[10] Costs and returns data for the crops considered for the analysis were obtained from the farmers through a farmer household survey. Crop Cutting Experiments (CCEs) have been conducted to assess the yields of the crops scientifically.

The annual study focusses on 11 major crops identified based on the normal cropped area in the state. For these11crops, detailed data are collected about costs, yield and returns. The crops include: (1) Paddy, (2) Groundnut, (3) Cotton, (4) Bengal gram, (5) Black gram, (6) Maize, (7) Red gram, (8) Chillies, (9) Green gram, (10) Ragi and (11) Tomato. While the first nine are cultivated on large areas in the state, the last two were selected as the special cases. These crops together account for more than 75% of the gross cropped area (GCA) in the state. Given the seasonality of the cropping pattern in the state, a set of seven seasonal crops, viz., Paddy, Groundnut, Cotton, Maize, Red gram, Chillies and Tomato were covered in the Kharif report and another set of seven seasonal crops, viz., (1) Paddy, (2) Groundnut, (3) Bengal gram, (4) Black Gram, (5) Maize, (6) Green gram and (7) Ragi were covered in the Rabi season reports[11]. In this final report, all 11 crops are covered.

1.3.2. Sample Design

The study was conducted in the entire State of Andhra Pradesh. For the CNF sample, the coverage of the study is the entire area where CNF is practised, while the rest of Andhra Pradesh is covered under the non-CNF areas. All the Gram Panchayats (GPs), where CNF practices are followed, constituted the sample frame for drawing CNF sample farmers. The list of CNF-GPs, with the number of cultivators, who adopted CNF in PMDS plots (referred as PMDS+CNF), as of May 2022, is the sample frame. The remaining GPs, where APCNF is yet to begin, form the sample

[9] The CNF sample has been selected from the CNF farmers who cultivated PMDS during 2022 and cultivated at least one of the 12 focused/ sample crops on those PMDS plots under S2S method.
[10] In this study the words PMDS+APCNF, APCNF and CNF are use as interchangeably. Similarly, the works non-APCNF and non-CNF are also use as interchangeably.
[11] Though Ragi is cultivated mostly in Kharif season, we could not get non-CNF Ragi cultivators in Kharif season. Therefore, it was covered in the Rabi report. Additional sample of CNF and non-CNF farmers were included for Rabi survey.

frame for non-CNF sample or control samples. The detailed description of sample selection process was given in the first and second interim reports of 2022-23 study (IDSAP 2023 and 2023a). The same is summarised below:

1. The study proposed to cover a total sample of 195 GPs, including 130 GPs for the CNF sample and 65 GPs for non-CNF sample. Given the sample size, it was decided to limit the disaggregated analysis to six Agroclimatic Zones.
2. The 130 sample GPs were allocated to the 30 strata[12] (of Agroclimatic Zones X districts) in proportion to the number of CNF farmers in each stratum. Similarly, the 65 non-CNF sample GPs were allocated across the 30 strata in proportion to number of CNF farmers in that stratum. A household listing was conducted in each of the sample CNF and non-CNF GPs.
3. The sample size, fixed at the state level for Paddy is 300; 200 for Groundnut and Cotton, 100 each for Maize, Black gram, Red gram, Tomato, and Ragi, and 150 for Chillies. For two crops, i.e., Bengal gram and Green gram which are predominantly Rabi crops, no samples are allocated as the reporting data itself is very small. The non-CNF sample is also selected based on the same principles, but a proportionately smaller number of crop observations. The crop specific sample size is spread across the GPs uniformly to ensure that the samples are not concentrated in a 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 deleted from the final set of sample cultivators.
4. A total of 1,331 CNF and 731 non-CNF farmers are selected for Kharif 2022.
5. Further, it was planned to collect the qualitative information through three methods, viz. 65 focus group discussions (FGDs), 13 Strategic Interviews (SIs) with the District Project Managers (DPMs), 13 SIs with RySS field staff, 65 case studies (CSs) of progressive and model farmers and (social) entrepreneurs, and a few case studies of horticulture farmers. Data has been collected as planned. Almost all the insights, from the qualitative data are incorporated in this report.

In the design, it was proposed to visit each sample household including CNF, non-CNF and Panel HHs, six to eight times to know the full impact of APCNF on household income and other factors. The same set of households has been surveyed multiple times throughout the year. However, it was noted that many sample farmers, selected during the Kharif season, do not cultivate any crop during the Rabi season. As a result, the study could not get an adequate number of sample observations for many crops, especially, for Rabi crops such as Bengal gram, Green gram, Black gram, etc. Therefore, an additional sample of 557 HHs, including 288 CNF and 269 non-CNF HHs has been selected, for the Rabi season survey. The additional sample was included only to conduct CCEs for select crops, which fall short of 40-50 observations and to collect the costs and returns data of such crops. Data with respect to household incomes, perceptions about input use, farmers' well-being, etc., was not collected from the additional sample farmers.

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

Those estimates were obtained with the original sample of 1331 CNF farmers and 731 non-CNF farmers. As also observed in previous surveys, only 47 per cent of CNF and 43 per cent of non-CNF sample households have cultivated crops during the Rabi season. The original sample size, the actual cultivators in the original sample in the Rabi season and the additional sample included in the Rabi survey for different Agroclimatic Zones and for farmers' categories are shown in Table 1.1.

Table 1.1: Distribution of Sample farmers in Kharif and Rabi seasons during 2022-23

Agroclimatic Zones & farmers categories		Original kharif Sample			Sample cultivators in Rabi			Additional sample in Rabi			Total sample for Rabi costs & returns estimation		
		CNF	non-CNF	Total	CNF	non-CNF	Total	CNF	non-CNF	Total	CNF	non-CNF	Total
State	**AP**	1,331	731	2,062	629	317	946	288	269	557	917	586	1503
Agro-climatic zones	HAT	215	59	274	46	43	89	52	26	78	98	69	167
	North coastal	97	51	148	69	30	99	42	21	63	111	51	162
	Godavari	83	31	114	80	31	111	2	30	32	82	61	143
	Krishna	232	92	324	130	33	163	144	128	272	274	161	435
	Southern	369	180	549	199	88	287	10	25	35	209	113	322
	Scarce rainfall	335	318	653	105	92	197	38	39	77	143	131	274
Farm size categories	Marginal	784	534	1,318	379	169	548	227	202	429	606	371	977
	Small	387	163	550	164	102	266	45	57	102	209	159	368
	Others	160	34	194	86	46	132	16	10	26	102	56	158
Tenurial categories	Tenant	31	23	54	22	12	34	7	3	10	29	15	44
	Owner-tenant	56	21	77	40	12	52	2	15	17	42	27	69
	Owner	1,244	687	1,931	567	293	860	279	251	530	846	544	1390
Social categories	SC	238	64	302	128	21	149	69	35	104	197	56	253
	ST	231	55	286	48	50	98	54	29	83	102	79	181
	BC	512	388	900	269	147	416	102	128	230	371	275	646
	OC	350	224	574	184	99	283	63	77	140	247	176	423

Source: *IDSAP, Field Survey 2022-23*

1.3.3. Selection of crops and observations

Most of the crops in the state are seasonal crops. Hence, it is not possible to cover all sample crops in the report for any one season. However, the final report can cover all crops by pooling the Kharif and Rabi data. Based on the available crop-wise observations, the study covered eleven crops in this report. Because of the additional sample, the study got a good number of observations to arrive at disaggregated results for most of the crops covered in the report. The total number of observations is 2,340 in CNF and 1,505 in non-CNF. The crops covered in the report and the number of available observations for the estimation of crop-wise costs and returns are shown in Table 1.2. The sample observations vary from 51 for CNF Green Gram to 783 for CNF Paddy. In the case of non-CNF, the sample observations vary from 52 in Tomato to 376 for Paddy (Table 1.2). It may be noted that there is a good number of observations for each of the crops to arrive at reliable estimates. This became possible due to the crop-wise sample selection strategy that was adopted for this year and the 557 additional sample selected during the Rabi season.

Table 1.2: Distribution of sample observations across crops for CNF and Non-CNF farmers for the analysis of cost and returns during [Kharif + Rabi] 2022-23

Crops	Kharif		Rabi		Kharif + Rabi	
	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF
Paddy	573	254	210	122	783	376
Groundnut	126	138	146	126	272	264
Cotton	134	156	0		134	156
Bengal gram	-	-	55	59	55	59
Maize	64	76	208	122	272	198
Black gram	129	9	183	97	312	106
Red gram	69	76	-	-	69	76
Chillies	110	100	-	-	110	100
Green gram	3	-	48	54	51	54
Ragi	108	-	87	64	195	64
Tomato	72	52	15	0	87	52
Total	1,388	861	952	644	2,340	1,505

Source: *IDSAP Field Survey 2022-23*

1.3.4. Crop cutting experiments for CNF and non-CNF crops

CCEs were conducted scientifically to get independent estimates of crop yields under CNF and non-CNF. For each of the selected farmers, a field, where the farmer is growing the sample crop was identified. From this field, a small sample plot of the *size*[13]*required by the CCE procedure* has been selected randomly for estimating yield through CCEs. The study used standard methodology developed and recommended by the Indian Agricultural Statistics Research Institute

[13] Normally, 5 metres x 5 metres, (5^2metres) plots are used for CCEs. However, 2 metres x 2 metres (Onion) or 10 metres x 10 metres (Red gram) are used for a few crops.

(IASRI), which is followed by the National Statistical Office (NSO) and the Directorate of Economics and Statistics (DES) of all states, including Andhra Pradesh, for conducting the CCEs.

Over 3,500 CCE have been conducted during the study period. Keeping aside the CCEs of panel farmers and Jowar crop, the data of 3,152 CCEs have been utilized in this report, especially in chapter 3 and 4. The number includes1,979 CCEs of CNF crops and 1,173CCEs of non-CNF crops. The data of CCEs of panel farmers is used in chapter 8 of panel study. The crop-wise number of CCEs used in chapters 3 and 4 are shown in Table 1.3. The number of CNF CCEs varies from a minimum of 41 for Red gram to a maximum of 631 for Paddy. The number of non-CNF CCEs varies from 37 for Tomato to 311for Paddy.

Table 1.3: Crop-wise number of CCEs of CNF and Non- CNF farmers during [Kharif + Rabi] 2022-23

Crop	Kharif		Rabi		Total (Kharif+ Rabi)	
	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF
Paddy	462	207	169	104	631	311
Groundnut	95	58	161	134	256	192
Cotton	112	97	-	1	112	98
Bengal gram	7		47	55	54	55
Maize	42	35	187	115	229	150
Black gram	112	7	172	95	284	102
Red gram	41	50	-	-	41	50
Chillies	57	55	-	-	57	55
Green gram	-	-	49	59	49	59
Ragi	106	4	81	60	187	64
Tomato	61	37	18	-	79	37
Total	1,095	550	884	623	1,979	1,173

Source: *IDSAP Field Survey 2022-23*

1.3.5. Data Collection and Management Process

This is a year-long survey. In all, eleven research tools, were used, and they are: (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. ***Further, the schedules of Kharif CNF and non-CNF households were revised for the Rabi survey***. The research tools were finalized through a series of brainstorming consultations. An intensive two-day training program was organized to train the field investigators and supervisors about CNF program, listing schedules and data entry in the App, at IDSAP, Visakhapatnam during the middle of July 2022. Another 5-days training program was organized during the second half of September 2022 to train the field staff about all research tools, data collection processes, CCEs processes, data entry in the App, etc. 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 six to eight

times by the field staff to collect data about farmer household's details and farming throughout the agriculture year (AY) 2022-23, with minimum time lapse. The household survey was conducted from September 2022, till the end of May 2023. Senior team members have visited the field and cross-checked the information collected and conducted Strategic Interviews (Sis) with DPMs and a few field staff of RySS; and also participated in the FGDs. They have also visited fields, especially of the model farmers and social entrepreneurs, for obtaining information on various farm practices; and prepared a few case studies. Since 2021-22, the field data is being digitalized with the help of a technical agency - "i for Development (i4D) **Parishkaar** Technologies". Each field staff was given a Tab. The agency developed Apps for the entry of household information and CCE data, apart from the PMDS survey data. Needless to say, the field staff was given comprehensive training about using the Tabs and Apps and data entry. The agency provided technical support throughout the year and provided the digital data to IDSAP in the Excel form. The data was collated and processed using the R program and Excel software. Descriptive statistics, frequency distributions and cross tabulation are generated at the state level agroclimatic zone[14]wise, for farm-size categories, for tenurial categories and for social categories. A list of Agroclimatic zone-wise demarcation of Mandals is given in Table 1.4 below.

Table 1.4: List of Agroclimatic Zones and their demarcation

No	Zone	District	Mandals
1	High Altitude Tribal Zone (HAT Zone)	Srikakulam	Hiramandalam, Kothuru, Mandasa, Meliyaputti,Pathapatnam Sarvakota.(6)
		PVP Manyam	Bhamini, Gummalakshmipuram, Komarada, Kurupam, Makkuva, Pachipenta, Parvathipuram, Saluru, Seethampeta. (9)
		ASR	All the mandal of ASR (22)
		Total	37
2	North Coastal Zone	Srikakulam	Amudalavalasa, Burja, Etcherla, G. Sighadam, Gara, Ichchapuram, Jalumuru, Kanchili, Kaviti, Kota Bhommali, Laveru, Laxminarsupeta, Narsannapeta, Palasa, Polaki, Ponduru, Ranasthalam, Santha Bhommali, Sarubujjili, Sompeta, Srikakulam, Tekkali, Vajrapukothuru. (23)
		PVP Manyam	Balijipeta, Garugubilli, Jiyyammavalasa, Palakonda, Seethanagaram, Veeraghattam (6)
		Visakhapatnam	All mandals of Visakhapatnam (11)
		Anakapalli	All the mandal of ASR (24)
		East Godavari	Nandigam (1)
		Vizianagaram	All mandals of Vizianagaram (27)
		Total	92
3	Godavari Zone	East Godavari	All mandals of East Godavari (19)
		West Godavari	All mandals of west Godavari (19)

.

No	Zone	District	Mandals
		Eluru	Bheemadole, Buttayagudem, Chintalapudi, Denduluru, Dwarakatirumala, Eluru, Ganapavaram, Jandareddigudem, Jeelugumilli, Kamavarapukota, Koyyalagudem, Kukunoor, Lingapalem, Nidamarru, Pedavegi, Peddapadu, Polavaram, T Narsapuram, Unguturu, Velairpadu. (20)
		Kakinada	All mandals of Kakinada (21)
		Konaseema	All Mandala of Konaseema (22)
		Total	101
4	Krishna Zone	Bapatla	All Mandals of Bapatla (25)
		Eluru	Agiripalli, Chatrai, Kaikaluru, Kalidindi, Mandavalli, Mudinepalle, Musunuru, Nuzividu. (8)
		Guntur	All mandals of Guntur (18)
		Krishna	All mandals of Krishna (25)
		NTR	All mandals of NTR (20)
		Palnadu	All mandals of Palnadu (28)
		Prakasam	All mandals of Prakasam (38)
		SPSN (Nellore)	Gudluru, Lingasamudram, Ulavapadu, Voletivaripalem. (4)
		Total	166
5	Southern Zone	Annamayya	All mandals of Annamayya (30)
		Chittoor	All mandals of Chittoor (31)
		SPSN (Nellore)	All mandals of Sri Potti Sriramulu Nellore except Gudluru, Lingasamudram, Ulavapadu, Voletivaripalem (34)
		Tirupati	All mandals of Tirupati (34)
		Y S R Kadapa	All mandals of Y S R Kadapa (36)
		Total	165
6	Scarce Rainfall Zone	Anantapuramu	All mandals of Anantapuramu (31)
		Kurnool	All mandals of Kurnool (26)
		Nandyala	All mandals of Nandyala (29)
		Sri Satya Sai	All mandals of Sri Satyasai (32)
		Total	118
	Grand Total		679

1.4. Structure of the Report

The context, objectives and methodology of the study have been presented in Chapter 1. Chapter 2 summarizes the profiles of CNF (PMDS+CNF) and non-CNF households, discussed in detail in the Kharif season report 2022-23.[15] Chapter 3 covers the impact of APCNF[16] on farming conditions. The impact of CNF on farming conditions at the disaggregated levels is discussed in Chapter 4. The impact of CNF on agriculture input/ natural resources uses and related issues, discussed in previous Kharif and Rabi reports of 2022-23, are illustrated in Chapter 5. The impact

[15]All previous reports can be seen at https://www.idsap.in/reports.html

[16]In this study the words PMDS+APCNF, APCNF and CNF are use as interchangeably. Similarly, the works non-APCNF and non-CNF are also use as interchangeably.

of CNF on farming and household incomes is covered in Chapter 6. The potential impact of CNF on state agriculture and related issues is deliberated in Chapter 7. The issues of the farmers' well-being, which were covered extensively in previous Kharif 2022-23, are summarized in Chapter 8. The panel study is covered in Chapter 9. The issues and challenges in implementation of APCNF are covered in Chapter 10. The insights from the qualitative data are summarized in Chapter 11. Apart from these eleven Chapters, a detailed Executive Summary of the study is also presented at the beginning of the Report.

Chapter 2: Profiles of CNF and non-CNF farmers

2.1. Introduction

The Second Interim (Kharif Season) 2022-23 Report discussed the profiles of CNF and non-CNF farmers in detail.[17] The parameters included in the profiles are: 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 another category of farmers including medium and large farmers), and tenurial categories of farmers (pure tenants, owner-tenants and owner farmers). The profiles also include literacy levels of the farmers (illiterate and educated farmers with different levels of education) and age of the farmers (young, middle, and old farmers). As the same sample farmers are tracked throughout the study period, the sample profiles will remain the same. Therefore, in this chapter, the profiles chapter of the Second Interim (Kharif Season) 2022-23 Report is summarized. The related tables are presented in Appendix Tables of Chapter 2.

2.2. Profiles of CNF and non-CNF farmers

The major findings of the profiles chapter of the Second Interim (Kharif Report) 2022-23 are:

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.
2. Among all sample households, the number of farmers, i.e., the household members who devote most of their working days/ hours to cultivation, were identified and analysed. Each sample family may have more than one person dependent on cultivation. 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 there are 142 and 135 cultivators for every 100 CNF and non-CNF sample households respectively. 607 or 32 per cent out of 1,884 CNF cultivators, are female farmers. The same is 30 per cent among the non-CNF cultivators. There are 46 female farmers for every 100 CNF sample households. The same is 40 for non-CNF households.
3. In total, the marginal and small farmers together account for 88 per cent in the CNF sample and 95 per cent in non-CNF sample.
4. There is no difference between CNF and non-CNF households in the land leased-in.
5. It is found that persons 40 years or below constitute 38.85 per cent of all farmers[18] in the sample CNF households, as compared to 32.62 per cent of all cultivators[19] in the non-CNF sample households. On the other hand, those who are 61 years and above form 6.05 per

[17]It may be noted that the study has taken households (HHs)/ family as sample. In each household/ family, there may be more than one cultivator. In this profile chapter the words household/ family and farmers/ cultivators are used separately. In some indicators such as social category and land ownership, the term HHs is used. In case of some indicators such as age, education, gender, etc., individual cultivators', in each HHs, data is used. In all other chapters the words sample HHs and sample farmers are used interchangeably.

[18] Household members who devote most of their working hours/ days to cultivation.

[19] Ibid.

cent of all cultivators[20] in the sample CNF households; and 11.25 per cent among the non-CNF HHs.

6. The data shows that education has not impacted the adoption of CNF.

2.3. Conclusions

The larger presence of SC and ST farmers, women cultivators and young cultivators in CNF compared to non-CNF, is indicative of positive inclusive policy of RySS. It also indicates that APCNF is attracting marginalised sections and youth.

[20] Ibid.

Appendix tables of Chapter 2

The following tables have been reproduced from Kharif 2022-23 Report, for the ready reference and use.

Appendix Table2.1: Social Groups-wise CNF and Non-CNF farmers in Kharif 2022-23

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

Appendix Table 2.2: Number of female farmers in CNF and non-CNF sample households in Kharif 2022-23

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 means a person, who devotes 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

Appendix Table 2.3: Farm-size category-wise CNF and non-CNF households in Kharif 2022-23

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

Appendix Table 2.4: Tenurial Status among CNF and non-CNF sample households in Kharif 2022-23

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

Appendix Table 2.5: Agro-climatic Zones and Tenurial Status-wise 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

Agroclimatic Zones	Unit	CNF				NON-CNF			
		Tenants	Owner-tenants	Owners	All	Tenants	Owner - tenants	Owners	All
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

Appendix Table 2.6: Average Operated area of CNF and non-CNF in Kharif 2023

Agroclimatic zone & farmers' categories		Average operated area (in hectares)		Percentage difference between CNF and non-CNF
		CNF	non-CNF	
1	2	3	4	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

Appendix Table 2.7: Age-wise distribution of CNF and non-CNF 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

Appendix Table2.8: Literacy-wise CNF and Non-CNF households in Kharif 2022-23

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
Degre and above	97	54	5	5
All	1884	987	100	100

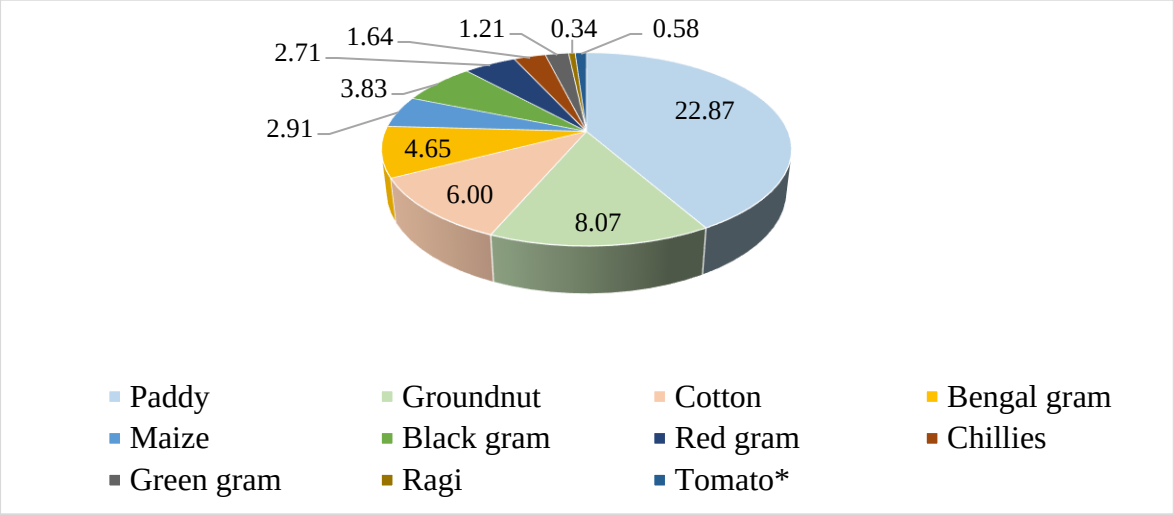
Source: APCNF Field Survey 2022-23

Chapter 3: Impact of CNF on the farming conditions

3.1. Introduction

This chapter covers the impact of CNF on farming conditions. The analysis covers both Kharif sample farmers and Rabi 2022-2023. The parameters considered in this chapter are: expenditure on Plant Nutrients and Protection Inputs (PNPIs)[21], paid-out costs, crop yields, prices, the gross value of crop output and the net value of crop output. As mentioned in chapter one, 11 crops are covered in this chapter. These 11 crops together account for 54.82 lakh hectares, which is equal to 74.33 per cent of the GCA area in the state. The area under each crop varies from 0.34 lakh hectares under Ragi to 22.87 lakh ha. for paddy (Figure 3.1). Using these areas as the weights, the average costs and returns of these 11 crops are calculated and used in this chapter.

Figure 3.1: Average area under 11 sample crops during Kharif + Rabi seasons of five years ending with 2021-22 in the state (In Lakh Hectares)



DES AP: Season and Crop Report 2021-22

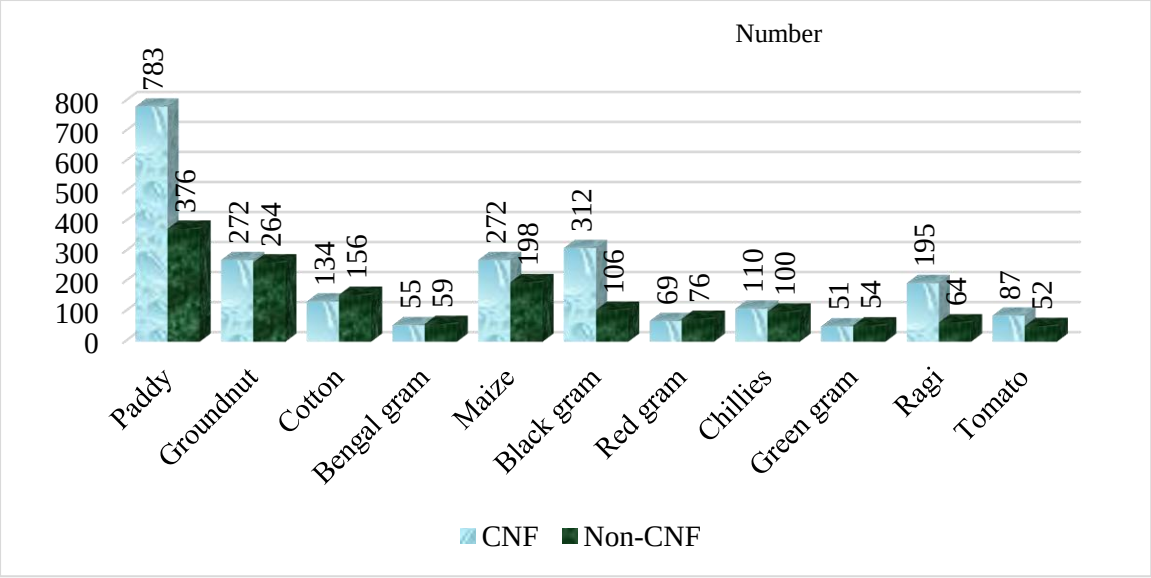
3.2. Crop-wise number of sample observations and CCEs

The total number of cross-section sample observations and CCEs for costs and returns estimations is shown in Table 1.2 and Table 1.3. Season-wise breakdowns are also given in those tables. The crops covered in this chapter and the number of available sample observations and CCEs for the estimation of crop-wise costs and returns are shown in Figure 3.2 and Figure 3.3. The number of CNF sample observations varies from 51 for Green gram to 783 for Paddy. The number of non-CNF sample observations varies from 52 for Tomato to 376 for Paddy (Figure 3.2). The number of CNF CCEs varies from a minimum of 41 for Red gram to a

[21]For the sake of comparison, the biological stimulants (also referred as biological inputs) like *Beejamrutham*, Dravajeevamrutham, Ghanajeevamrutham, Kashayams, and Astras under CNF and the agrochemical inputs such as fertilizers, pesticides and herbicides, are together denoted as Plant Nutrient and Protection Inputs (PNPIs).

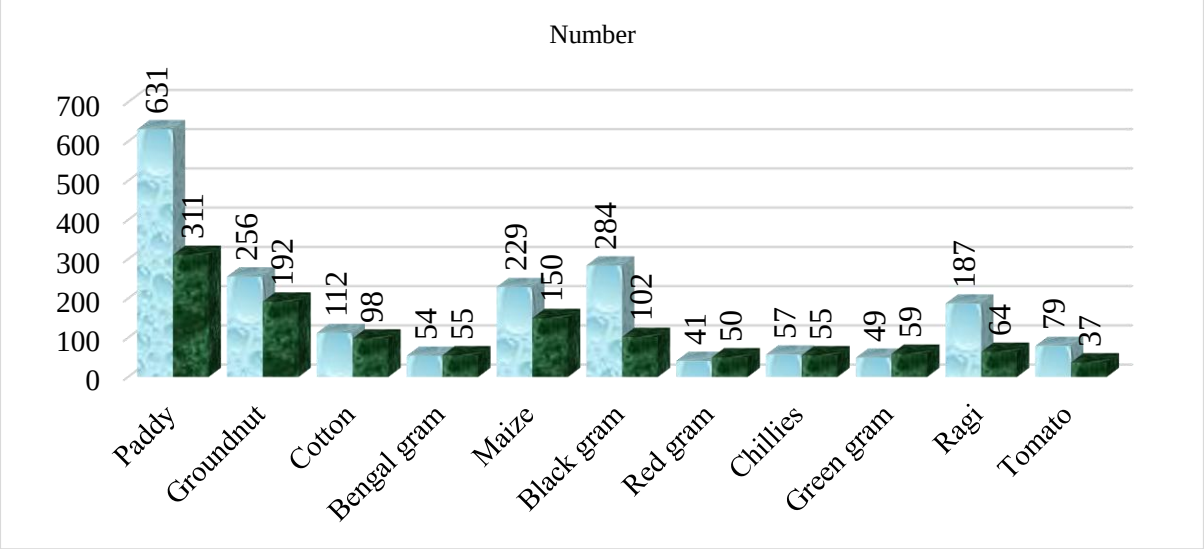
maximum of 631 for Paddy. The number of non-CNF CCEs varies from 37 for Tomato to 311for Paddy

Figure 3.2: Crop-wise CNF and non-CNF sample observations for the cost and returns analysis in (Kharif plus Rabi) 2022-23



Source: *IDSAP, Field Survey 2022-23*

Figure 3.3: Crop-wise CNF and non-CNF CCEs in (Kharif plus Rabi) 2022-23



Source: *IDSAP, Field Survey 2022-23*

3.3. Plant Nutrient and Protection Inputs (PNPIs)

For the sake of comparison, the biological stimulants (also referred as biological inputs) such as *Beejamrutham*, *Dravajeevamrutham*, *Ghanajeevamrutham*, *Kashayams*, and *Asthrams* under CNF and the agrochemical inputs such as fertilizers, pesticides and herbicides, are together, denoted as Plant Nutrient and Protection Inputs (PNPIs). The biological stimulants

are prepared by the farmers or other local people with locally available inexpensive raw materials such as cattle dung, urine, jaggery, Bengal gram-flour, and parts/ products of wild trees. Needless to say, they are inexpensive and give a boost to the local economy.[22] On the other hand, fertilisers and pesticides are factory made, expensive and involve a huge fertilizer subsidy and are associated with multiple side-effects on human health. Thus, from the very beginning of the production process, the CNF farmer is on a better footing – he/ she requires to spend little on the inputs. This was also seen to be true in all previous studies. On an average, CNF farmers saved ₹8,997 (50 per cent) per hectare in their expenditure on PNPIs vis-à-vis non-CNF farmers (Table 3.1). As observed in the previous studies, here also, the CNF farmers have obtained larger savings in PNPIs in input intensive crops like Chillies, Tomato, Cotton, Paddy and Maize, under CNF. In absolute terms, the savings are over ₹72,000 per hectare in Chillies and over ₹.9,000 per hectare in the other four input-intensive crops. On the other hand, the savings are negative, but marginal in Ragi and positive but small in four pulses crops, which are usually cultivated with less inputs (agrochemicals) under non-CNF.

Table 3.1: Crop-wise PNPI Expenditure among CNF and Non-CNF farmers in [Kharif + Rabi] 2022-23

Crop	₹/ Hectare		Difference between CNF & non-CNF		
	CNF	Non-CNF	₹/ hectare	Percentage	Significance
Paddy	8,298	17,450	-9,152	-52	**
Groundnut	8,031	12,803	-4,772	-37	**
Cotton	14,745	24,519	-9,774	-40	**
Bengal gram	3,980	7,639	-3,659	-48	**
Maize	8,670	18,516	-9,846	-53	**
Black gram	8,200	10,063	-1,863	-19	*
Red gram	6,989	9,758	-2,769	-28	**
Chillies	20,429	92,921	-72,492	-78	**
Green gram	4,333	6,406	-2,073	-32	*
Ragi	5,597	4,820	778	16	ns
Tomato	16,880	25,915	-9,035	-35	**
Average$	8,896	17,893	-8,997	-50	

@ PNPI means plant nutrients and protection inputs, which include the biological stimulants under CNF and agrochemical inputs under non-CNF

*Note: '**', '*' and ns indicate significance at '1%', '5%' and 'not significance' respectively*

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

Source: IDSAP, Field Survey 2022-23

3.3. Paid-out Cost

Paid-out cost, considered in this study, consists of the expenditure on (1) seeds, (2) PNPI, (3) hired labour, (4) farm yard manure (FYM), (5) machinery, (6) bullocks, (7) implements, (8) irrigation and (9) miscellaneous items, including supervision and emergencies. This cost closely represents the "Cost concept of A1" of the owner cultivator[23]. Other cost items which

[22]In some villages the market for cattle dung and urine are developing, albeit, slowly.

[23] Official definition of Cost A1 – It includes all actual expenses in cash and kind in production by the owner

are not included in the present studies are (1) actual rent paid on land, (2) imputed rental value of own land, (3) imputed value of own labour, (4) interest paid on borrowed funds, (5) depreciation of agriculture assets, excluding land. In a sense, the paid-out cost used is a narrow concept. Needless to say, all these inclusions and exclusions are common to both CNF and non-CNF farmers. By adding all the above-mentioned items, crop-wise paid-out costs are estimated under CNF and non-CNF. The same are presented in Table 3.2.

Table 3.2: Paid-out Cost for each sample crop under CNF and non-CNF in Kharif and Rabi 2022-2023

Crop	₹/ Hectare		Difference between CNF & non-CNF		
	CNF	Non-CNF	₹/Hectare	Percentage	Sign.
Paddy	59,915	69,255	-9,341	-13	**
Groundnut	64,759	63,401	1,358	2	Ns
Cotton	75,347	76,266	-918	-1	Ns
Bengal gram	44,517	46,744	-2,226	-5	Ns
Maize	53,500	59,828	-6,328	-11	**
Black gram	41,221	34,140	7,081	21	*
Red gram	34,035	33,706	328	1	Ns
Chillies	2,23,787	3,10,148	-86,361	-28	Ns
Green gram	27,594	25,183	2,411	10	Ns
Ragi	31,260	26,192	5,068	19	Ns
Tomato	1,00,791	1,00,056	736	1	Ns
Average	62,532	68,834	-6,303	-9	

*Note: '**', '*', 'ns' indicate '1%', '5%' and 'not-significance' respectively using t test.*
Source: *IDSAP, Field Survey 2022-23*

On an average, the savings CNF farmers in the paid-out cost is ₹6,303 (9 per cent) compared with non-CNF farmers. This is on lower side compared to earlier studies. Apart from the usual factors which influence farm investment, especially under non-CNF, such as annual weather, farmers expectations, availability of funds and credit, etc., the composition of sample crops explain the lower savings in paid-out costs for CNF farmers. Out of 11 crops considered in this report, all four pulses crops and Ragi are usually grown with less inputs under non-CNF.[24] However, the CNF farmers usually apply the recommended doses of inputs.[25] As a result, the paid-out cost under CNF is higher than that of non-CNF in all these five crops. Out of 11 crops, the difference in the paid-out cots of CNF and non-CNF crops is not statistically significant in

farmer: i) Value of hired human labour, ii) Value of hired bullock labour, iii) Value of machine labour, owned and hired, iv) Value of owned bullock labour, v) Value of owned machinery, vi) Value of hired machinery vii) Value of seed (a) farm produced & (b) purchased, viii) Value of insecticides and pesticides, ix) Value of manure (owned and purchased), x) Value of fertilizers, xi) Depreciation of implements and machinery, xii) Irrigation charges, xiii) Land revenue, xiv) Interest on working capital, and xv) Misc. expenses (artisans etc.). See DES (GoI): Manual on Cost of Cultivation Survey; https://desagri.gov.in/wp-content/uploads/2021/06/manual_cost_cultivation_surveys_23july08_0.pdf (Accessed on 28 June 2024)

[24] Especially Black gram, Green Gram and Ragi in Rabi season, which are, usually, cultivated on the Paddy fallow fields with very little inputs.

[25] Another reason could be an in increase in cash flows in CNF households, which enables them to invest more on agriculture, among others.

eight crops. In the three crops in which the difference is significant, the paid-out cost under CNF is less in two crops, viz., Paddy and Maize and in Black gram, the paid-out cost under CNF is larger than that of non-CNF.[26]

3.3.1. Structure of Paid-out Costs

As mentioned above, the study collected the data of nine cost items, viz., (1) seeds, (2) PNPI, (3) hired labour, (4) farm yard manure (FYM), (5) machinery, (6) bullocks, (7) implements, (8) irrigation and (9) miscellaneous items; and included them in the paid-out cost. However, very little expenditure is incurred on the abovementioned items. Hence those three items were clubbed under 'other' items/ expenditure. The percentage share of each of the seven cost items in the paid-out cost of each crop under CNF and non-CNF are shown in Table 3.3. Four items viz., PNPIs, Human labour, Machine labour and Seeds occupy the top four positions in the paid-out costs, in different orders in different crops across the state. Bullock labour and FYM are used in notable proportions in a few crops/ regions. By and large, the paid-out cost structure remained same in both CNF and non-CNF methods. The only important difference is that the share of PNPIs is less under CNF, which results from a significant reduction in the expenditure on PNPIs under CNF. As a result, the share of human labour and machine labour is relatively higher under CNF.

Table 3.3: Crop-wise percentage share of different input costs in the paid-out cost in (Kharif + Rabi) 2022-2023

Crop	Method	% of Input Cost							
		Seed	FYM	PNPI	Human Labour	Bullock Labour	Machine Labour	Others	Total
Paddy	CNF	5	7	14	34	2	35	3	100
	Non-CNF	5	5	25	29	2	32	2	100
Ground-nut	CNF	25	5	12	25	5	25	3	100
	Non-CNF	25	4	20	22	0	24	2	100
Cotton	CNF	8	3	20	41	12	14	3	100
	Non-CNF	7	2	32	30	11	14	4	100
Bengal gram	CNF	22	16	9	13	0	40	1	100
	Non-CNF	22	13	16	7	-	41	1	100
Maize	CNF	13	2	16	28	3	35	3	100
	Non-CNF	10	2	31	19	3	33	3	100
Black gram	CNF	8	6	20	30	1	33	2	100
	Non-CNF	10	1	29	24	0	33	3	100
Red gram	CNF	5	6	21	26	4	36	3	100
	Non-CNF	3	4	29	20	5	34	4	100
Chillie	CNF	8	3	9	59	6	11	3	100
	Non-CNF	9	2	30	42	4	9	4	100
	CNF	15	1	16	35	-	30	4	100

[26] One possible reason is, in Black gram and Ragi the share of Kharif sample is significantly higher in CNF sample vis-à-vis in non-CNF sample.

Crop	Method	% of Input Cost							
		Seed	FYM	PNPI	Human Labour	Bullock Labour	Machine Labour	Others	Total
Green gram	Non-CNF	15	-	2	31	-	26	2	100
Ragi	CNF	3	5	18	29	32	12	1	100
	Non-CNF	2	3	18	39	16	21	2	100
Tomato	CNF	22	3	17	31	1	20	5	100
	Non-CNF	20	3	26	25	1	21	4	100

Source: *IDSAP, Field Survey 2022-23*

An analysis of the absolute expenditures on each cost item under CNF and non-CNF may give additional insights. The expenditure on FYM under CNF is more than that of non-CNF in all crops considered (Table 3.4). In a sense, the application of FYM is inevitable under CNF. Since livestock is a part of CNF, the farmers automatically get the FYM (waste from the livestock sector), and apply the same in their fields. As anticipated, the expenditure on human labour under CNF is higher than that of non-CNF in nine out of 11 crops. Though the expenditure on machine labour appeared to be high in relative terms under CNF, but in absolute terms, it is less than that of non-CNF in six out of 11 crops. The data indicates that under CNF the paid-out costs are about the same or less than under non-CNF, besides they are diversified.

Table 3.4: Crop-wise expenditure on major farm inputs under CNF and non-CNF in [Kharif + Rabi] 2022-23

Crop	Details	Expenditure (Rs/ha)									
		Seed	FYM	PNPI	Human Labour	Bullock Labour	Machine Labour	Implements	Irrigation	Others	Total
Paddy	CNF	3,267	4,111	8,298	20,354	1,422	20,922	590	494	459	59,915
	Non-CNF	3,297	3,229	17,450	20,360	1,442	22,255	637	251	334	69,255
	Difference (Rs)	-30	882	-9,152	-7	-21	-1,333	-47	242	125	-9,341
	% Change	-1	27	-52	0	-1	-6	-7	96	37	-13
Groundnut	CNF	16,390	2,949	8,031	16,385	3,178	15,986	384	425	1,032	64,759
	Non-CNF	15,566	2,403	12,803	14,059	1,759	15,229	423	160	1,000	63,401
	Difference (Rs)	824	546	-4,772	2,326	1,419	757	-39	265	31	1,358
	% Change	5	23	-37	17	81	5	-9	165	3	2
Cotton	CNF	5,819	1,951	14,745	31,009	9,028	10,472	1,038	470	815	75,347
	Non-CNF	5,691	1,491	24,519	22,818	8,540	10,414	2,043	166	584	76,266
	Difference (Rs)	128	460	-9,774	8,192	488	59	-1,005	303	231	-918
	% Change	2	31	-40	36	6	1	-49	182	40	-1
Bengal Gram	CNF	9,713	7,154	3,980	5,625	108	17,627	135	61	114	44,517
	Non-CNF	10,070	6,280	7,639	3,089	-	19,227	163	11	265	46,744
	Difference (Rs)	-357	874	-3,659	2,536	108	-1,600	-28	50	-151	-2,226
	% Change	-4	14	-48	82		-8	-17	471	-57	-5
Maize	CNF	6,988	1,090	8,670	14,748	1,471	18,665	678	363	826	53,500
	Non-CNF	6,009	981	18,516	11,416	1,523	19,580	747	77	978	59,828
	Difference (Rs)	979	109	-9,846	3,332	-51	-915	-69	286	-153	-6,328
	% Change	16	11	-53	29	-3	-5	-9	370	-16	-11
Black gram	CNF	3,487	2,556	8,225	12,337	246	13,589	248	290	242	41,221
	Non-CNF	3,252	262	10,063	8,248	167	11,137	528	222	260	34,140
	Difference (Rs)	236	2,293	-1,838	4,089	79	2,452	-280	68	-18	7,081
	% Change	7	874	-18	50	47	22	-53	31	-7	21

Crop	Details	Expenditure (Rs/ha)									
		Seed	FYM	PNPI	Human Labour	Bullock Labour	Machine Labour	Implements	Irrigation	Others	Total
Red gram	CNF	1,565	2,032	6,989	8,926	1,459	12,209	606	51	199	34,035
	Non-CNF	1,162	1,180	9,758	6,762	1,771	11,576	742	12	744	33,706
	Difference (Rs)	403	852	-2,769	2,164	-312	633	-136	38	-546	328
	% Change	35	72	-28	32	-18	5	-18	319	-73	1
Chillis	CNF	17,199	7,585	20,429	1,32,225	13,990	24,831	4,798	923	1,807	2,23,787
	Non-CNF	27,343	6,223	92,921	1,31,366	12,300	28,075	7,883	830	3,205	3,10,148
	Difference (Rs)	-10,145	1,362	-72,492	859	1,690	-3,244	-3,085	93	-1,399	-86,361
	% Change	-37	22	-78	1	14	-12	-39	11	-44	-28
Green gram	CNF	4,153	194	4,333	9,571	-	8,280	641	71	350	27,594
	Non-CNF	3,757	-	6,406	7,887	-	6,647	354	70	62	25,183
	Difference (Rs)	396	194	-2,073	1,684	-	1,633	287	2	288	2,411
	% Change	11		-32	21		25	81	2	463	10
Ragi	CNF	983	1,650	5,597	9,099	9,975	3,760	60	35	99	31,260
	Non-CNF	434	659	4,820	10,128	4,074	5,503	-	-	575	26,192
	Difference (Rs)	550	992	778	-1,029	5,901	-1,743	60	35	-476	5,068
	% Change	127	150	16	-10	145	-32			-83	19
Tomato	CNF	22,243	3,479	16,880	31,611	1,476	20,026	282	796	3,999	1,00,791
	Non-CNF	19,520	3,192	25,915	25,356	1,186	20,957	1,067	664	2,198	1,00,056
	Difference (Rs)	2,723	287	-9,035	6,254	290	-931	-785	132	1,801	736
	% Change	14	9	-35	25	24	-4	-74	20	82	1

Source: *IDSAP, Field Survey 2022-23*

3.4. Crop Yields:

There is a keen interest among the different stakeholders, about the impact of CNF on crop yields. Given the importance of yields, the study is mandated to conduct CCEs to estimate crop yields independently and scientifically. The crop yields under CNF and non-CNF were the same, i.e., no difference statistically, in eight out of 11 crops included in this report. In all the remaining three crops, viz., Bengal gram, Maize and Tomato, the yields under CNF are statistically higher than under non-CNF (Table 3.5). The data indicate that yields under CNF are either the same or a little more than that under non-CNF. PMDS is the major contributor to this situation.

Table 3.5: Crop-wise CCE Yields under CNF and non-CNF in [Kharif + Rabi] 2022-2023

Crop	Yield (q/ha)		Difference between CNF & non-CNF		
	CNF	Non-CNF	quintals/ ha	Percentage	Significance
Paddy	53.00	53.36	-0.36	-0.68	ns
Groundnut	25.91	25.50	0.41	1.60	ns
Cotton	11.37	10.86	0.51	4.67	ns
Bengal gram	17.92	16.37	1.55	9.44	*
Maize	73.75	67.57	6.18	9.15	**
Black gram	14.36	13.44	0.92	6.84	ns
Red gram	6.39	5.77	0.62	10.72	ns
Chillies	51.88	54.37	-2.50	-4.59	ns
Green gram	13.01	13.78	-0.77	-5.61	ns
Ragi	14.51	14.75	-0.24	-1.64	ns
Tomato	180.73	145.39	35.34	24.31	*

*Note: **, *, ns indicates 1%,5% and non-significant respectively*
Source: *IDSAP, Field Survey 2022-23*

3.5. Prices of CNF Output vis-à-vis non-CNF output

The prices received by the farmers are critical for the expansion of CNF in the state. The CNF farmers are of the opinion that their CNF crop output is quality output, and, hence higher prices can be expected for the same. Crop-wise average prices obtained by CNF and non-CNF farmers and their differences are presented in Table 3.6.

Table 3.6: Prices obtained for each sample crop by farmers for their CNF and non-CNF output in [Kharif + Rabi] 2022-23

Crop	₹/Quintal		Difference between CNF & non-CNF		
	CNF	Non-CNF	₹/quintal	Percentage	Significance
Paddy	1,958	1,900	58	3	**
Groundnut	6,176	5,966	210	4	**
Cotton	7,039	7,008	31	0	ns
Bengal gram	6,365	6,518	-153	-2	ns
Maize	1,946	1,904	41	2	ns

Crop	₹/Quintal		Difference between CNF & non-CNF		
	CNF	Non-CNF	₹/quintal	Percentage	Significance
Black gram	6,892	6,911	-19	-0	ns
Red gram	5,600	5,552	48	1	ns
Chillies	22,116	17,670	4,446	25	**
Green gram	6,934	6,985	-52	-1	ns
Ragi	2,734	2,679	55	2	ns
Tomato	604	612	-8	-1	ns

*Note: **, *, ns indicates 1%,5% and non-significant respectively using t test.*

Source: *IDSAP, Field Survey 2022-23*

The prices obtained for CNF and non-CNF are statistically the same for eight out of 11 crops. Of the three remaining crops, viz., Paddy, Groundnut and Chillies[27], the CNF output got significantly higher prices. Apart from local marketing factors such as supply-demand and marketing infrastructure, the higher prices realized for CNF crops reflect the growing interest in CNF output. Further, facilitations by RySS such as bulk buying by Tirumala Tirupathi Devasthanam (TTD), exclusive stalls in Rythu Bazars, exhibition-cum-sales events, etc., are also helping the CNF farmers in realizing better marketing support for CNF output, especially for food and horticulture crops.

3.6. Gross Value of Output

The gross value of output has been obtained by multiplying 'the average yield of a crop', obtained through CCEs, with 'average price of that crop', as reported by the farmers and adding 'the average of value of by-product of that crop', as reported by the farmers. Thus, yield and prices of a crop are crucial in determining the gross value of output. The difference between the CNF and the non-CNF in respect of the gross value of output per hectare is positive in case of 10 out of the 11 crops studied in this report. The only exception is Green Gram (Table 3.7). On an average the gross value of CNF crops is higher than that of non-CNF crops by ₹11,284 (8 per cent) per hectare. It implies that CNF crops are able to make up for any losses in the yields through better prices in almost all crops.

Table 3.7: Gross value of output for each sample crop under CNF and non-CNF in [Kharif + Rabi] 2022-2023

Crop	₹/hectare		Difference between CNF & non-CNF	
	CNF	Non-CNF	₹/hectare	Percentage
Paddy	1,11,095	1,07,016	4,080	4
Groundnut	1,74,074	1,65,080	8,993	5
Cotton	80,281	76,310	3,971	5
Bengal gram	1,15,961	1,07,633	8,328	8
Maize	1,45,050	1,29,688	15,362	12
Black gram	1,00,108	93,692	6,416	7
Red gram	37,319	33,616	3,703	11
Chillies	11,47,278	9,60,758	1,86,520	19
Green gram	90,476	96,363	-5,887	-6

[27] The prices of Chillis fluctuate wide geographically and temporally. In one of the previous surveys, it was observed that prices obtained by non-CNF farmers are significantly higher than that of CNF farmers. Therefore, the big difference obtained in this study need to be taken cautiously.

Crop	₹/hectare		Difference between CNF & non-CNF	
	CNF	Non-CNF	₹/hectare	Percentage
Ragi	40,635	39,914	720	2
Tomato	1,09,265	89,091	20,173	23
Average	1,44,880	1,33,596	11,284	8

Source: IDSAP, Field Survey 2022-23

3.7. Net Value of Output

The net value of crop output per hectare is calculated by deducting the paid-out costs from the gross value of the same crop. The crop-wise net value of output per hectare under CNF and non-CNF and the differences are presented in Table 3.8. In two crops, the net value of output is negative under non-CNF, i.e., -10,965 and -91 per hectare in Tomato and Red gram respectively. The net value of Cotton output for non-CNF farmers is just ₹44 per hectare. These figures reflect the state's status of non-CNF. The non-CNF farmers are not able to recover cost of cultivation in those three crops. On an average, the net value of CNF crop output is ₹17,587 (27 per cent), per hectare, higher than that of non-CNF. Out of this, ₹6,303 is due to savings in the paid-out costs (see Table 3.2), and ₹11,284 is due to the higher gross value of output (see Table 3.6). In recent years, it is observed that the paid-out costs and gross value of output are both increasing under CNF. While the increase in the former has a dampening effect on the net value of output, the increase in the latter has an enhancing effect on it.

Table 3.8 Net value of each of sample crops under CNF and non-CNF output in [Kharif + Rabi] 2022-23

Crop	₹/hectare		Difference between CNF & non-CNF	
	CNF	Non-CNF	₹/hectare	%
Paddy	51,180	37,760	13,420	36
Groundnut	1,09,315	1,01,679	7,636	8
Cotton	4,934	44	4,890	11,114
Bengal gram	71,444	60,890	10,555	17
Maize	91,550	69,860	21,691	31
Black gram	58,887	59,552	-665	-1
Red gram	3,284	-91	3,375	+ve large
Chillies	9,23,491	6,50,610	2,72,881	42
Green gram	62,883	71,180	-8,298	-12
Ragi	9,375	13,722	-4,347	-32
Tomato	8,473	-10,965	19,438	+ve large
Average	82,348	64,761	17,587	27

Source: *IDSAP, Field Survey 2022-23*

3.8. Conclusions

In this chapter, the differences between CNF and non-CNF in PNPIs, paid-out costs, yields and prices have been statistically tested. These tests have added value to the analysis and provided additional insights. It is seen that paid-out costs are either less or the same regarding crops under consideration for CNF farmers when compared to non-CNF farmers. Yields are also slightly more favourable. CNF yields are on par with non-CNF or higher. The prices realised also followed the same pattern as yields. The gross value of output and the net value of output are higher on an average under CNF when compared to non-CNF.

Chapter 4: Impact of CNF on farming conditions at disaggregate level

4.1. Introduction

The major objective of the disaggregated analysis is to see whether all the regions and farmers' categories benefit from the APCNF. The sample size is large enough to carry out a disaggregated analysis of farming conditions across the Agroclimatic Zones and farmers' categories for seven crops, viz., Paddy, Groundnut, Cotton, Bengal gram, Maize, Black gram and Chillis. As mentioned in Chapter One, the disaggregated analysis is carried out for:

- Six Agroclimatic Zones - High-altitude and Tribal areas (HAT) zone, North coastal zone, Godavari zone, Krishna zone, Southern zone and Scarce rainfall zone;
- Three Farm Size Categories - Marginal farmers, small farmers and other farmers;
- Three Tenurial Category – Landless Tenants, Owner Tenants and Owner Farmers;
- Four Social categories – SCs, STs, BCs, and OCs.

The analysis includes the Agroclimatic Zones and farmers' categories with a minimum of 10 CNF and 10 non-CNF sample observations and CCEs for each crop. The crop-wise analyses are limited to paid-out costs, crop yields, and net value of crop output. CCE yields are used in this analysis. The number of sample observations and the number of CCEs in each zone, for each category of farmers for all the crops are given in Appendix Table 4.1. Wherever, there are no data or less than 10 observations or CCEs for any crop, those zones and farmers categories are deleted from the analysis of that crop. In this process, we have data for 7 major crops which are analysed in this chapter. Similarly, crop-wise yields, paid-out cost and net incomes of all crops for all the agroclimatic zones and all the categories of farmers are given in Appendix Table 4.2 of the Appendix to Chapter 4.

4.2. Paddy

Because of the large number of sample observations and CCEs of Paddy for both CNF and non-CNF, each agroclimatic zone and farmer category could be included in the analysis of the section. The data on the number of observations and CCEs is given in Appendix Table 4.1. Among the Agroclimatic Zones, the Southern zone has the most significant number of sample observations both for CNF and non-CNF farmers. Similarly, marginal farmers under farm size category have the largest number of sample observations and CCEs across CNF and non-CNF farmers. In terms of tenurial category, the owners' category of farmers has the largest number of sample observations and CCEs. Among social category of farmers, BCs have the largest number of sample observations and CCEs.

Paid out costs on Paddy: The paid-out costs for Paddy under CNF and non-CNF during the study period are presented at the disaggregated level in Appendix Table 4.2. Among the Agroclimatic Zones, CNF paid-out costs are lower than non-CNF paid-out costs by -34% in the HAT zone, while in the Southern zone, the CNF paid-out costs are higher than the non-CNF paid-out costs by 2%. Among the farmer size categories, the CNF paid out costs lower than the non- CNF paid out costs by -17% for marginal farmers but these are higher than the

non-CNF paid out costs by 10 per cent in the case of others category of farmers. Among the tenurial category of farmers, the CNF paid-out costs are lower by -14% in the case of owners' category of farmers and by -1% for tenants. Among the social category of farmers, the CNF paid-out costs are lower by 31% for the ST category of farmers and by - 3% for the OC category of farmers. Relatively poorer regions like HAT zone, North coastal zone and Scarce rainfall zone have obtained considerable savings in paid-out costs. And, the resource poor sections like ST, SC, marginal and small farmers have got benefitted, in terms of lower paid-out costs.

Yields of Paddy: Paddy yields under CNF and non-CNF, at the disaggregated level, during the study period are presented in Appendix Table 4.2. Though the CNF Paddy yields are more or less equal to that of non-CNF at the state level, in the majority of zones the yields were higher under CNF. A relatively resource poor zone like North Coastal zone (14 per cent), Scarce rainfall zone (8 per cent) and HAT zone (7 per cent) got higher Paddy yields under CNF compared to non-CNF yields. Among farmers' size category, the CNF yields are higher than the non-CNF yields by 3.2% in the case of small farmers and by 4.0% in case of others category of farmers. However, CNF yields are lower than the non-CNF yields by -0.2% in case of marginal farmers. Among the tenurial class category of farmers, the CNF yields are lower than the non-CNF yields for tenants (-0.3%) and owners (0.5%) categories, while the CNF yields are higher for owner cum tenant category of farmers (2.4%). For social class category of farmers, the CNF yields are higher for STs (-9.0%) and BCs (-1.5%) while the CNF yields are lower for SCs by (9.0%) and by 1.7% for OCs. The yields are mixed, although the CNF yields are more or less equal to the non-CNF yields at the state level.

Net Values of Paddy: The net value of Paddy output under CNF and non-CNF, at the disaggregated level, during the study period are presented in Appendix Table 4.2 Zone-wise analysis shows that, compared to the State average of 36 per cent higher net value of CNF Paddy output, the relatively resource poor zones including HAT zone (210 per cent), North coastal zone (73 per cent) and Scarce rainfall zone (46 per cent) fared better. On the other hand, relatively resource rich zones, particularly Godavari (-0.2 per cent) and Southern zone (-15 per cent did not get higher net value under CNF. All categories of CNF farmers under farm size categories realised better net values compared to non-CNF ranging from 13 per cent in other categories of farmers to 46 per cent for tenant category. Among the social category of farmers, only SC farmers received lower CNF net value (-17 per cent). All the other social categories of CNF farmers received better net values ranging from 7 per cent in case of OCs to 188 per cent for STs. Thus, nine out of 10 farmers' categories have obtained higher net value under CNF. However, there are no noticeable patterns to record. Due to the effect of savings in the paid-out costs and higher gross value, the CNF farmers received overall higher net values compared to non-CNF farmers.

4.3. Groundnut

Agroclimatic Zones and farmers' categories-wise number of CNF and non-CNF Groundnut sample observations and CCEs are shown in Appendix Table 4.1. Groundnut is predominantly cultivated only in the Rayalaseema districts. As a result, of most sample observations are from Southern and Scarce rainfall zones. The sample observations are not adequate for tenant

farmers, owner-cum-tenant farmers, SC and ST farmers and CCEs to be included in this crop's analysis.

Paid Out Costs of Groundnut: The paid-out costs of groundnut under CNF and non-CNF at a disaggregated level during the study period are shown in Table 4.2. The paid-out cost under CNF remained about the same across the Agro-climatic Zones and farmers categories in the range of ₹63,905 to ₹67,769. On the other hand, the paid-out cost under non-CNF varied widely across the Agro-climatic Zones and farmers categories in the range of ₹51,394 to ₹70,950. The CNF paid-out costs are lower in the scarce rainfall zone by -8 per cent but higher in the Southern zone by 19 per cent.

Yields of Groundnut: Though the CNF yields are marginally higher than that of non-CNF at the state level, it varied across the Agro-climatic Zones and farmers categories. CNF yields are higher by 11 per cent in the Southern zone but lower by -4 per cent in the Scarce rainfall zone. Across the farm size categories, the difference between CNF and non-CNF yields varied randomly. While marginal farmers and others category of CNF farmers got better yields by 2 per cent and 12 per cent respectively, small farmers received lower yields by -1.0 per cent. We have data for owner's category of farmers under tenurial category of farmers and the CNF yields in this category are lower than the non-CNF yields by -1.0 per cent. As per the results of social category of farmer, the CNF yields are higher than non-CNF yields for OC category by 17 per cent but lower by -5.0 per cent for BC farmers.

Net Value of Groundnut: Detailed disaggregated results are presented in Table Appendix 4.2. In terms of Agroclimatic zones, the net value of Groundnut output under CNF is higher by 8 per cent at the State level. The net values for both the Southern zone and the scarce resource zone for which data is available are higher in CNF by 18 per cent and 2 per cent respectively. In terms of farmer size categories, the net values of CNF Groundnut are higher by 30 per cent and 10 per cent respectively for others category of farmers and marginal farmers respectively. However, the CNF net values are lower by -1 per cent in case of small farmers. In tenurial category of farmers, the CNF net values are higher for the owner's category by 4 per cent. In terms of social category of farmers, the net value of CNF output is higher than that of non-CNF output by 33 per cent for the OC category but lower by -2 per cent for BC categories. Overall, the data indicates that the relatively better-off zone (Southern zone) and other farmers and OC farmers fared better under CNF[28].

4.4. Cotton

Appendix Table 4.1 gives the Agroclimatic Zones and the numbers by farmers' categories of CNF and non-CNF Cotton sample observations and CCEs. Given the sample size and CCEs number, the analysis is limited to two zones, Krishna and Scarce rainfall zones, and six farmers' categories, viz., marginal, small, other farmers, owner farmers, BC farmers, and OC farmers.

[28] It is broadly known that the soil quality is better in most parts of Southern zone compared to most parts of the Scarce rainfall zone, especially in Anantapur, where Groundnut is widely cultivated. It is also known that in general the medium and large farmers own/ cultivate fields with better quality soils.

Paid-out Costs of Cotton: The CNF paid-out costs of cotton are lower than the paid-out costs of non-CNF cotton at the State level by -0.92 per cent. As per Agroclimatic Zones, the paid-out costs of CNF are lower in the Krishna zone by -9 per cent while they are higher in the Scarce rainfall zone by 3 per cent. In terms of farm size categories, the CNF paid-out costs are lower by -10 per cent for marginal farmers but higher by 11 per cent and 7 per cent for small farmers and others category of farmers respectively. The CNF paid-out costs are lower for the owners' category of farmers by -3 per cent. In terms of social category of farmers, the paid-out costs of CNF and non-CNF are similar for BC farmers but higher by 2 per cent for OC farmers.

Yields of Cotton: Yields of CNF cotton is higher than the yields in non-CNF cotton by 5 per cent at the State level. Similarly, the CNF yields are higher in both the Krishna and scarce rainfall zones by 27 per cent and 8 per cent respectively. In terms of farm size categories, CNF cotton yields are better than non-CNF cotton yields by 22 per cent for marginal farmers and one per cent for small farmers. The yields are lower by -27 per cent for others category of farmers. The tenurial class is represented only by the owner category of farmers and the CNF yields are higher by 5 per cent compared to non-CNF yields for this category of farmers. Even across social classes the CNF cotton yields are higher by 16 per cent and 13 per cent respectively for BC farmers and OC farmers compared to non-CNF yields.

Net Values of Cotton: The Net values of Cotton output under CNF and non-CNF at disaggregated level and are presented in Appendix Table 4.2. The net values of CNF cotton are very much higher (10737%) owing to very low net values of non-CNF farmers at the State level. In terms of Agroclimatic zones, these values are very high in Krishna zone (7473%) but the difference is negligible in the Scare rainfall zone. In terms of farm size category of farmers, the net values of CNF output are positive for marginal farmers and negative for small framers and Others. These results indicate that smallholder farmers can also take full advantage of CNF.

4.5. Bengal Gram

Bengal gram is predominantly cultivated during the Rabi season. Hence, the data used in this section is predominantly Rabi data. Only a handful of Kharif observations are included. The number of sample observations and CCE of Bengal gram at the disaggregated level is presented in Appendix Table 4.1. Since the sample observations at the state level are relatively few, only a limited number of disaggregated units of analysis is available for discussion under this crop. The crop is predominantly grown in the Krishna zone, particularly in the erstwhile Guntur and Prakasam districts. Though it is also cultivated in the Southern and Scarce rainfall zones, the study did not get the minimum (10) CNF and non-CNF observations and CCEs. Hence, only the Krishna zone is included in the analysis, and four farmer categories, viz., marginal farmers, owner farmers, BC farmers and OC farmers, are included.

Paid-out Cost of Bengal Gram: Paid-out cost and yields of Bengal gram under CNF and non-CNF, at the disaggregated level during the study period are presented in Appendix Table 4.1. The CNF paid-out costs of Bengal Gram are lower by 5 per cent at the State level. In terms of Agro-climatic zones, the CNF paid out costs are lower in Krishna zone (-11%). This is the only zone for which the required observations are available. Similarly, the CNF costs are lower for marginal farmers by -11 per cent and also by owner-farmers category of farmers by -8 percent.

The paid-out costs are lower for OC farmers by -10 per cent but higher by 1 per cent for BC farmers.

Yields of Bengal Gram: The yields under CNF at the disaggregated level are presented in Appendix Table 4.2. CNF Bengal Gram yields are higher than non-CNF by 9 per cent at the State level. This is true for all the units of analysis. In terms of Agroclimatic zones, the CNF yields are higher by 3 per cent in the Krishna zone, 6 per cent for marginal farmers, 9 per cent for owners' category of farmers, 20 per cent for BC farmers and 8 per cent for OC farmers. This implies that, on the whole, CNF has performed better in terms of yields.

Net Values of Bengal gram: The values of Bengal gram output under CNF and non-CNF at disaggregated level are presented in Appendix Table 4.2. CNF Bengal Gram's net values are higher than non-CNF Bengal gram's net values by 17 per cent at the State level. The net value of Bengal gram is higher for CNF farmers over non-CNF farmers at all disaggregated levels of analysis: by 14 per cent in the Krishna zone, 9 per cent for marginal farmers, 19 per cent for owner's category of farmers, 24 per cent for BC farmers and by 19 per cent for OC farmers. The results indicate that farmers under CNF can benefit either through savings in the cost of cultivation or higher yields or higher prices, or any of two or all three factors.

4.6. Maize

The number of sample observations and CCEs of Maize at the disaggregate level are presented in Table Appendix 4.1. The crop is cultivated primarily on the Krishna and Scarce rainfall zones. It is also cultivated in both seasons, but mostly in the Rabi season. Given the suitable number of sample observations and CCEs under both CNF and non-CNF, four Agro-climatic Zones and eight farmers' categories are included in the analysis. The units left out of analysis are the Godavari and Southern zones, tenant and owner-cum-tenant farmers in which number of sample observations or CCEs are less than 10 either under CNF or non-CNF or both.

Paid-out Costs: Paid-out cost and yields of Maize under CNF and non-CNF, at disaggregated level during the study period are presented in Appendix Table 4.2. The paid-out costs of CNF Maize are lower than the paid-out costs of non-CNF Maize by -11 per cent at the State level. In terms of Agroclimatic zones, the paid-out costs under CNF are less than that of non-CNF in HAT zone (-43%), North Coastal zone (-34%) and Krishna zone (-21%). However, the paid-out costs of maize in CNF are higher than those of non-CNF farmers by a small margin of 0.4%. In terms of farm size categories, the paid-out costs of CNF Maize are lower by -13% for marginal farmers and by -2 per cent for small farmers. However, these costs are higher than the non-CNF costs by a margin of 17 per cent for others category of farmers.

Yields of Maize: At the State level, the CNF yields are higher by 9 per cent over non-CNF yields; out of four Agroclimatic Zones, the CNF yields are higher in the HAT zone (4%), Krishna zone ((9%), and Scarce rainfall zone (8%). The yields are lower in the North Coastal zone by -19 percent. As explained earlier, only owners' category of farmers is represented by tenurial category and the CNF yields for this category of farmers are higher by 6 per cent compared to non-CNF yields. In terms of social categories of farmers, the CNF yields are higher than the non-CNF yields for SC farmers (26%) and OC farmers (17%). In the case of ST and BC farmers, the yields are lower by -9 per cent and -1 per cent respectively.

Net Values of Maize: At the state level, the net values of CNF maize are 31 per cent higher than the net values of non-CNF farmers. In terms of Agroclimatic zones, the VNF net values are higher by 7 per cent in the HAT zone, 66 per cent in the Krishna zone, and 19 per cent in the scare rainfall zone. The only exception is the North Coastal zone, where the CNF net values are lower than the non-CNF net values by 6 percent.

4.7. Black gram

Black gram is predominantly cultivated in the Rabi season, especially as a follow-up crop after Paddy in the coastal districts. However, some of the CNF farmers are also cultivating Black gram in the Kharif season. All the available data on Black Gram are used in this report. The number of observations by Agroclimatic zone and farmers' category and CCEs of Black gram under CNF and non-CNF are shown in Appendix Table 4.1. The study got adequate number of observations and CCEs in four Agroclimatic Zones and seven farmers' categories.

Paid-out Costs of Black Gram: The paid-out costs of Black gram under CNF and non-CNF, at the disaggregated level during the study period are shown in Appendix Table 4.2. Black gram is usually cultivated with less inputs under non-CNF. Because of this reason, perhaps, the CNF farmers have incurred higher cost of cultivation over non-CNF. At the state level CNF farmers incurred additional paid-out cost by 21 per cent compared to non-CNF farmers.

In terms of Agroclimatic zones, the CNF paid-out costs of Black Gram are lower in the North Coastal Zone ((-25%), and the Scarce Rainfall zone (-35%). However, these costs are higher in the Godavari zone (31%) and the Krishna zone (40%). In terms of farm size categories, the CNF paid-out costs are 13 per cent higher for marginal farmers and by 57 per cent for small farmers. In terms of tenurial categories of farmers, the CNF paid-out costs are higher than the non-CNF paid costs by 143 per cent for tenants and by 10 per cent for owner categories of farmers. In terms of social class, the CNF paid-out costs are higher than the non-CNF paid-out costs by 21 per cent for SCs, 8 per cent for STs, 31 per cent for OC farmers.

Yields of Black gram: The yields of Black Gram for CNF and non-CNF farmers at the disaggregated levels are given in Appendix Table 4.2. The yields of Black gram under CNF are higher than that of non-CNF at the state level and also in all but one Agroclimatic Zones and all but one farmers' category covered for this crop.

CNF Black Gram yields are higher than non-CNF Black Gram yields by 7 per cent at the State level. At the Agroclimatic zone level, the CNF Black Gram yields are higher by 72 per cent in the North Coastal zone, 3 per cent in the Krishna zone and by 15 per cent in the scarce rainfall zone. However, these yields are lower than the non-CNF yields by -4 per cent in the Godavari zone. In terms of farm size categories, the CNF yields are higher by 9 per cent for marginal farmers and by 2 per cent for small farmers. For tenurial category of farmers also, the CNF costs are higher for tenants (1%) and owner categories of farmers (10%). In terms of social categories of farmers, the CNF yields are higher for BC farmers (25%) and OC farmers (3%).

Net Values of Black Gram: The net values of Black gram output under CNF and non-CNF at the disaggregated level during the study period are shown in Appendix Table 4.2.CNF farmers incurred higher paid-out costs at the state level (-1%) and in most units of analysis. Regarding Agroclimatic zones, the net values of CNF Black gram are higher in the North Coastal zone

(122%), and the Scarce rainfall zone (63%). However, these net values are lower than the non-CNF net values in the Godavari zone (-15%) and Krishna zone (-21%). In terms of farm size categories of farmers, the CNF net values are higher in marginal farmers by 9 per cent but lower by -23 per cent for small farmers. In terms of social category of farmers, the CNF net values are higher than the non-CNF net value by 42 per cent for BC farmers and lower by -27 per cent for SC farmers and by -11 per cent for OC farmers.

4.8. Chillis

Chilli is mostly cultivated in the Kharif season. As it is a long duration and multiple picks crop, its harvesting goes up to March, well into the Rabi season. As a result, very few farmers cultivate Chillis in the Rabi season. Chillis are cultivated predominantly in the Krishna and Scarce rainfall zones. Hence, the data are available only for a limited number of categories and Agroclimatic zones.

Paid-out Costs of Chillis: The paid-out costs of Chillis under CNF and non-CNF, at the disaggregated level, during the study period are shown in Appendix Table 4.2. Overall, in the State, the CNF paid-out costs of chilies are lower than paid-out cots of non-CNF farmers by -28 percent. CNF paid-out costs are lower in the Krishna zone by -41 per cent and by -22 per cent in scarce rainfall zone. In terms of farm size categories of farmers, CNF paid costs are lower by -24 per cent for marginal farmers and by -22 per cent for small farmers. Among the tenurial category of farmers, the costs of owners' category of CNF farmers are lower by -27 per cent compared to paid-out costs of non-CNF farmers. In terms of social category of farmers, the CNF paid-out costs are lower by -40 per cent for BC farmers and by -21 per cent for OC farmers. Compared to inter-zonal variations, different farmers categories experienced lesser variations in paid-out costs.

Yields of Chillis: The Chilli yields under CNF are lower than that under non-CNF by -5 per cent at the State level. per cent However, the variations are wide across the Agroclimatic Zones, ranging from -34 per cent in the Scarce rainfall zone to 21 per cent in the Krishna zone. The CNF yields are lower for marginal farmers (-9%) and for small farmers (-13%). The CNF yields are lower for OC farmers by -14 per cent and higher by 11 per cent for BC farmers. One of the reasons for the wider variations in crop yields is the differences in seeds used by CNF and non-CNF farmers in different locations. Another reason is pest attacks in different locations and in different time periods.[29] In the case of Chillis yields, the impact of seed improvements and pest attacks/ plant diseases is apparently larger than the impact of CNF.

Net values of Chillis: The net values of Chillis output under CNF and non-CNF at a disaggregated level during the study period are shown in Appendix Table 4.2. CNF farmers have obtained larger net value of Chillis output over non-CNF at the state level (42%). In terms of Agroclimatic zones, the CNF net values are higher in the Krishna zone by 193 per cent but lower by -32 per cent in the scarce rainfall zone. The CNF net values are higher for marginal farmers by 30 per cent and by 16 per cent for small farmers. The CNF net values are also

[29] If pest attacks or diseases are severe at the early stages, the farmers replace the crop. If pest attacks or diseases are severe, they would abandon field for that season.

higher for owners' category of farmers by 41 percent, BC farmers by 80 per cent and for OC farmers by 17 percent.

4.9. Conclusions

The results of the disaggregated analysis indicate that the state-level picture obtained indicates that, in general, resource-poor Agroclimatic Zones and farmers too can benefit equally from CNF. If the farmers are provided access to marketing infrastructure like warehouses and farmers producers companies (FPCs), the CNF farmers can get more benefits. CNF has proved to be a scale-neutral technology. However, a couple of broad patterns can be derived from the analysis.

1. The variations in the impact of CNF on farming conditions are higher across the Agroclimatic Zones compared to among farmers' categories. These trends were also observed in earlier studies. This indicates the need for agroclimatic zone-specific CNF packages.
2. Another broad inference, which is somewhat related to the previous insight, is that CNF has performed better in the southern part of the state, particularly in less irrigation intensive areas. However, CNF needs special attention in the Scarce rainfall zone, which has also relatively poor soil quality fields.
3. Another broad pattern observed is that relatively poorer sections such as tenant farmers, SC and ST farmers are confined to a few crops. They are conspicuously absent in commercial crops like Chillis and Cotton.

Appendix Tables to Chapter 4

Appendix Table4.1: Crop-wise number of CNF and Non-CNF sample observations and CCEs across agro-climatic zones and farmers categories in (Kharif plus Rabi) 2022-2023

Crop	Agroclimatic Zones & farmers' categories		No. of crop observations		Number of CCEs	
	Zones/Farmer Category		CNF	non-CNF	CNF	non-CNF
Paddy	**State**	AP	783	376	631	311
	Agroclimatic Zones	HAT	192	74	138	54
		North coastal	118	66	99	53
		Godavari	116	83	116	68
		Krishna	71	45	65	42
		Southern	254	77	190	68
		Scarce rainfall	32	31	23	26
	Farm size categories	Marginal	474	283	421	227
		Small	223	73	158	67
		Others	86	20	52	17
	Tenurial categories	Tenants	28	26	42	23
		Owner- tenants	37	20	44	20
		Owners	718	330	545	268
	Social categories	SC	97	21	80	18
		ST	190	65	139	47
		BC	273	167	235	153
		OC	223	123	177	93
Groundnut	**State**	AP	272	264	256	192
	Agroclimatic Zones	HAT	3	0		
		North coastal	5	4	5	4
		Godavari	5	0	2	
		Krishna				
		Southern	117	109	128	73
		Scarce rainfall	142	151	121	115
	Farm size categories	Marginal	122	165	148	104
		Small	94	78	66	63
		Others	56	21	42	25
	Tenurial categories	Tenants	4	1	3	1
		Owner-tenants	2	0	4	
		Owners	266	263	249	191
	Social categories	SC	38	13	27	5
		ST	10	0	10	
		BC	134	178	147	133
		OC	90	73	72	54
Cotton	**State**	AP	134	156	112	98
	Agroclimatic Zones	HAT	11	10	14	4
		North coastal	1	3	3	2
		Godavari	1	0		
		Krishna	35	34	34	33
		Southern	22	10	6	9

Crop	Agroclimatic Zones & farmers' categories		No. of crop observations		Number of CCEs	
	Zones/Farmer Category		CNF	non-CNF	CNF	non-CNF
		Scarce rainfall	64	99	55	50
	Farm size categories	Marginal	63	95	57	45
		Small	49	44	38	31
		Others	22	17	17	22
	Tenurial categories	Tenants	3	9	5	7
		Owner-tenants	8	9	9	12
		Owners	123	138	98	79
	Social categories	SC	31	14	28	7
		ST	12	9	14	1
		BC	47	97	44	66
		OC	44	36	26	24
Bengal Gram	**State**	AP	55	59	54	55
	Agroclimatic Zones	HAT				
		North coastal				
		Godavari				
		Krishna	38	40	39	39
		Southern	0	14		14
		Scarce rainfall	17	5	15	2
	Farm size categories	Marginal	49	37	45	31
		Small	4	12	7	15
		Others	2	10	2	9
	Tenurial categories	Tenants	0	2		2
		Owner-tenants	0	4	9	7
		Owners	55	53	45	46
	Social categories	SC	1	1	2	
		ST	1	0		
		BC	19	26	17	22
		OC	34	32	35	33
Maize	**State**	AP	272	198	229	150
	Agroclimatic Zones	HAT	11	21	13	20
		North coastal	34	26	40	30
		Godavari	22	8	10	8
		Krishna	108	37	109	35
		Southern	6	1		
		Scarce rainfall	91	105	57	57
	Farm size categories	Marginal	163	119	132	100
		Small	73	68	63	39
		Others	36	11	34	11
	Tenurial categories	Tenants	18	3	26	3
		Owner-tenants	13	9	13	8
		Owners	241	186	190	139
	Social categories	SC	70	25	57	18
		ST	13	26	16	11
		BC	134	109	110	92
		OC	55	38	46	29
	State	AP	312	106	284	102

Crop	Agroclimatic Zones & farmers' categories		No. of crop observations		Number of CCEs	
	Zones/Farmer Category		CNF	non-CNF	CNF	non-CNF
Black Gram	Agroclimatic Zones	HAT	14	1	12	
		North coastal	46	12	54	24
		Godavari	34	36	24	33
		Krishna	167	31	156	33
		Southern	20	4	14	2
		Scarce rainfall	31	22	24	10
	Farm size categories	Marginal	197	69	183	76
		Small	73	28	69	18
		Others	42	9	32	8
	Tenurial categories	Tenants	19	12	35	15
		Owner-tenants	23	7	22	5
		Owners	270	87	227	82
	Social categories	SC	102	14	89	16
		ST	11	0	11	
		BC	141	44	132	47
		OC	58	48	52	39
Chillies	State	AP	110	100	57	55
	Agroclimatic Zones	HAT				
		North coastal				
		Godavari				
		Krishna	67	38	41	30
		Southern		16		3
		Scarce rainfall	43	46	16	22
	Farm size categories	Marginal	77	66	38	35
		Small	19	26	12	14
		Others	14	8	7	6
	Tenurial categories	Tenants	2	7	2	9
		Owner-tenants	4	5	2	6
		Owners	104	88	53	40
	Social categories	SC	26	9	14	2
		ST				
		BC	27	40	12	28
		OC	57	51	31	25

Source: IDSAP, APCNF Field survey 2022-23

Appendix Table 4.2: Paid-out Cost, Yields, Gross Values and Net Values of Different Crops at disaggregated level in [Kharif plus Rabi] 2022-23

Crop	Agroclimatic Zones & farmers categories		Paid-out Costs				Yields				Gross value of output				Net value of output			
			₹1,000/ hectare		Difference between CNF & non-CNF		quintal/ hectare		Difference between CNF & non-CNF		₹1,000/ hectare		Difference between CNF & non-CNF		₹1,000/ ha		Difference between CNF & non-CNF	
			CNF	non-CNF	₹1,000/ ha	In %	CNF	non-CNF	quintal/ ha	In %	CNF	non-CNF	₹1,000/ ha	in %	CNF	non-CNF	₹1,000/ ha	in %
Paddy	State	AP	59.92	69.25	-9.34	-13	53.00	53.36	-0.36	-1	111.10	107.02	4.08	4	51.18	37.76	13.42	36
	Agroclimatic Zones	HAT	42.16	63.54	-21.39	-34	47.09	43.83	3.26	7	98.52	81.72	16.80	21	56.36	18.17	38.19	210
		North coastal	55.37	63.25	-7.88	-12	54.54	48.02	6.51	14	110.35	95.04	15.32	16	54.98	31.79	23.20	73
		Godavari	66.87	69.06	-2.19	-3	57.05	63.52	-6.47	-10	121.33	123.74	-2.41	-2	54.46	54.68	-0.22	0
		Krishna	66.31	92.94	-26.63	-29	55.63	53.55	2.08	4	110.72	108.00	2.72	3	44.40	15.06	29.35	195
		Southern	68.80	67.18	1.62	2	52.98	55.95	-2.98	-5	112.76	118.94	-6.17	-5	43.96	51.76	-7.80	-15
		Scarce rainfall	50.65	59.39	-8.74	-15	54.34	50.43	3.9	8	122.52	108.45	14.07	13	71.87	49.07	22.81	46
	Farm size categories	Marginal	59.64	72.22	-12.58	-17	53.54	53.3	0.24	0	111.96	108.35	3.61	3	52.32	36.13	16.19	45
		Small	59.58	63.10	-3.52	-6	51.03	54.27	-3.24	-6	108.94	104.35	4.59	4	49.36	41.25	8.11	20
		Others	62.44	56.66	5.78	10	54.69	50.67	4.02	8	110.77	99.31	11.46	12	48.33	42.65	5.68	13
	Tenurial categories	Tenants	69.38	70.40	-1.02	-1	56.6	56.91	-0.31	-1	118.50	104.08	14.42	14	49.12	33.68	15.44	46
		Owner-tenants	62.91	70.82	-7.91	-11	56.09	53.67	2.42	5	115.53	99.39	16.14	16	52.63	28.58	24.05	84
		Owners	59.42	68.83	-9.40	-14	52.48	53.04	-0.56	-1	110.09	107.42	2.67	2	50.67	38.59	12.08	31
	Social categories	SC	63.01	65.61	-2.60	-4	52.34	61.37	-9.03	-15	112.23	124.69	-12.46	-10	49.22	59.08	-9.87	-17
		ST	44.02	63.42	-19.40	-31	47.16	42.81	4.35	10	101.06	83.22	17.84	21	57.04	19.81	37.23	188
		BC	60.42	68.15	-7.73	-11	54.89	53.39	1.5	3	112.17	107.64	4.53	4	51.75	39.49	12.26	31
		OC	70.61	73.09	-2.48	-3	55.38	57.11	-1.73	-3	116.20	115.54	0.65	1	45.59	42.45	3.13	7
Groundnut	State	AP	64.76	63.40	1.36	2	25.91	25.5	0.41	2	174.07	165.08	8.99	5	109.31	101.68	7.63	8
	Agroclimatic Zones	Southern	66.55	55.90	10.66	19	27.24	24.65	2.59	11	190.00	160.60	29.40	18	123.45	104.70	18.75	18
		Scarce rainfall	65.59	70.95	-5.37	-8	25.24	26.38	-1.14	-4	166.33	169.24	-2.91	-2	100.75	98.29	2.46	2
	Farm size categories	Marginal	63.91	63.95	-0.04	0	24.68	24.3	0.38	2	166.97	157.54	9.43	6	103.07	93.59	9.47	10
		Small	64.39	61.47	2.93	5	27.31	27.7	-0.39	-1	182.91	180.70	2.21	1	118.52	119.24	-0.72	-1
		Others	67.77	66.40	1.37	2	28.07	25.01	3.06	12	186.18	157.69	28.49	18	118.42	91.30	27.12	30
	Tenurial categories	Owners	64.67	63.50	1.17	2	25.39	25.61	-0.22	-1	170.93	165.73	5.20	3	106.26	102.23	4.03	4
	Social categories	BC	64.76	65.01	-0.25	0	24.36	25.57	-1.21	-5	163.88	166.04	-2.16	-1	99.12	101.03	-1.91	-2
		OC	67.51	61.75	5.76	9	29.18	24.98	4.2	17	198.78	160.72	38.06	24	131.27	98.97	32.30	33
Cotton	State	AP	75.34	76.26	-0.92	-1	11.37	10.86	0.51	5	80.28	76.31	3.97	5	4.94	0.05	4.89	11,114
	Agroclimatic Zones	Krishna	70.76	77.64	-6.87	-9	15.16	11.92	3.24	27	115.13	78.22	36.91	47	44.37	0.59	43.79	7473
		Scarce rainfall	80.78	78.66	2.12	3	10.59	9.83	0.76	8	73.78	72.20	1.58	2	-7.00	-6.46	-0.54	-Ve
	Farm size categories	Marginal	72.62	80.59	-7.97	-10	12.84	10.5	2.33	22	90.30	71.33	18.98	27	17.69	-9.26	26.95	+Ve
		Small	77.90	70.36	7.55	11	10.04	9.94	0.1	1	69.15	71.76	-2.61	-4	-8.76	1.40	-10.16	-Ve

Crop	Agroclimatic Zones & farmers categories		Paid-out Costs				Yields				Gross value of output				Net value of output			
			₹1,000/ hectare		Difference between CNF & non-CNF		quintal/ hectare		Difference between CNF & non-CNF		₹1,000/ hectare		Difference between CNF & non-CNF		₹1,000/ ha		Difference between CNF & non-CNF	
			CNF	non-CNF	₹1,000/ ha	In %	CNF	non-CNF	quintal/ ha	In %	CNF	non-CNF	₹1,000/ ha	in %	CNF	non-CNF	₹1,000/ ha	in %
		Others	77.29	72.02	5.27	7	9.44	12.9	-3.47	-27	72.10	96.62	-24.52	-25	-5.20	24.60	-29.79	-Ve
	Tenurial categories	Owners	75.40	77.95	-2.54	-3	11.11	10.55	0.55	5	77.69	74.16	3.54	5	2.29	-3.79	6.08	+Ve
	Social categories	BC	79.82	80.76	-0.94	-1	11.9	10.25	1.66	16	86.16	74.50	11.66	16	6.33	-6.26	12.60	+Ve
		OC	76.91	75.44	1.47	2	15.09	13.31	1.78	13	110.98	89.03	21.95	25	34.07	13.59	20.48	151
Bengal Gram	**State**	AP	44.52	46.74	-2.23	-5	17.92	16.37	1.55	9	115.96	107.63	8.33	8	71.45	60.89	10.55	17
	Zones	Krishna	47.41	53.29	-5.88	-11	16.5	16.05	0.44	3	113.55	111.49	2.06	2	66.14	58.20	7.94	14
	Farm size categories	Marginal	45.83	51.37	-5.54	-11	17.91	16.86	1.05	6	114.66	114.37	0.30	0	68.84	62.99	5.84	9
	Tenurial categories	Owners	44.52	48.18	-3.67	-8	18.21	16.65	1.55	9	117.81	109.82	7.99	7	73.29	61.64	11.66	19
	Social categories	BC	43.19	42.63	0.56	1	20.05	16.68	3.37	20	121.56	105.74	15.82	15	78.38	63.11	15.27	24
		OC	45.05	50.13	-5.08	-10	17.38	16.17	1.22	8	115.88	109.84	6.04	5	70.83	59.71	11.12	19
Maize	**State**	AP	53.50	59.83	-6.33	-11	73.75	67.57	6.18	9	145.05	129.69	15.36	12	91.55	69.86	21.69	31
	Agroclimatic Zones	HAT	26.18	45.68	-19.50	-43	45.41	43.85	1.56	4	69.01	85.56	-16.55	-19	42.83	39.88	2.95	7
		North coastal	55.35	83.44	-28.09	-34	60.92	75.53	-14.61	-19	117.75	149.88	-32.13	-21	62.40	66.44	-4.05	-6
		Krishna	56.75	71.42	-14.66	-21	85.5	78.63	6.87	9	167.62	138.35	29.27	21	110.86	66.93	43.93	66
		Scarce rainfall	50.87	50.45	0.42	1	68.25	63.46	4.79	8	138.03	123.51	14.53	12	87.16	73.05	14.11	19
	Farm size categories	Marginal	53.51	61.83	-8.32	-13	71.58	65.71	5.86	9	139.65	125.07	14.58	12	86.14	63.25	22.89	36
		Small	57.13	58.29	-1.16	-2	74.4	71.52	2.88	4	147.62	138.59	9.03	7	90.48	80.29	10.19	13
		Others	51.65	44.32	7.33	17	81.02	70.53	10.49	15	161.69	140.64	21.05	15	110.04	96.32	13.72	14
	Tenurial categories	Owners	52.65	59.98	-7.33	-12	72.5	68.22	4.28	6	142.03	131.29	10.75	8	89.38	71.31	18.08	25
	Social categories	SC	55.11	64.48	-9.38	-15	84.86	67.32	17.55	26	167.12	126.31	40.81	32	112.01	61.83	50.18	81
		ST	33.82	49.43	-15.60	-32	53.14	58.27	-5.13	-9	84.08	112.70	-28.62	-25	50.26	63.27	-13.02	-21
		BC	56.20	60.08	-3.88	-6	67.18	67.68	-0.5	-1	135.27	131.97	3.30	3	79.07	71.89	7.19	10
		OC	55.36	61.60	-6.24	-10	82.88	70.93	11.95	17	161.34	131.01	30.33	23	105.98	69.41	36.57	53
Black Gram	**State**	AP	41.22	34.14	7.08	21	14.36	13.44	0.92	7	100.11	93.69	6.42	7	58.89	59.55	-0.66	-1
	Agroclimatic Zones	North coastal	6.52	8.70	-2.19	-25	10.42	6.08	4.35	72	63.68	34.46	29.22	85	57.17	25.76	31.41	122
		Godavari	39.25	29.91	9.34	31	15.87	16.61	-0.73	-4	110.53	113.73	-3.20	-3	71.28	83.82	-12.54	-15
		Krishna	51.55	36.93	14.62	40	15.66	15.17	0.48	3	111.22	112.63	-1.40	-1	59.67	75.69	-16.02	-21
		Scarce rainfall	31.67	48.83	-17.16	-35	16.1	13.95	2.16	15	117.83	101.81	16.03	16	86.16	52.98	33.19	63
	Farm size categories	Marginal	39.51	35.00	4.51	13	14.33	13.16	1.17	9	99.87	90.60	9.27	10	60.37	55.60	4.77	9
		Small	43.66	27.86	15.80	57	14.05	13.72	0.33	2	97.96	98.43	-0.47	0	54.30	70.57	-16.28	-23
	Tenurial categories	Tenants	44.13	18.18	25.96	143	15.19	14.98	0.21	1	110.26	112.87	-2.61	-2	66.13	94.70	-28.57	-30
		Owners	40.22	36.52	3.71	10	14.18	12.91	1.28	10	98.41	89.52	8.89	10	58.18	53.00	5.18	10
		SC	50.48	41.66	8.82	21	15.12	17.79	-2.67	-15	107.22	119.18	-11.95	-10	56.75	77.52	-20.77	-27

Crop	Agroclimatic Zones & farmers categories		Paid-out Costs				Yields				Gross value of output				Net value of output			
			₹1,000/ hectare		Difference between CNF & non-CNF		quintal/ hectare		Difference between CNF & non-CNF		₹1,000/ hectare		Difference between CNF & non-CNF		₹1,000/ ha		Difference between CNF & non-CNF	
			CNF	non-CNF	₹1,000/ ha	In %	CNF	non-CNF	quintal/ ha	In %	CNF	non-CNF	₹1,000/ ha	in %	CNF	non-CNF	₹1,000/ ha	in %
	Social categories	BC	35.71	32.91	2.80	8	14.04	11.22	2.83	25	96.41	75.80	20.61	27	60.70	42.89	17.81	42
		OC	42.37	32.45	9.92	31	14.76	14.34	0.42	3	106.22	104.09	2.13	2	63.85	71.65	-7.80	-11
Chilies	**State**	AP	223.79	310.15	-86.36	-28	51.88	54.37	-2.5	-5	1,147.28	960.76	186.52	19	923.49	650.61	272.88	42
	Agroclimatic Zones	Krishna	250.66	421.60	-170.94	-41	55.58	45.95	9.63	21	1,274.49	770.89	503.60	65	1,023.83	349.30	674.54	193
		Scarce rainfall	182.84	234.30	-51.47	-22	42.39	64.14	-21.75	-34	883.57	1,258.98	-375.41	-30	700.73	1,024.68	-323.95	-32
	Farm size categories	Marginal	240.01	315.44	-75.43	-24	47.09	51.51	-4.42	-9	1,088.68	965.76	122.92	13	848.66	650.32	198.34	30
		Small	210.80	269.21	-58.41	-22	54.08	62.41	-8.33	-13	1,012.03	958.40	53.64	6	801.23	689.19	112.04	16
	Tenurial categories	Owners	218.45	298.72	-80.28	-27	53.66	55.57	-1.91	-3	1,192.76	990.00	202.76	20	974.31	691.28	283.04	41
	Social categories	BC	202.60	334.95	-132.35	-40	61.05	55.12	5.93	11	1,465.20	1,034.96	430.24	42	1,262.60	700.01	562.59	80
		OC	262.00	330.68	-68.68	-21	46.67	53.96	-7.29	-14	936.42	909.21	27.21	3	674.41	578.52	95.89	17

Source: IDSAP, APCNF Field survey 2022-23

Chapter 5: Impact of CNF on Resources/ Input use

5.1. Introduction:

Apart from improving farming conditions, as discussed in the previous two chapters, CNF also has a positive impact on the use of various farm inputs, especially, natural resources; and also farm output. These changes, in turn, are expected to improve the wealth and well-being of the farmers. For example, land quality and productivity are expected to increase; further the land is expected to be used more intensively under CNF. All these changes may improve the value of land and annual returns from the land. As land is used throughout the year and put under multiple crops instead of mono-cropping, family labour could be utilized optimally in small quantities over a long period. This, in turn, will reduce the incidence of disguised unemployment and need for distress migration in agricultural families. Since CNF is based on cattle dung and urine, farmers are obliged to rear livestock. This will enable CNF farmers to reap the potential benefits from the symbiotic relationship between crop cultivation and livestock rearing. The savings in expenditure on agrochemicals would not only improve the financial conditions of the farmers, but also save them from their dependence on input and credit markets, which are often unfair, to the farmers. ***These issues are discussed in detail in the Kharif 2022-23 and Rabi 2022-23 reports. The major issues from those reports are illustrated below and the corresponding Tables are given in the Appendix.[30] Some of the monetized impact of CNF on resource use changes and farming conditions are discussed in chapter 7 below.***

5.2. Impact of CNF on Input Use

The inputs covered in the surveys are land, human labour, water, livestock, agriculture technologies/ practices and credit.

5.2.1. Impact of CNF on land use

In this section, three indicators, viz., (1) area cultivated, (2) area allocated to CNF and (3) crop cover over the fields, are analyzed. It is possible that land use could differ between the CNF and non-CNF farmers. But as the sample is drawn on the basis of identical cropping patterns, the difference could be limited in the present study. Still differences are visible. CNF farmers have cultivated 20 per cent more land during the study period in the state[31] and in all Agroclimatic Zones, and in seven out of 10 farmer categories (Table 5.1).

[30] Needless to say, this chapter provides a few glimpses of the impact of CNF on agriculture input/ resources use. More details can be seen in the Kharif 2022-23 and Rabi 2022-23 reports.
[31]The reasons could be less cost of cultivation and improved soil qualities.

Table 5.1: Average operated area for CNF and non-CNF farmers across Agroclimatic Zones & farmers' category in [Kharif + Rabi] 2022-23 (in hectors)

Agroclimatic zone & farmers' categories		Average operated area in Kharif		Average operated area in in Rabi		Total operated area in both seasons		Difference between CNF and non-CNF	
		CNF	non-CNF	CNF	non-CNF	CNF	non-CNF	in ha	in %
1	2	3	4	5	6	7	8	9	10
State	AP	1.04	0.80	0.47	0.46	1.51	1.26	0.25	20
Agroclimatic Zones	HAT	0.94	0.61	0.20	0.50	1.14	1.11	0.03	3
	North coastal	0.83	0.48	0.71	0.61	1.54	1.09	0.45	41
	Godavari	1.00	0.76	1.00	0.86	2.00	1.62	0.38	23
	Krishna	1.00	0.89	0.60	0.38	1.60	1.27	0.33	26
	Southern	1.14	0.71	0.48	0.43	1.62	1.14	0.48	42
	Scarce rainfall	1.09	0.92	0.33	0.43	1.42	1.35	0.07	5
Farm size categories	Marginal	0.54	0.55	0.28	0.21	0.82	0.76	0.06	8
	Small	1.35	1.29	0.56	0.71	1.91	2.00	-0.09	-4
	Others	2.79	2.50	1.16	3.28	3.95	5.78	-1.83	-32
Tenurial categories	Pure tenants	0.74	0.89	1.66	0.85	2.40	1.74	0.66	38
	Owner-tenants	1.41	1.95	0.27	0.62	1.68	2.57	-0.89	-35
	Pure owners	1.03	0.76	0.45	0.44	1.48	1.20	0.28	23
Social categories	SC	0.85	0.77	0.42	0.44	1.27	1.21	0.06	5
	ST	0.93	0.61	0.18	0.61	1.11	1.22	-0.11	-9
	BC	1.04	0.78	0.53	0.41	1.57	1.19	0.38	32
	OC	1.25	0.90	0.59	0.52	1.84	1.42	0.42	30

Source: *IDSAP, Field Survey 2022-23*

The CNF farmers' allocation of land to CNF has increased from an average of 0.35 hectares in Kharif 2019-20 to 0.53 hectares in Kharif 2022-23 (Appendix Table 5.1). Area allocated as percentage of total operated area has increased during last four Kharif seasons from 35 per cent in 2019-20 to 54 per cent in 2022-23 (Appendix Table 5.2). This is true across all Agroclimatic Zones and framers' categories. Further, 40 per cent of sample CNF farmers allocated their entire cropped area to CNF during Rabi 2022-23 (Appendix Figure 5.1). Such a shift, apart from improving the soil quality, reflects the growing confidence of the farmers and their trust in CNF. During the reference period - March 2022 to May 2023, CNF fields of CNF farmers have 187 days of crop cover, the non-CNF fields of non-CNF farmers have 167 days crop cover. That is, CNF fields have 20 days or 12 per cent of additional crop cover compared to non-CNF fields (Appendix Table 5.3).

5.2.2. Impact of CNF on labour use

On an average 20 per cent more labour is used under CNF than under non-CNF during Kharif 2022-23. It includes 25 per cent and 15 per cent higher own and hired labour respectively (Appendix Table 5.4). On an average 22 per cent more female labour and 16 per cent more male labour is used under CNF. On an average 21 additional labour days are used in CNF crops as compared to non-CNF crops in Rabi 2022-23. Out of these, over 17 days are own labour and about 4 days are hired labour. In relative terms about 31 per cent more own labour is used and only 6 per cent hired labour is used under CNF (Appendix Table 5.5). Of the 21 additional days employed in CNF, 12 are female days and nine are male days. But in relative terms 20 per cent more male labour is used compared to 15 per cent more female labour. On the other hand, as

high as 52 per cent more own female labour is used in CNF crops; the same is 16 per cent for own male labour (Appendix Table 5.6).

5.2.3. Impact of CNF on water use in crop cultivation

A majority of CNF farmers of all categories have reported that the water requirement for crop cultivation has come down. This is pronounced among farmers from all the Agroclimatic Zones except the Krishna Zone. Among the social category of farmers, a large percentage of ST farmers have reported that the water requirement for irrigation has come down (Appendix Table 5.7).

5.2.4. Integration of livestock with agriculture

APCNF is being developed on the symbiotic relationship between crop cultivation and livestock rearing. Apart from contributing to the development of agriculture, livestock can provide additional and diversified income sources to HHs. It was noticed in some villages that the markets are developing for livestock's dung and urine also due to CNF. Out of 1,331 sample HHs, 373 have purchased livestock because of CNF. The average number of livestock acquired is 2 (Appendix Table 5.8).

5.2.5. Avoidance of agrochemicals and adoption of CNF inputs

The major intervention under CNF is the replacement of agrochemicals with biological stimulants such as *Beejamrutham* and *Jeevamruthams*; botanical remedies such as *Asthrams* and *Kashayams*; and ecological principles such as border-crops, inter-crops, Pheromone traps, sticky-pads, etc.

On an average the CNF farmers have avoided 4.82 quintals of fertilizers per hectare in Rabi 2022-23. The avoided fertilizers are in the range of 0.40 quintals per hectare in Green gram to 8.50 quintals in Maize (Appendix figure 5.2)[32]. Apart from reducing the cost of cultivation, avoidance of fertilizers would lead to an improvement in soil quality; and in reduction of the fertilizers' subsidy of Government of India.[33] Needless to say, the avoidance of fertilizers would also lead to healthy food, improved human health and so on.

On an average the CNF farmers have avoided an expenditure of Rs. 12500 on agrochemicals per hectare, including ₹79,400 on fertilizers and ₹46,400 on pesticides in Rabi 2022-23. The avoided expenditure on agrochemicals is in the range of ₹4,8200 per hectare in Ragi to ₹20,950 per hectare in Maize (Appendix figure 5.3)[34]. Such savings in expenditure on agrochemicals,

[32] As mentioned above this chapter is drawn from the corresponding chapters of the Kharif 2022-23 and Rabi 2022-23 reports. A discussion about the comprehensive impact of CNF on agrochemical use in both seasons can be seen chapter 7 below.

[33]According to the Union Budget 2023-24 documents, in 2021-22, the GoI has spent ₹2,88,968.54 crore on Food subsidy and ₹1,53,758.10 crore on Fertilizer subsidy. The total expenditure on these two items was equal to 11.67 percent of total expenditure (₹37,93,801.00 crore) of GoI. As per the revised estimates (RE) of 2022-23, the GoI's expenditure on food subsidy (₹2,87,194.05 crore) and fertiliser subsidy (₹2,25,220.16 crore), together, accounted for 12.24 percent of total expenditure (₹41,87,232.00 crore).These documents were accessed on 16 February 2023 from https://www.indiabudget.gov.in/

[34]As mentioned above this chapter is an illustration of the corresponding chapters of the Kharif 2022-23 and Rabi 2022-23 reports. A discussion about the comprehensive impact of CNF on agrochemical use in both seasons can be seen chapter 7 below.

not only improves the financial conditions of the farmers, but also saves them from their dependence on input and credit markets which are often unfair to the farmers.

Instead of agrochemicals, CNF farmers are using PMDS, biological stimulants such as *Beejamrutham* and *Jeevamruthams*; botanical remedies such as *Asthrams* and *Kashayams* and ecological principles such border-crops, inter-crops, including Pheromone-traps, sticky-plates etc. All the farmers have adopted PMDS, and nearly 100 per cent adopted *Beejamrutham* and *Dravajeevamrutham*. Around 90 per cent of farmers have adopted *Kashayams*, *Ghanajeevamrutham*, Border crops and *Asthrams*. Over 40 to 70 per cent of farmers adopted Bund crops, Inter-cropping and other practices like Pheromone traps, sticky-pads, etc., (Appendix figure 5.4). It may be noted that some of the significant objectives of PMDS, border crops, bund crops and inter-cropping are to protect and feed the microbes in the soil, to break the spread of diseases and pests and to repel pests and insects.

5.2.6. Credit

Out of 1,331 sample CNF households, 1,079 have outstanding loans in 2022-23, i.e., 81 per cent of CNF households have current loans. The same is 91 per cent for non-CNF households (HHs). The CNF farmers have total 1,112 current loans. This indicates that the CNF farmers have 84 loans for every 100 sample HHs; the same is 94 per non-CNF farmers. Total loans outstanding of CNF HHs and non-CNF HHs are ₹8.21 crores and ₹6.21 crores respectively. On average, the borrowed amounted to ₹61,701 and ₹84,886 for each of the CNF and non-CNF sample HHs, respectively (Table 5.2). ***The CNF HHs also have lower outstanding loan. The data clearly indicates that the incidence of debt is considerably lower for CNF HHs compared to non-CNF HHs.***

Table 5.2: 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 (borrowed) amount	₹	8,21,24,536	6,20,52,029
Average borrowed amount per loanee	₹	76,112	93,032
Average borrowed 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

5.3. Conclusions

The evidence provided in this chapter clearly shows the positive impact of CNF on resource use and on farmers' well-being. This chapter gives a gist of the corresponding chapters in the Kharif and Rabi 2022-23 reports. More details can be seen in those reports.

Appendix Tables of Chapter 5

Appendix Table 5.1: Average area allocated for CNF across Agroclimatic Zones and farmers' category during last four Kharif seasons (in hectares)

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

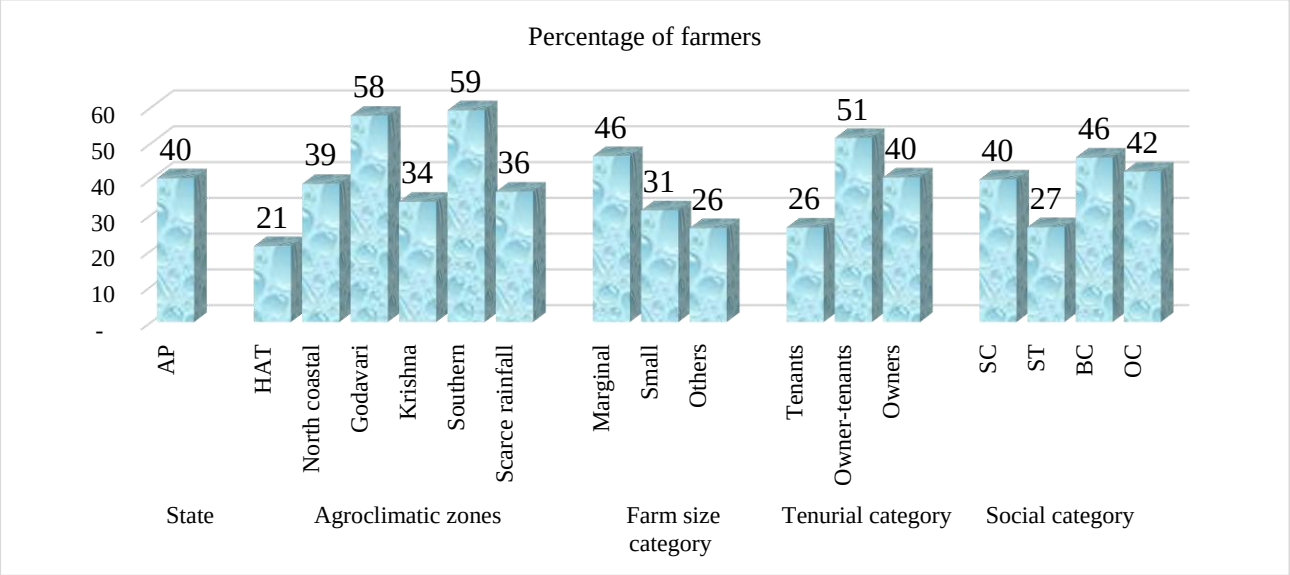
Source: IDSAP: Field Survey, 2022-23

Appendix Table 5.2: Percentage of cultivated area allocated for CNF across Agroclimatic Zones and farmers' category during last four Kharif seasons (in percentage)

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

Appendix figure 5.1: Percentage of farmers, who allocated their entire operated holdings to CNF according to Agroclimatic zone-wise & farmers' categories-wise during Rabi 2022-2023



Source: *IDSAP, Field Survey 2022-23*

Appendix Table 5.3: Number of crop cover days over CNF and non-CNF fields according to Agroclimatic Zones and farmers categories-wise during March 2022 and May 2023

Agroclimatic Zones and farmers categories	*Number of days*			% difference between CNF and non-CNF
	CNF	Non-CNF	Difference between CNF & non-CNF	
AP	**187**	**167**	**20**	**12**
Agroclimatic Zones				
HAT	161	192	-31	-16
North coastal	174	210	-36	-17
Godavari	152	128	24	19
Krishna	228	104	124	119
Southern	183	159	24	15
Scarce rainfall	197	171	26	15
Farm categories				
Marginal	173	133	40	30
Small	187	186	1	0
Others	222	195	26	14
Tenurial categories				
Tenants	213	143	70	49
Owner -tenants	212	157	55	35
Owners	184	168	17	10
Social categories				
SC	203	157	46	30
ST	158	190	-32	-17
BC	196	167	29	17
OC	188	154	34	22

Source: *IDSAP, Field Survey 2022-23*

Appendix Table 5.4: Own and hired labour used under CNF and non-CNF for each crop 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[35]	65	64	130	52	56	108	25	15	20

Source: IDSAP: Field Survey, 2022-23

Appendix Table 5.5: Average use of male and female labour under CNF and non-CNF for each crop 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[36]	46	84	130	40	68	108	16	22	20

Source: IDSAP: Field Survey, 2022-23

Appendix Table 5.6: Changes in the average* labour use due to CNF in different categories of labour in Rabi 2022-23

Indicator	Days/ hectare		Difference between CNF & non-CNF	
	CNF	Non-CNF	Days/ hectare	in %
Own male	35	30	5	16
Own female	34	22	12	52
Own Total	69	52	16	31
Hired male	17	13	4	29
Hired female	60	60	1	1
Hired total	78	73	4	6
Total male	52	43	9	20
Total female	95	82	12	15
Grand total	147	126	21	17

** Weighted average of seven crops covered in this report. The average area under each crop during last five Rabi seasons, at the state level, are used as weights*
Source: *IDSAP, Field Survey 2022-23*

[35]Weighted average of seven crops covered in this report. The area under each crop, at the state level, is used as weights.
[36]Weighted average of seven crops covered in this report. The area under each crop, at the state level, is used as weights.

Appendix Table 5.7: Farmers response about CNF impact (reduction) according to Agroclimatic zone and farmers categories'-wise 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
	OC	51	45	4

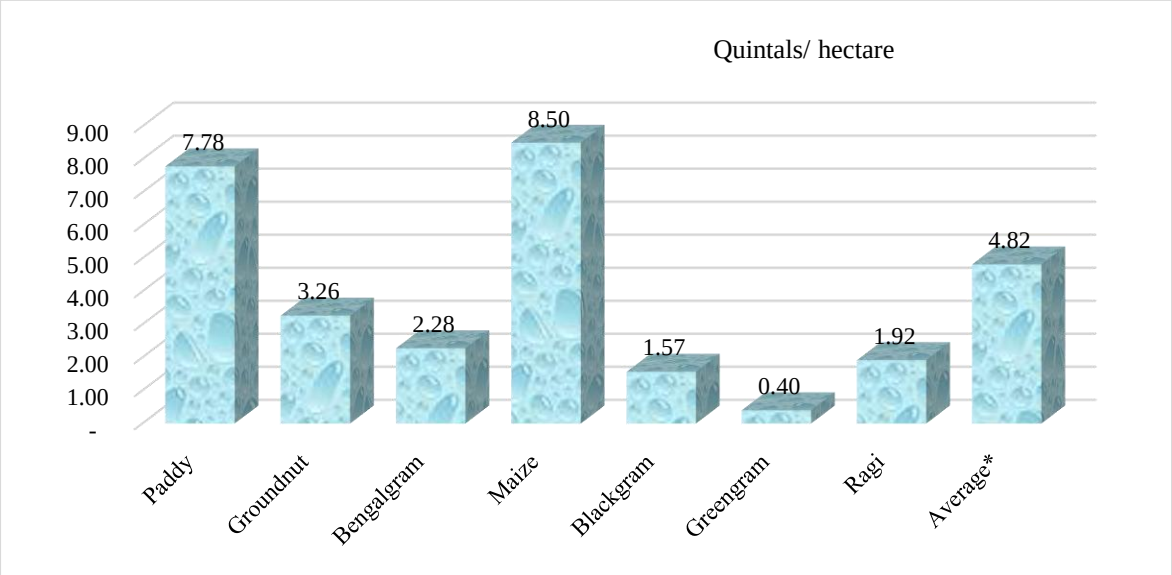
Source: IDSAP: Field Survey, 2022-23

Appendix Table 5.8: Number of CNF farmers purchased livestock and number livestock acquired for CNF according to Agroclimatic zone and farmers categories'-wise

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

Appendix figure 5.2: Crop-wise fertilizers avoided@ by CNF farmers in Rabi 2022-23

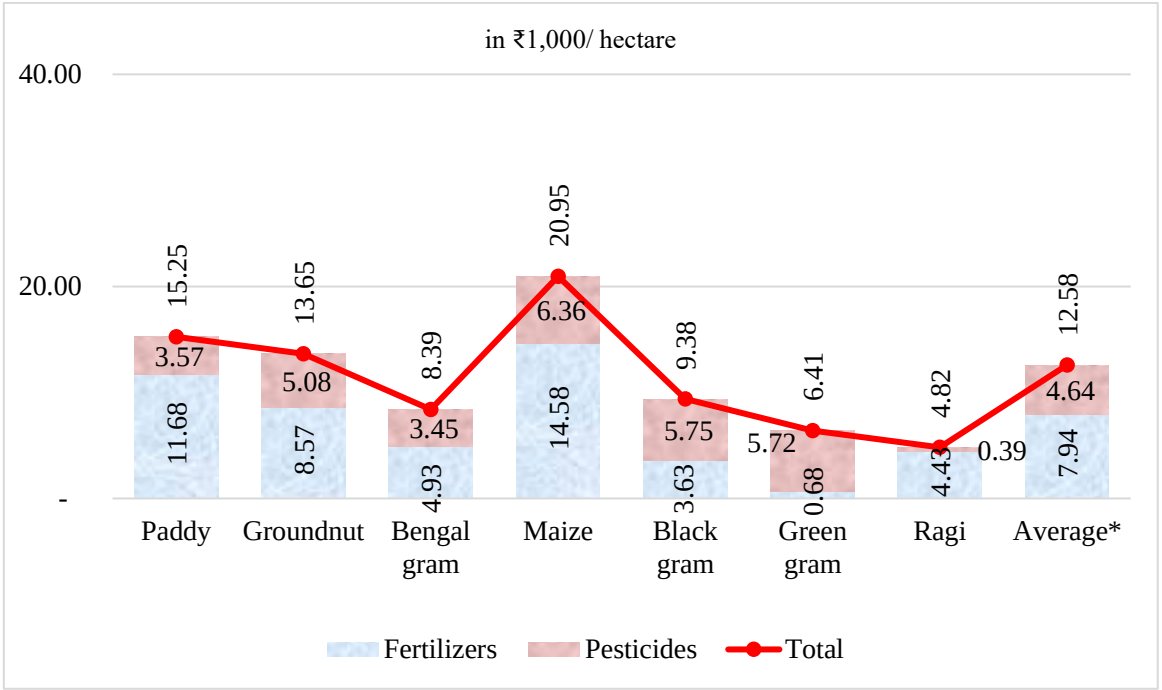


@ *These are actual quantities used by non-CNF farmers. These are considered as quantities avoided by CNF farmers in every hectare under S2S*

* *This is the weighted average of seven crops considered in the report. The average area under each crop during last five Rabi seasons, in the state, are used as the weights.*

Source: *IDSAP, Field Survey 2022-23*

Appendix figure 5.3: Crop-wise avoided expenditure on agrochemicals@ by CNF farmers in Rabi 2022-23

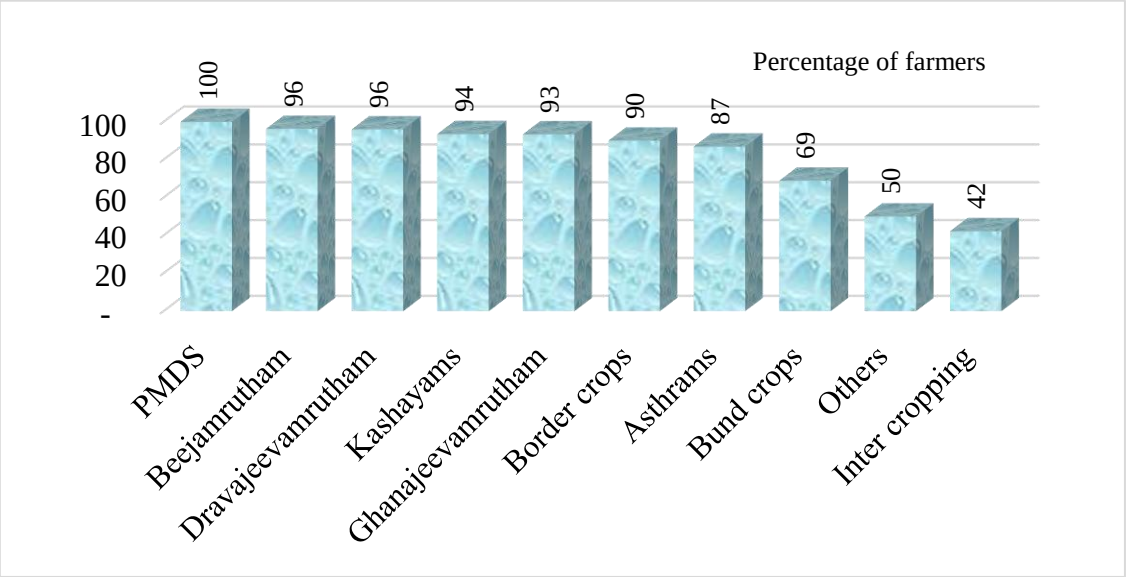


@ *These are actual expenditure on agrochemicals by non-CNF farmers. These are considered as avoided expenditure on agrochemicals by CNF farmers in every hectare under S2S*

* *This is the weighted average of seven crops considered in the report. The average area under each crop during last five Rabi seasons, in the state, are used as the weights.*

Source: *IDSAP, Field Survey 2022-23*

Appendix figure 5.4: Percentage of CNF farmers adopting different CNF practices and inputs during Rabi 2022-23



Source: *IDSAP, Field Survey 2022-23*

Chapter 6: Impact of CNF on Household Incomes

6.1 Introduction

It is well known, that income from crop cultivation is one of many sources of income for agricultural households (AHs). They get income from wages, salaries, self-employment, rental income from agricultural machinery, bullocks, implements, land, houses, buildings, remittances, transfers from government, etc. Chapters 3 and 4 indicated clearly that the CNF farmers have derived more crop income per hectare compared to non-CNF farmers from select crops. It may be noted that CNF and also non-CNF farmers cultivate other crops along with the 12 sample crops. Further, livestock is slowly becoming an integral part of CNF. It has been observed in the field and also mentioned in some of the previous years' reports that markets for cattle dung and urine are also developing in some villages. Apart from providing higher income, APCNF is expected to have a positive impact on the structure/ sources of income. However, such shifts take time. In this chapter, the household income from agriculture, including livestock, is discussed first before discussing the total household income from all sources. The rationale for such a discussion is to know the direct impact of CNF on farm income. The chapter covers the following issues.

1. Farming income during the agricultural year 2022-23
2. Impact of CNF on farming income across Agroclimatic Zones and farmer categories.
3. Source-wise composition of households' income of CNF and non-CNF farmers, in terms of number of households reporting and the amount earned.

Farming and household incomes are estimated based on reported yields of CNF and non-CNF farmers. One of the reasons for using the reported yields is the data availability for each household and for each crop. Further, the reported yields of all other crops have been used apart from the yields of the 12 sample crops considered in this report. As CCEs are conducted only for the select 12 crops, there is no other alternative. Needless to say, uniform methods are used for both CNF and non-CNF farmers, in every aspect.

6.2. Household income from agriculture

As mentioned above, apart from cultivating the 12 sample crops, which are the major crops in the state are also referred to as "major crops" in this chapter, farmers also cultivate other crops in different regions. All those crops are referred to as "other crops" in this chapter. Data have been obtained about those crops such as how many households are cultivating those crops, the cost of cultivation, yields, prices, gross and net value of outputof those crops. Further, in the case of CNF farmers, the 12 sample crops cultivated under CNF are considered **major crops**. If CNF farmers cultivate any of those 12 crops under non-CNF method or any other method, they are considered as **other crops**. In the case of non-CNF farmers, the sample 12 crops cultivated under non-CNF method or chemical-based method are considered as **major crops** and the rest areconsidered as **other crops**. In addition the net income from livestock has been

collected.[37] The total income from these three sources is considered as income from agriculture. As CNF and non-CNF sample farmers were selected based on the criterion of the cultivation of major crops. 100 per cent of CNF and non-CNF farmers have cultivated major crops during the study period. On the other hand, only 31 per cent of non-CNF household cultivated other crops vis-à-vis of 68 per cent of CNF households. About 59 per cent of CNF and 50 per cent of non-CNF household have obtained income from livestock farming during the study period (Table 6.1).

Table 6.1: Distribution of Number of CNF and non-CNF households who reported different sources of income during 2022-23

Sorce of income	Number		Percentage	
	CNF	non-CNF	CNF	non-CNF
Major crops	1,331	731	100	100
Other crops	906	223[38]	68	31
Livestock	781	364	59	50
All sources	1,331	731	100	100

Source: *IDSAP Field Survey 2022-23*

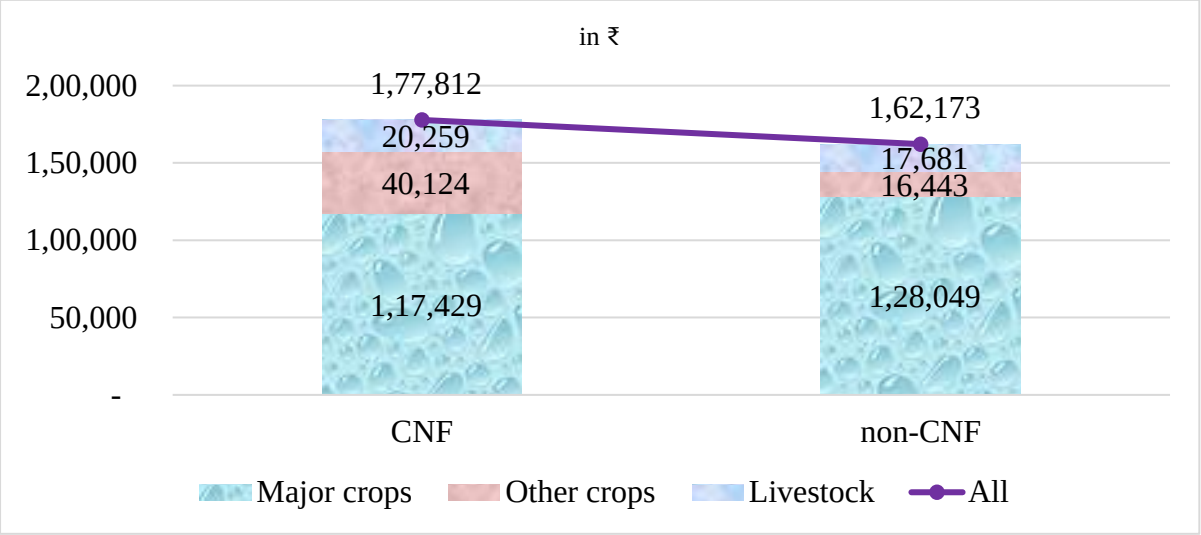
The average income obtained by CNF and non-CNF farmers from each of three components of agriculture, viz., major crops, other crops and livestock are shown in Table 6.2 and figure 6.1 On an average, the CNF farmers got 10 per cent or ₹15,639 more income than non-CNF farmers from agriculture. But CNF farmers obtained ₹10,620 (8%) less income from major crops than non-CNF farmers. One of the reasons for the relatively lower income obtained by CNF farmers from major crops is that CNF farmers usually allocate only a part of their operated holding for CNF crops. As a result, the CNF farmers have relatively smaller sized plots under major CNF crops as compared to major crops of non-CNF formers. Another possible reason is the composition of crop-wise observations (this issue is elaborated below). On the other hand, the CNF farmers got 144 per cent and 15 per cent higher income from other crops and livestock farming, respectively, over non-CNF farmers. CNF farmers have obtained 66 per cent of their agricultural income from major crops vis-à-vis 79 per cent by non-CNF farmers. This indicates a considerable and healthy diversification[39] in agricultural income for CNF farmers. CNF not only provided higher income but also provided a healthy diversified agriculture income for the participants. CNF is also contributing to a growing synergy between crop production and livestock rearing.

[37] Traditionally livestock was an integral part of crop cultivation, mutually reinforcing each other. The by-product of one sector used to be used as the input for another sector. This linkage was broken due to chemical-based agriculture and other factors. Under CNF, livestock is again becoming an integral part of crop cultivation.

[38] One non-CNF farmer in HAT zone, who operated over 10 acres, cultivated Strawberry on 10 acres and did some value addition and obtained over ₹50 lakh. He was considered as an outlier and omitted in the analysis in this chapter. It may be noted that even before he was omitted the CNF farmers got higher farm income.

[39] Diversified income from different crops and allied sectors is assumed to be healthy because of climate change related uncertainties. On the other hand, a diversified income from agricultural wages for cultivators is assumed to be unhealthy.

Figure 6.1: Source-wise agriculture income of CNF and non-CNF households in 2022-23



Source: *IDSAP Field Survey 2022-23*

Table 6.2: Source-wise agriculture income for CNF and non-CNF farmers in 2022-23

Source	Amount in ₹		Difference between CNF & non-CNF		Percentage share of each source	
	CNF	non-CNF	in ₹./	in %	CNF	non-CNF
Major crops	1,17,429	1,28,049	-10,620	-8	66	79
Other crops	40,124	16,443	23,681	144	23	10
Livestock	20,259	17,681	2,578	15	11	11
All	1,77,812	1,62,173	15,639	10	100	100

Source: *IDSAP Field Survey 2022-23*

Unlike previous years, the income of CNF farmers from major crops is less than that of non-CNF farmers. Apart from smaller plot sizes under CNF, another possible resaons is the sample composition. As mentioned in Chapter 1, both CNF and non-CNF samples are drawn, based on crop-wise data, to get a minimum number of sample observations for each crop. However, a farmer selected for one sample crop may be cultivating another sample crop also. As a result, the composition of sample crops for CNF and non-CNF farmers is not uniform. Among six high value crops, viz., Paddy, Groundnut, Cotton, Maize, Chillis and Tomato, the percentage share inCNF sample is high in two crops, viz., Paddy and Tomato; and their share in the non-CNF sample is high in four crops, viz., Groundnut, Cotton, Maize and Chillis (Table 6.3).[40] Given the very high net value of Chillis output, more than 10 times the average net value of all sample crops, the higher weightage of 7 per cent of Chillis crop in the non-CNF sample compared to 5 per cent in the CNF sample worked in favour of the income of non-CNF farmers.

Table 6.3: Composition of sample crops for CNF and non-CNF farmers in 2022-23 survey (in percentage)

Crop	CNF	Non-CNF
Paddy	33	25
Groundnut	12	18

[40] Such distribution is, at least partially, result of crop wise selection of sample. As the methodology of the study is evolving over the years, this issue would be addressed in the next years (2024-25) study.

Crop	CNF	Non-CNF
Cotton	6	10
Bengal gram	2	4
Maize	12	13
Black gram	13	7
Red gram	3	5
Chillies	5	7
Green gram	2	4
Ragi	8	4
Tomato	4	3
Total	100	100

Source: *IDSAP Field Survey 2022-23*

Though the difference between the agricultural income of CNF and non-CNF farmers is 10 per cent at the state level, it varied widely from (minus) -13 per cent in Southern zone to (plus) 62 per cent in the North coastal zone, across the Agroclimatic Zones. However, such variations are relatively moderate across the farmers' categories (Table 6.4). While relatively better-off or resource-rich zones such as North coastal, Godavari and Krishna zones got higher agriculture income under CNF, no such clear trend can be observed across the farmers categories. While marginal farmers got higher farm income, small farmers got less farm income under CNF. Similarly, while ST farmers got less income, SC farmers got higher income.

Table 6.4: Agricultural income of CNF and non-CNF households in 2022-23

Agroclimatic Zones& farmers categories		Total agriculture income in ₹		Difference between CNF and non-CNF	
		CNF	non-CNF	in ₹	in %
State	AP	1,77,812	1,62,173	15,639	10
Agroclimatic Zones	HAT	81,395	80,429	966	1
	North coastal	1,30,652	80,745	49,907	62
	Godavari	2,26,409	1,81,424	44,985	25
	Krishna	3,31,127	2,13,862	1,17,265	55
	Southern	1,55,267	1,78,169	-22,902	-13
	Scarce rainfall	1,59,964	1,64,557	-4,593	-3
Farm size categories	Marginal	1,44,156	1,29,541	14,615	11
	Small	1,91,591	2,24,475	-32,885	-15
	Others	3,12,555	3,79,247	-66,691	-18
Tenurial categories	Tenants	1,75,065	2,38,503	-63,438	-27
	Owner- tenants	2,36,243	3,15,609	-79,366	-25
	Owners	1,75,250	1,54,927	20,323	13
Social categories	SC	1,86,652	1,55,314	31,338	20
	ST	84,623	89,724	-5,101	-6
	BC	1,71,402	1,52,566	18,836	12
	OC	2,42,682	1,98,632	44,050	22

Source: *IDSAP Field Survey 2022-23*

6.3. Annual income of Households

This issue is discussed in two parts. Firstly, the number of households engaged in or receiving income from different sources and secondly, the amount obtained from each source.

6.3.1. Composition of households by income source

Apart from agriculture, farmer households obtain income from many other sources, such as agricultural wages, other wages, salary income from regular employment, self-employment in non-farm sectors, remittances, rental income, and so on. As mentioned above, CNF is expected to have a positive impact on the structure of the income of CNF households. The previous section has confirmed that relatively a higher number of CNF households are engaged in the cultivation of other crops and livestock farming. This may adversely impact their participation in other income-earning occupations. The study has collected data about different sources of households' incomes and the amount derived from each source, in 2022-23. The major sources of income included in the survey are agricultural income from major crops, consisting of 12 sample crops[41], other crops[42], livestock, wages, salary income, self-employment/ business income; rental income from agriculture machinery, implements, land, houses, buildings, commercial space, etc.; remittances; cash assistance received from the government; and others. The percentage of farmers reporting different sources of income, during the study period, are presented in Table 6.5. After agriculture, government cash assistances or transfers are the second most widespread source of income reported by 96 per cent of CNF farmers and 93 per cent of non-CNF farmers. As expected, a relatively smaller proportion of CNF farmers (60 percent) reported wages as source of income compared to 65 per cent by non-CNF farmers. Further, only 9 per cent CNF farmers reported salary income vis-à-vis 14 per cent by non-CNF farmers. On the other hand, relatively a higher proportion of CNF farmers reported self-employment/ business and others as sources of income during the study period. Interestingly, as many as 36 per cent of CNF and 23 per cent of non-CNF households reported income from other sources. Other income sources consist predominantly of poultry. Fisheries and NTFP collections are also reported by a handful of households, and they are included in other sources. The overall results once again support the results of previous years that CNF, apart from increasing farm income, also improves the quality of the sources of household income. Table 6.5: Number and percentage of CNF and non-CNF farmers' reporting different sources of their households' income

Sources	Number		Percentage	
	CNF	non-CNF	CNF	non-CNF
Agriculture	1,331	731	100.0	100.0
Cash assistance from Govt.	1,276	678	95.9	92.7
Wage income	801	473	60.2	64.7
Self-employment/ Business	135	55	10.1	7.5
Salary	114	105	8.6	14.4
Rents	27	21	2.0	2.9
Remittances	8	9	0.6	1.2
Others	477	171	35.8	23.4
Total income	1,331	731	100.0	100.0

Source: IDSAP, Field Survey 2022-23

[41] In the case of CNF farmers, the sample12 crops cultivated under CNF are considered as major crops. If CNF farmers cultivated the same 12 crops under non-CNF method or any other method, are considered as other crops. In case of non-CNF farmers, the sample crops cultivated under non-CNF method or chemical based method are considered as major crops. If those crops are cultivated under natural farming or organic farming or any other such method, are considered as other crops. [This information is already given at the beginning of the chapter. Repetition does not make for better reading]

[42] Ibid.

6.3.2. Amount of household income by source

The income obtained by CNF and non-CNF households by sources and their differences in 2022-23 are presented in Table 6.6. As a relatively smaller number of CNF households are engaged in wage labour and salaried employment, they got ₹4,886 and ₹11,680 less income from these two sources, respectively, compared to non-CNF households. Though a relatively greater number of CNF households reported self-employment in the non-agricultural sector as a source of income, they got ₹777 less income than non-CNF households from that occupation. In fact, CNF farmers got a higher income of ₹904 only from other sources (which is mostly poultry), along with agricultural income. On the other hand, non-CNF households got higher income in six out of eight sources included in Table 6.6. Further, non-CNF farmers got ₹6,586 higher household income than CNF. This is the first time that non-CNF households got higher income. In all previous years' studies since 2019-20, CNF farmers got higher household income. In some of the previous studies, though the non-CNF farmers got higher income in non-farm activities, the higher farm incomes of CNF farmers would compensate for the shortfall in non-farm incomes. But this year, higher farm income of CNF farmers is not able to compensate for the shortfall in non-farm income. As mentioned above, the crop-wise selection of the sample appears to be a reason. A relatively higher proportion of high value crops, especially Chillis, are found in the non-CNF sample (see Table 6.6). This could be because of differences in farm size between CNF and non-CNF farmers. Further, CNF does not have any impact on some other sources of household income, such as remittances, cash transfers from the government, regular employment, etc. The eligibility and accessibility of households determine the income from these sources.

Table 6.6: Sources-wise income obtained by CNF and non-CNF households and their differences in 2022-23

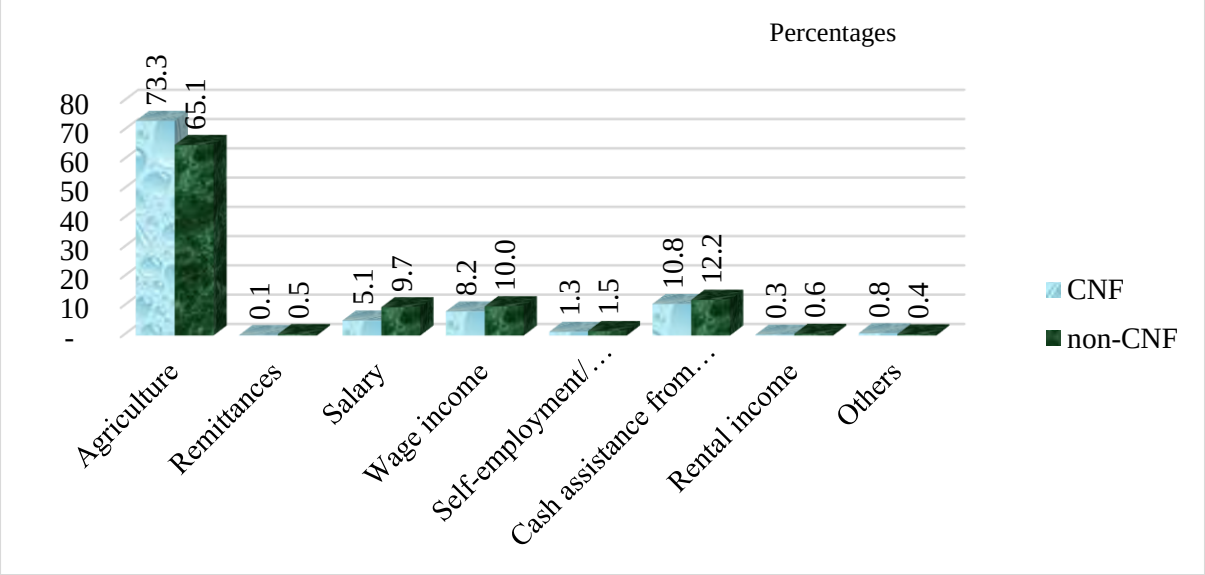
Sources	Amount in ₹		Difference between CNF & non-CNF		Percentage share	
	CNF	non-CNF	in ₹	in %	CNF	non-CNF
Agriculture	1,77,812	1,62,173	15,639	10	73	65
Remittances	359	1,224	-865	-71	0	0
Salary	12,410	24,090	-11,680	-48	5	10
Wage income	19,989	24,875	-4,886	-20	8	10
Self-employment/ business	3,057	3,834	-777	-20	1	2
Cash assistance from Govt.	26,151	30,365	-4,215	-14	11	12
Rental income	744	1,452	-708	-49	0	1
Others	1,928	1,024	904	88	1	0
Total income	2,42,450	2,49,036	-6,586	-3	100	100

Source: IDSAP, Field Survey 2022-23

The percentage shares of each source of income in total income of CNF and non-CNF households are given in Figure 6.2. Compared to non-CNF households, CNF farmers have a higher percentage of income from agriculture and other sources (poultry) and a lower percentage of income from the remaining six listed sources. It clearly indicates that CNF can

impact the structure of household income. The trend may gather momentum in the coming years.

Figure 6.2: Share of households' income from different sources for CNF and non-CNF farmers in AY 2022-23



Source: IDSAP, Field Survey 2022-23

6.4. Conclusions

The survey results in this chapter clearly indicate the potential of CNF in enhancing household farm income and bringing a synergy between crop cultivation and livestock rearing. In past studies, the disaggregated analysis showed that CNF benefits are reaching almost all parts of the state, with some minor exceptions and almost all sections of farmers in the state. But the pattern in this year's results is not equally positive. This may be due to annual fluctuations which are wide and common in agriculture in the state and the country. As mentioned above, structural changes, such as income sources of a household, take time. Even in these early days, the impact of CNF is visible.

Chapter 7: Potential impact of APCNF on agriculture in the state

7.1. Introduction

The crop-wise impact of CNF on farming conditions is analysed in Chapter 3. The impact of CNF on the income of individual households is discussed in Chapter 6. The potential impact of CNF on crop production, use of agrochemicals and labour use in the state are discussed in this chapter. As mentioned in the consolidated report of last year, the scope and methodology of this chapter have been evolving. Apart from covering the major farming indicators, such as paid-out costs, yields, gross value of crop output and net value of crop output, the potential use of fertilizers and potential changes in labour use are covered in this chapter.

7.2. Average CNF impact per hectare

In chapter 3, the impact of CNF on farming conditions is analysed for 11 crops individually. From that data, the weighted average values of these 11 crops per hectare were estimated, using the area under each of these 11 crops in the state as the weights in that chapter. The same (uniform) cropping pattern was used as weights for both CNF and non-CNF crops[43]. The average values of four indicators of farming conditions are presented in Table 7.1. On an average the CNF farmers spent ₹8,896 per hectare on PNPI and they saved ₹8,997 (50 percent) per hectare on PNPI, by avoiding non-CNF inputs. CNF farmers saved ₹6,303 (9 percent) per hectare in paid-out cost. On an average, CNF farmers obtained ₹11,284 (8 percent) higher gross value of output per hectare and ₹17,587 (27 percent) higher net value of output per hectare. These 11 crops together account for 74.33 per cent of the gross cropped area (GCA) in the state. Hence the average values of these 11 crops can be assumed to be the average values of all crops in the state.

Table 7.1: Average expenditure on PNPIs, paid-cost and gross and net value of output under CNF and non-CNF and differences in the state in AY 2022-23

Farming Indicator	₹/ hectare		Difference between CNF & non-CNF	
	CNF	non-CNF	₹/ hectare	Percentage
PNPIs	8,896	17,893	-8,997	-50
Paid-cost	62,532	68,834	-6,303	-9
Gross value of crop output	1,44,880	1,33,596	11,284	8
Net value of crop output	82,348	64,761	17,587	27

Note: - Compiled from tables of chapter 3

Source: IDSAP, Field Survey 2022-23

7.3. Potential benefits of APCNF

The potential benefits from APCNF that would accrue to the state, if the entire cropped area in the state is put under CNF are estimated. The estimation of potential benefits is simple and

[43]The area under each of the 11 crops covered in this report is shown in Figure 3.1.

straightforward[44]. But this is an academic exercise. The average benefits per hectare derived and presented in Table 7.1 are extrapolated with the average of the last five years GCA of 73.76 lakh hectares in the state. With a simple and realistic assumption that the average values of 74.33 per cent of GCA, would hold good for 100 per cent of GCA, the potential benefits are estimated and given in Table 7.2. If the entire GCA had been put under CNF, the state would have saved ₹6,636 crore (50 percent) in PNPI, ₹4,648 crore (16 percent) in paid-out costs; and would have attained ₹8,823 crore (8 percent) additional gross value of crop output and ₹12,971 crore (27 percent) higher net value of crop output. It is worth noting that the contribution of the gross value of crop output in the incremental net value of crop output is higher than that of the savings obtained in paid-out cost. This is the second time such a phenomenon has been observed. A similar trend was observed last year also.[45] This implies that the impact of CNF on crop yields and output prices is positive.

Table 7.2: Potential benefits from APCNF in the state, if the entire GCA is put under CNF in 2022-23

Farming Indicator	₹crores		Difference between CNF & non-CNF	
	CNF	non-CNF	₹crores	Percentage
PNPIs	6,561.30	13,197.10	-6,635.80	-50
Paid-cost	46,120.89	50,768.97	-4,648.08	-9
Gross value of crop output	1,06,857.19	98,534.61	8,322.59	8
Net value of crop output	60,736.31	47,764.90	12,971.41	27

Source: IDSAP, Field Survey 2022-23

7.3.1. Potential impact of CNF on crop output

The impact of CNF on crop output is analysed here. If the entire GCA is put under APCNF, the change in the output of 11 sample crops covered in this report in 2022-23 are shown in Table 7.3. As seen in chapter 3, out of 11 crops covered in this report, in eight crops, the yield differences are not statistically significant. Hence the output of those eight crops would have remained the same if the entire GCA had been allocated to CNF. At the same time, the output of Maize would have increased by 1.80 lakh tons (9.1 percent), by 0.72 lakh tons (9.5 percent) for Bengal gram and by 2.06 lakh tons (24.3 percent) for Tomato.

Table 7.3: Potential impact of APCNF on crop output, if the entire GCA is put under CNF during AY 2022-23

Crop	Output (lakh tons)		Difference between CNF & non-CNF		
	CNF	Non-CNF	Lakh tons	Percentage	Significance (of yields)
Paddy	121.22	122.04	-0.82	-0.7	ns
Groundnut	20.91	20.58	0.33	1.6	ns
Cotton	6.82	6.52	0.31	4.7	ns

[44] But it is a rough estimate as about 20 percent of GCA in the state is under horticulture. At least some of those have different practices.

[45] In the previous reports, savings in the paid-out costs were the major benefits in CNF.

Crop	Output (lakh tons)		Difference between CNF & non-CNF		
	CNF	Non-CNF	Lakh tons	Percentage	Significance (of yields)
Bengal gram	8.33	7.61	0.72	9.5	*
Maize	21.46	19.66	1.80	9.1	**
Black gram	5.50	5.15	0.35	6.8	ns
Red gram	1.73	1.57	0.17	10.7	ns
Chillies	8.51	8.92	-0.41	-4.6	ns
Green gram	1.57	1.67	-0.09	-5.6	ns
Ragi	0.49	0.50	-0.01	-1.6	ns
Tomato	10.56	8.49	2.06	24.3	*

Source: IDSAP, Field Survey 2022-23

7.3.2. Potential impact of CNF on the use of agrochemicals

If the entire GCA is put under CNF, the state would have avoided the use of 38.22 lakh tons of fertilizers in 2022-23. In the same year, the state would have avoided ₹13,197.10 crore expenditure on agrochemicals, including ₹8,069.98 crores on fertilizers and ₹5,127.12 crores on pesticides (Table 7.4). As mentioned above, avoiding the use of agrochemicals has larger social (health) and environmental benefits (soil quality improvement and mitigation of climate change).

Table 7.4: Potential impact of CNF on use of agrochemicals in the state in 2022-23

Indicator	Units	Total avoided quantities and expenditure
Quantity of fertilizers	Lakh tons	38.27
Expenditure on fertilizers	Crore ₹	8,069.98
Expenditure on pesticides	Crore ₹	5,127.12
Expenditure on agrochemicals	Crore ₹	13,197.10

Source: IDSAP, Field Survey 2022-23

7.4. Impact of CNF on labour use

Shortage of labour is often cited as one of the major constraints in the expansion of CNF. This issue is discussed in this section. A rough estimation is made of the additional labour requirement if the entire GCA is put under CNF.[46] As given in the Kharif and Rabi reports, on average, 23 and 21 additional person days per hectare are required in the Kharif and Rabi seasons, respectively, under CNF than under non-CNF. Using those field estimates and the average area under each crop and season in the state during the last five years, the additional labour requirement, if the entire GCA is put under CNF, is estimated and presented in Table 7.5. In total, 5.5 lakh additional persons (19 percent) are required if the entire area is put under CNF. These include 3.34 lakh persons of own labour and 2.25 persons of hired labour. Gender distribution-wise, CNF requires 4.08 lakh persons (22 per cent) of female and 1.52 lakh persons

[46] The study is focussed on major seasonal crops. Apart from seasonal crops, about 15 lakh hectares of GCA is under horticulture crops, whose labour requirements are quite different. However, it is **assumed** that labour requirements of those crops are broadly on the lines of seasonal crops. The process provides a broad and rough estimation of CNF impact on labour use.

of male additional labour. As per Census 2011, there were 33.1 lakh farmers and 109.8 lakh agricultural labourers. These days, the Government of AP is providing cash assistance under the Rythu Bharosa scheme to more than 52 lakh farmers. The additional labour requirement is about 2 per cent given the total number of agricultural workers, including farmers and agricultural labour. Further, disguised unemployment is huge in agriculture in view of its seasonal nature of agriculture. The additional requirement can be met easily in view of the overall number of agricultural workers. In addition, CNF can reduce disguised unemployment and increase the productivity of agricultural workers. As CNF is focusing on mixed cropping, crop rotation and crop diversity, the peak time demand for agricultural labour would be considerably reduced. It would enable the CNF farmers to optimize their labour use.

Table 7.5: Additional labour requirement, if the entire cropped area is put under CNF in 2022-23

Indicator	Lakh persons		Difference between CNF & non-CNF	
	CNF	Non-CNF	Lakh persons	in %
Own male	8.41	6.76	1.65	24
Hired male	2.86	3.00	-0.13	-4
Own female	7.11	5.42	1.69	31
Hired female	15.29	13.00	2.29	18
Total male	11.28	9.76	1.52	16
Total female	22.49	18.42	4.08	22
Total own	15.52	12.18	3.34	27
Total hired	18.25	15.99	2.25	14
Grand total	33.77	28.27	5.50	19

Source: *IDSAP Field Survey 2022-23*

7.5. Conclusions

The analysis indicates that the demand for chemical-free food and other output is on the rise and it is also fetching higher prices for CNF farmers. Avoiding the use of agrochemicals has larger health and environmental benefits, in addition to the economic benefits. The additional labour required for CNF is very low in comparison to the size of the manpower in state agriculture. Further, CNF enables participating farmers to optimize their labour use.

Chapter 8: Well-being of CNF farmers

8.1. Introduction

CNF has reduced agrarian distress by improving the financial conditions of the participating households and reducing their dependency on agrochemicals and credit markets. CNF contributed to the health of the households, and it has contained expenditure on household health by making available chemical residue-free food. CNF adds prestige to farming as a vocation and farmers no longer feel that they are tied up in a frivolous agricultural activity. A lot of data about all these issues have been collected during the Kharif 2022-23 survey and a detailed analysis was included in the Kharif 2022-23 report under the Farmers Wellbeing[47] chapter.[48] The findings are summarized in this chapter. The related Tables are provided in the Appendix.

8.2. Farmers' well-being

1. Over two-thirds of CNF farmers reported an improvement in their financial position.
2. Because of adopting CNF, farmers are able to avoid considerable expenditure on agrochemicals. Around 72 per cent of CNF farmers reported a decrease in the requirement for funds, and over 77 per cent reported a reduction in borrowing for agriculture.
3. About 54 per cent of CNF farmers experienced a considerable or moderate increase in new market channels.
4. Over 94 per cent of the farmers, at the state level, expressed their interest in farming, due to CNF.
5. At the aggregate level (state level), as many as 96 per cent of the farmers reported that they consume CNF food. According to about 97 per cent of the HHs, CNF food is not only healthy but also tasty.
6. From a minimum of 78 per cent to a maximum of 98 per cent of farmers across Agroclimatic Zones and categories of farmers have reported that their health status has improved either 'considerably' or 'moderately'. Improvement in the health status of households, naturally, leads to a reduction in their expenditure on health. About 73 per cent of the farmers stated that their health expenditure has decreased either 'considerably' or 'moderately' due to CNF.

[47] Well-being 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 consist of (1) Income and wealth, (2) Jobs and earnings, and (3) Housing. Further, the Report pointed out that the 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.

[48] That chapter did not address all indicators of well-being. Only a sub-set of well-being indicators relevant to CNF were analysed.

7. About 24 per cent of CNF farmers at the state level have experienced considerable public interest in CNF food/ output. Further, 58 per cent of farmers witnessed a moderate public interest in CNF output.
8. 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 per cent of the sample CNF farmers reported that they are getting respect from friends and relatives because of their adherence to CNF. CNF farmers are also getting respect and recognition in the markets. Some farmers said in FGDs, that they are getting priority in unloading their produce in the markets and also getting allocations of preferred slots and shops in the markets. Over 82 per cent famers, at the state level, said that they are getting considerable or moderate respect in the markets.
9. 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 (5) the CNF standing crop is less likely to be subject to the vagaries of the monsoon. 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.

8.3. Conclusions

The analysis clearly indicates that CNF has had a substantial positive impact on the well-being of farmers. This is the need of the hour. Apart from improving household income, it has had a positive impact on the health and education of the CNF households. CNF is freeing farmers from many compulsions and dependence.

Appendix tables of chapter 8

Appendix Table 8.1: 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.

Appendix Table 8.2: 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

Agroclimatic Zones & Categories of Farmers	Increased considerably	Increased moderately	No change	Decreased moderately	Decreased considerably
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.

Appendix Table 8.3: 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[49]	12,756	6,337	19,093

** These are actual expenditure on agrochemicals by non-CNF farmers. These are considered as the avoided expenditure by CNF farmers.*
Source: IDSAP: Field Survey, 2022-23

[49]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

Appendix Table 8.4: Agro-climatic zones 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 the difference in estimation methodology. While the figure in previous Appendix Table 8.3 was estimated through crop-wise weighted average, in this table all crops data was simply aggregated at zones and farmers categories level.*

Source: IDSAP: Field Survey, 2022-23

Appendix Table 8.5: 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

Agroclimatic Zones & Categories of farmers	Decreased considerably	Decreased moderately	No change	Increased moderately	Increased considerably
Godavari	42	58	-	-	-
Krishna	1	52	1	45	1
Southern	10	80	10	0	0
Scarce rainfall	2	75	24	-	-
AP	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.

Appendix Table 8.6: 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

Agroclimatic Zones & Categories of farmers	Decreased considerably	Decreased moderately	No change	Increased moderately	Increased considerably
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.

Appendix Table 8.7: 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

Agroclimatic Zones & Categories of farmers	Increased considerably	Increased moderately	No change	Decreased moderately	Decreased considerably
BC	9	38	52	2	0
OC	7	39	54	0	-
All	8	46	45	1	0

Source: IDSAP Field Survey, 2022-23.

Appendix Table 8.8: 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

Appendix Table 8.9: 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.

Appendix Table 8.10: 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
Agroclimatic Zones					
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	-

Agroclimatic Zones & Categories of farmers	Increased considerably	Increased moderately	No change	Decreased moderately	Decreased considerably
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

Appendix Table 8.11: CNF farmers response with respect to changes in respect they get from the relatives and friends due to CNF (in percentages)

Agro-climatic Zones & Categories of farmers	Increased considerably	Increased moderately	No change	Decreased moderately	Decreased considerably
Agro-climatic Zones					
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	-

Agro-climatic Zones & Categories of farmers	Increased considerably	Increased moderately	No change	Decreased moderately	Decreased considerably
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

Appendix Table 8.12: 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.

Chapter 9: Panel Study

9.1. Introduction

One of the unique features of this study is that it has a small number of panel farmers since 2018-19. The number of panel farmers was 260 from 26 GPs, at the rate of 10 farmers per GP and two GPs from each of the 13 erstwhile districts in 2019-20. Furthermore, 130 additional farmers from another set of 26 GPs at the rate of five farmers per GP and two GPs from each of the pre-reorganized 13 districts were included in the panel list in 2020-21. All 390 panel farmers have been selected from 52 GPs from all over the state. The principal objective of the panel study is to assess the transformative potential of CNF. It indicates that the study wishes to learn the long-term impact of CNF on the lives of the project participants/ CNF farmers beyond the short-term impacts, such as changes in the cost of cultivation, yields, profitability, etc. The expected long-term changes are all-round prosperity, including improved human resources development, command over CNF, improved soil quality and fertility, improved local natural resources, etc. However, such changes take time.

It is a well-known fact that in India, agriculture is a gamble, along with the vagaries of the monsoon. Apart from annual fluctuations in the weather and climate change related fluctuations, agricultural investment and returns fluctuate widely from year to year due to changes in the expectations of farmers (influence of previous years yields, prices and returns), availability of funds with the farmers, credit availability, government transfers, availability of farm inputs, output prices, etc. As mentioned in the previous report, given the wider annual volatilities in Indian and state agriculture, a smooth trend in improvement in the conditions of CNF panel farmers is not probable, especially in a short span of five years. Further, during the last five years, agriculture was affected by COVID-19 19 for two years. In addition, direct cash transfers are emerging as major sources of cash in the hands of farmers in recent years. Though medium to long-term data of 10-15 years is needed to show a clear improvement in the lives of panel farmers, the transformative potential of CNF can be seen by comparing the performance of panel farmers with the cross-section CNF farmers and also that of non-CNF farmers.[50] Evidently, both panel and cross-section farmers would experience similar weather

[50] It may be noted that data in this report and also in all previous reports clearly show that CNF farmers are far better off, compared to non-CNF farmers in all farming conditions related indicators, in almost all the crops. Hence the comparison is limited to CNF panel farmers and CNF cross-section farmers during last four years.

conditions in each year. ***The differences between the farming outcomes of panel and cross-section farmers can be attributed to the transformative potential of CNF.***

It may be worth noting that CNF itself is evolving. For example, PMDS has become an integral part of CNF. The panel farmers, who were selected 4-5 years ago, might be or might not be conversant with such changes. Further, the panel farmers need time to learn and perfect the art and science of CNF. These factors may also adversely affect the farming conditions of panel farmers in the short run. These are the possible limitations with respect to the panel study in the initial years. One of the positive features of the panel study is an improvement in data collection and coverage, which is also evolving. Because of these improvements and data over a number of years, the study is able to provide a better coverage of crops and a vigorous analysis of the data in this chapter.

Ideally, the time series data has to be analysed in the panel study. Given the nature of agriculture and the availability of data for only a few years, this chapter has adopted the following three methods/ indicators to understand the impact of CNF over the years.

1. A comparison of the farming outcomes of CNF panel and cross-section farmers of 2022-23.
2. A comparison of the household incomes of panel and cross-section farmers in 2022-23.
3. A comparison of the farming outcomes of panel farmers, CNF cross-section farmers and non-CNF cross-section farmers during the last five years. This issue is elaborated in the corresponding section below.

9.2. Farming outcomes of panel and CNF cross-section farmers 2022-23

By pooling the Kharif and Rabi data, the study obtained 10 plus cost observations and CCEs for eight crops. The crops include Paddy, Groundnut, Cotton, Bengal gram, Maize, Black gram, Green gram, and ragi. The crop-wise number of observations and CCEs of panel farmers are shown in Table 9.1. The number of crop observations varies from 16 for Green gram to 416 for Paddy. The number of CCEs varies from 16 for Green gram to 271 for Paddy.

Table 9.1: Crop-wise number of observations and CCEs for panel farmers during (Kharif plus Rabi) 2022-23

Crop	Crop observations	CCEs
Paddy	416	271
Groundnut	65	54
Cotton	19	19
Bengal gram	30	16
Maize	55	36
Black gram	53	51
Green gram	16	16
Ragi	26	26
Total	*680*	*489*

Source: IDSAP, APCNF Field Survey 2022-23

9.2.1. PNPIs

It is assumed that the microbes in the soil will multiply and continue their soil regenerative activity perpetually. Therefore, there is less need for repeated application *Ghanajeevamrutham* and *Dravajeevamrutham* over the years. For that, the soil should have conducive conditions in terms of soil temperature, moisture and aeration. However, the CNF farmers are tempted to invest more since they are experiencing an increasing return to scale. Further, they are also experiencing a relatively higher cash flow because of savings in the application of PNPIs and sale of intermittent CNF output from mixed crops, bund crops, border crops, etc., and would be interested in investing more in farming. Farmers get livestock waste, known as FYM as livestock rearing gets integrated, and apply the same in their fields irrespective of the need. Because of these factors, one may not be able to see clear trends in the application of PNPIs over short period of 4-5 years, which are the initial years. However, as mentioned in the time series analysis which is carried out in section 9.4 below, where the crop-wise expenditures of the panel and CNF cross-section farmers are compared, the panel farmers incurred less, but marginally less, expenditure on PNPIs vis-à-vis the cross-section farmers. The data is presented in Table 9.2. As pointed above that we need more time to see the full impact of CNF. Though on an average the difference in the expenditure on PNPIs by two sets of farmers is just ₹569 per hectare (6.7 percent) in PNPIs, the panel farmers have incurred considerably less expenditure on PNPIs in some crops. These include Green gram (-93.2%), Black gram (-68.8%), Ragi (-46.4%). On the other hand, they incurred higher expenditure on PNPIs in other crops. But the difference is quite small (Table 9.2).

Table 9.2: Crop-wise expenditure on PNPIs by the panel and cross-section farmers during [Kharif + Rabi] 2022-23

Crop	₹/ hectare		Difference between CNF & non-CNF	
	Panel	Cross-section	₹/ hectare	Percentage
Paddy	8,613	8,298	315	3.8
Groundnut	10,467	8,031	2,436	30.3
Cotton	9,648	14,745	-5,097	-34.6
Bengal gram	4,362	3,980	382	9.6
Maize	8,983	8,670	313	3.6
Black gram	2,560	8,200	-5,640	-68.8
Green gram	294	4,333	-4,039	-93.2
Ragi	3,001	5,597	-2,596	-46.4
Average	7,958	8,527	-569	-6.7

Source: IDSAP, APCNF Field Survey 2022-23

9.2.2. Paid-out costs

The crop-wise paid-out costs of the panel and CNF cross-section farmers are presented in Table 9.3. The panel farmers have lower paid-out costs compared to the CNF cross-section farmers in six out of eight crops covered here. Though the average difference is just 2.4 percent, the panel farmers have relatively larger savings in paid-out costs in Black gram (48.5%), Ragi (43.1%), Green gram (13.7%) and Bengal gram (12.3%). On the other hand, the panel farmers incurred more paid-out costs in Maize (17.7%) and Groundnut (8.4%). The data indicates that panel farmers can have more significant savings in their expenditure on PNPIs and paid-out costs in coming years.

Table 9.3: Crop-wise paid-out costs of panel and CNF cross-section farmers in 2022-23

Crop	₹/ hectare		Difference between CNF & non-CNF	
	CNF	Non-CNF	₹/hectare	Percentage
Paddy	59,649	59,915	-266	-0.4
Groundnut	70,224	64,759	5,465	8.4
Cotton	71,268	75,347	-4,079	-5.4
Bengal gram	39,034	44,517	-5,483	-12.3
Maize	62,984	53,500	9,484	17.7
Black gram	21,239	41,221	-19,982	-48.5
Green gram	23,821	27,594	-3,773	-13.7
Ragi	17,791	31,260	-13,469	-43.1
Average	**56,929**	**58,332**	**-1,403**	**-2.4**

Source: IDSAP, APCNF Field Survey 2022-23

9.2.3. Yields

The yields of panel farmers are expected to be higher than of cross-section farmers because of their longer experience in CNF. The soil quality in the panel farmers' fields is also expected to be better than that of cross-section farmers. However, the panel farmers might have rotated their CNF plots. Further, while 100 per cent of cross-section farmers adopted PMDS, the number is a little lower among panel farmers, which may depress the yields of panel farmers. Despite these issues, the panel farmers got higher yields in five of the eight crops considered in this section. Further, the panel farmers had higher yields in four out of significant crops, viz., Paddy, Groundnut, Bengal gram and Maize, which are cultivated independently. On the other hand, the cross-section farmers got higher yields in Black gram and Green gram, which are mostly grown on fields after the harvesting of the Paddy crop with the available residual nutrients and moisture in the soil.

Table 9.4: Crop-wise yields of panel and CNF cross-section farmers in 2022-23

Crop	Yield (q/ha)		Difference between CNF & non-CNF	
	Panel	Cross-section	quintals/ ha	Percentage
Paddy	54.26	53.00	1.26	2.4
Groundnut	26.34	25.91	0.43	1.7
Cotton	11.17	11.37	-0.20	-1.8
Bengal gram	19.00	17.92	1.08	6.0
Maize	82.59	73.75	8.84	12.0
Black gram	11.03	14.36	-3.33	-23.2
Green gram	11.28	13.01	-1.73	-13.3
Ragi	14.81	14.51	0.30	2.1

Source: IDSAP, APCNF Field Survey 2022-23

9.2.4. Prices

The prices realized by panel and cross-section farmers crop-wise are shown in Table 9.5. The panel farmers are expected to obtain higher prices for their CNF output because they have been in CNF for a longer period and are expected to be known as the suppliers of CNF crop output. However, the panel farmers obtained relatively lower prices in five out of eight crops covered in this analysis. However, the difference is considerable, i.e., more than 10 percent, only in two crops, Green gram (17%) and Bengal gram (10.9%). Interestingly, the panel farmers got higher prices for both crops. These findings indicate that more efforts are needed in the marketing of CNF crop output.

Table 9.5: Crop-wise prices realized by panel and CNF cross-section farmers during [Kharif + Rabi] 2022-23

Crop	₹/ quintal		Difference between CNF & non-CNF	
	Panel	CNF cross-section	₹/quintal	Percentage
Paddy	2,007	1,958	49	2.5
Groundnut	5,719	6,176	-457	-7.4
Cotton	6,353	7,039	-686	-9.7
Bengal gram	7,060	6,365	695	10.9
Maize	1,842	1,946	-104	-5.3
Black gram	6,664	6,892	-228	-3.3
Green gram	8,111	6,934	1,177	17.0
Ragi	2,708	2,734	-26	-0.9

Source: IDSAP, APCNF Field Survey 2022-23

9.2.5. Net value of crop output

The net value of output crop-wise is presented in Table 9.6. As expected, the panel farmers obtained a higher average net value of crop output, but this was marginal. At the same time, there are wide fluctuations across the crops. While the panel farmers obtained larger net values of 154.5% in Ragi, 35.2% in Bengal gram, 8.8% in Paddy, and 7.7% in Green gram; the CNF cross-section farmers got larger net values of 106.2% in Cotton, 16.2% in Groundnut, 9.5% in Black gram and 2.6% in Maize (Table 9.6). Annual and seasonal fluctuations, which are normal in agriculture in the state agriculture, explain a larger part of the observed wider variations across the crops. The fact that the panel farmers obtained a higher net value in Paddy, which is the most stable crop in the state, indicates that the panel farmers would get more benefit in the long run, as the annual and seasonal fluctuations are counterbalanced.

Table 9.6: Crop-wise net value of output of panel and CNF cross-section farmers in [Kharif + Rabi] 2022-23

Crop	₹/hectare		Difference between CNF & non-CNF	
	CNF	Non-CNF	₹/hectare	%
Paddy	55,693	51,180	4,513	8.8
Groundnut	91,557	1,09,315	-17,758	-16.2
Cotton	-306	4,934	-5,240	-106.2
Bengal gram	96,572	71,444	25,128	35.2
Maize	89,177	91,550	-2,373	-2.6
Black gram	53,301	58,887	-5,586	-9.5
Green gram	67,722	62,883	4,839	7.7
Ragi	23,859	9,375	14,484	154.5
Average	60,415	59,858	557	0.9

Source: IDSAP, APCNF Field Survey 2022-23

9.3. Household income

In the previous section, we provided a detailed analysis of a few individual crops. However, APCNF is moving away from single crop cultivation to multiple crops and from single season crops to 365 days green cover (365DGC). Further, livestock rearing is becoming an integral part of agriculture. All these changes need more human labour, and put more demand on family labour. As a result, one would expect a change in the occupational structure of the CNF families. They may forego income from other sources like wage employment, seasonal migration, etc. The study has collected all these data. This section compares the variations in the occupational structure of panel farmers and CNF cross-section households. Household incomes source-wise are also analysed between the two categories of households.

The income derived source-wise by the number and percentage of panel and CNF cross-section households is shown in Table 9.7. It is assumed that the panel farmers/ households would exhibit some difference in the sources of household income as compared to cross-section CNF and non-CNF households. It is interesting to note that 12 per cent of panel farmers did not cultivate the major crops. It appears, as mentioned above, that CNF is enabling the participants to shift from single-crop cultivation to multiple crops and from single-season crops to 365 days of green cover (365DGC). A relatively higher proportion of panel farmer are cultivating other crops and raising livestock. Compared to 60 per cent of CNF cross -section households, only 52 per cent of panel farmers reported wage labour as a source of income. At the same time, about a higher proportion of panel households by 12 percentage points have reported salary income as a source of income (Table 9.7). These trends reflect an improvement in human resources for the panel farmers, apart from other factors.

Table 9.7: Number and percentage of Panel and CNF cross-section farmers reporting different sources of their households' income in 2022-23

Source of income	Number		Percentage	
	Panel	CNF	Panel	CNF
Major crops	319	1,331	88	100
Other crops	252	906	69	68
Livestock	219	781	60	59
Sub-total agriculture	***363***	***1,331***	***100***	***100***
Cash transfers	329	1,276	91	96
Wage income	190	801	52	60
Self-employment/ Business	35	135	10	10
Salary	78	114	21	9
Rents	16	27	4	2
Remittances	5	8	1	1
Others	123	477	34	36
Total	**363**	**1,331**	**100**	**100**

Source: IDSAP, APCNF Field Survey 2022-23

The incomes of panel and CNF cross-section households' source-wise during the study period are shown in Table 9.8. Both panel and CNF cross-section households obtained over 73 per cent of their income from agriculture. This is not only because of higher productivity and profitability in agriculture, but also due to shifts in the occupational structure. Panel farmers

have obtained ₹10,605 (6%) higher agriculture income and ₹13,471 (6%) higher household income. These facts indicate the potential impact of CNF over the years.

Table 9.8: Source-wise income of panel and CNF cross-section households during 2022-23

Sources	Amount in ₹		Difference between Panel& CNF cross-section		Percentage share	
	Panel	CNF cross-section	in ₹	in %	CNF	non-CNF
Major crops	1,28,135	1,17,429	10,706	9	50.1	48.4
Other crops	41,848	40,124	1,724	4	16.4	16.5
Livestock	18,434	20,259	-1,825	-9	7.2	8.4
Agriculture	***1,88,417***	***1,77,812***	***10,605***	***6***	***73.6***	***73.3***
Cash transfers	22,500	26,151	-3,651	-14	8.8	10.8
Wage income	13,397	19,989	-6,592	-33	5.2	8.2
Self-employment/ business	4,738	3,057	1,681	55	1.9	1.3
Salary	22,102	12,410	9,692	78	8.6	5.1
Rental income	1,618	744	874	117	0.6	0.3
Remittances	1,010	359	651	181	0.4	0.1
Others	2,140	1,928	212	11	0.8	0.8
Total income	**2,55,921**	**2,42,450**	**13,471**	**6**	**100.0**	**100.0**

Source: IDSAP, APCNF Field Survey 2022-23

The above analysis has provided indirect evidence for the long-term potential of CNF. Yet another but more vigorous analysis is attempted below.

9.4. Impact of CNF over the years

9.4.1. Objectives

The purpose of this section is to study the impact of CNF on Costs, Yields and Returns (C/Y/R) in a comparative perspective. That is, we compare the randomly selected cross-section data of the households practicing CNF with those adopting conventional farming techniques (non-CNF) to comment on the promise that CNF holds. While CNF's superiority over conventional farming may egg farmers to experiment with the practice for a start, it requires that the practice exhibits encouraging results year after year, for the farmers to not drop out of it. For CNF to be taken up by farmers spontaneously it is necessary that it out-performs non-CNF. Besides, how it performs on its own in respect of C/Y/R in successive years also will have a determining influence on its prospects.

This understanding leads us to the second objective of this section; that is, to examine how C/Y/R under CNF fare over time as we transition from one year to the next. Basically, two data sets emerged from the field surveys undertaken by CESS/IDSAP over a five-year period; the

cross-section data collected from the CNF and non-CNF farmers and the panel data collected by visiting a small but the same set of CNF farmers over the years. The first objective noted above can be best addressed employing the cross-section data, whereas, the panel data is ideal for accomplishing the second objective.

9.4.2. The Data

We analyse the patterns observed in the data collected by CESS/IDSAP through field surveys over five years (from 2018-19 to 2022-23) administering structured questionnaires, on paid-out costs (Cost A1), yields (from crop cutting experiments) and net returns in trying to comment on the economic viability of CNF in a comparative perspective. The data has been generated in the process of assessing the impact of CNF on farmers and farming conditions in AP at the instance of RySS. Table 9.9 gives details on the sizes of the samples in the five years.

Table 9.9: Sample size of farmers in the cross-section study in different years: Kharif

Year	No. of farmers in cross-section sample	
	CNF	Non-CNF
(1)	(2)	(3)
2018-19	1,300	1,300
2019-20	1,169	628
2020-21	1,140	646
2021-22	1,186	748
2022-23	1,331	731

Source: IDSAP, APCNF Field Survey 2022-23

A few comments on the CNF farmers that constitute the panel sample are in order (Table 9.10). In the year 2018-19, the sample size of the panel farmers was 260 – drawn at the rate of 10 farmers from each of the 2 project villages of the 13 districts of the state. The panel sample includes a set of farmers different from the set included in the cross-section sample. Because of attrition (caused by drop outs from cultivation, migration, termination of lease agreements, death etc) not all panel farmers of 260 contacted in 2018-19 could be traced to in the surveys of later years. Next, in the year 2020-21, the sample size of the panel study was increased by another 130 farmers. (It may be noted that even some of the 130 farmers added to the panel sample in 2020-21 could not be contacted in the subsequent years).

The sample farmers of 381 of the year 2020-21 thus comprises 251 farmers of the original set of 260 and 130 additional farmers. Estimates of C/Y/R for the year are available separately for these two sample sets of 251 and 381 – and these separate estimates enabled us to include the year 2020-21 in the three-yearly averages of Period 1 (2018-19, 2019-10 and 2020-21) and Period 2 (2020-21, 2021-22 and 2022-23) arrived at to even out weather induced annual fluctuations.

Table 9.10: Sample size of farmers in the panel study in different years: Kharif

S. No.	Year	No. of farmers in the panel
(1)	(2)	(3)
I. Period 1		
I.1	2018-19	260
I.2	2019-20	253
I.3	2020-21*	251
II. Period 2		
II.1	2020-21**	381
II.2	2021-22	372
II.3	2022-23	363

* Estimates of C/Y/R of Period 1 are made working with a sample of 251 panel farmers for the period's last year, 2020-21 (see Appendix Table 3).
** Estimates of C/Y/R of Period 2 are made working with a sample of 381 panel farmers for the period's first year, 2020-21 (see Appendix Table 3).
Source: IDSAP, APCNF Field Survey 2022-23

The chapter limits its scope to three kharif crops only namely, paddy, groundnut and red gram. Cross-section data for CNF and non-CNF farmers is no doubt available for few more crops. But the panel data pertaining to the rest of the crops is sparse. The number of observations is too few for these crops to arrive at meaningful averages. Thus, the availability of panel data conditions the reporting of cross-section data in this chapter.

9.4.3. Methodology

The cross-section data of farmers practicing CNF can be used to comment on inter-year changes in C/Y/R from CNF – to test whether these quantities change over time; as one gets used to the practices, as the soil is exposed more and more to the practices. Such an analysis of the data emanating from the resurveys is useful, no doubt, but is subject to some limitations. First, the inter-year changes that we observe in the cross-section data may have been caused by variations in the characteristics of the households that comprise the samples of the individual years. C/Y/R may have changed from one year to the next, because the studies worked with sample households with different characteristics relating to, for example, work ethic, willingness and capacity to invest, family size and composition, number of years of acquaintance with CNF practices etc., (that is, these traits may have influenced the impact of CNF on C/Y/R). To overcome this limitation, CESS/IDSAP has additionally collected panel data from households practicing CNF. The inter-year comparison of panel data helps us to know whether C/Y/R from CNF are increasing, decreasing or remained stable, holding constant the characteristics of the sample households. The panel data enables us to study the pure effect of CNF on C/Y/R. To repeat, the inter-year comparison of cross-section data may give erroneous conclusions because the characteristics of the sample households that make up the sample change from one study year to the next. But with panel data this is least likely to happen.

Note, however, that the basic problem with both the cross-section data and the panel data remains – that is, they can be vitiated by the weather outcomes and other extraneous factors. To circumvent this problem, we have worked with the quantities of C/Y/R averaged over two periods, called Period 1 and Period 2. The averages of the Period 1 are those corresponding to the first three years (2018-19, 2019-20 and 2020-21) of the five-year data and those of the Period 2 are those relating to the later three years (2020-21, 2021-22 and 2022-23) of the five-year data. Note that the year 2020-21 is common to both the Period 1 and Period 2. (What we have attempted is to arrive at moving averages, while ensuring that the sample sizes in both the periods are about the same – 260 in Period 1 and 390 in Period 2).

Next, we can no doubt use panel data in inter-year comparisons. But the problem is paid-out costs/net returns (C/R) change over time due to changes that are real and nominal. We seek to overcome this limitation by adjusting the panel data for changes in prices employing appropriate indices. In this chapter we have employed the indices of the average wage rate for harvesting, winnowing and threshing as applicable to males to express the paid-out costs in real terms. To express the net returns in real terms we have used the indices of the average farm harvest prices of the paddy, groundnut and red gram. The corresponding data is sourced from the Season and Crop Reports of AP. Cross-section data is not adjusted for price rise because it will not be used for inter-year comparisons where changes in prices matter.

CNF may be said to be viable if (1) paid-out costs are lower, (2) yields are higher and (3) net returns are higher under the practices relative to non-CNF. We explore if they are really so, based on the cross-section data, in the five years under consideration and within the individual Periods 1 and 2. A static analysis is involved here and is presented immediately below.

9.4.4. Results and discussion: analysis of cross-section data

9.4.4.1 Profiles of the Sample Households

The average picture that emerges from an analysis of the 5-year data on social, economic and demographic features of CNF and non-CNF farmers is that: (1) SCs and STs are more predominant among CNF farmers than among non-CNF farmers, (2) the small and marginal farmers figure as prominently among CNF farmers as among non-CNF farmers, (3) the young and middle-aged farmers constitute a larger proportion among CNF farmers than among non-CNF farmers and (4) those with secondary education and above form a larger proportion among CNF farmers than among non-CNF farmers (Table 9.11).

Table 9.11: Profiles of farmers practicing CNF and non-CNF: summary table giving average picture of the five study years (%)

S. No.	Characteristics of farmers	% of farmers practicing	
		CNF	Non-CNF
(1)	(2)	(3)	(4)
1	SCs and STs	32.37	19.11
2	Small and marginal farmers (<= 2ha)	87.96	87.69
3	Farmers aged 40 years or less	34.93	27.94
4	Farmers with secondary education & above	44.07	38.84

Source: IDSAP, APCNF Field Survey 2022-23

The observations (1) and (2) together would mean that CNF is accessible to the disadvantaged sections. Put differently, the disadvantaged sections are not averse to taking to CNF, even though it is ostensibly risky and it is still early days to practice CNF. The observation (3) would amount to the fact that younger farmers, who are likely to be less risk-averse and more enterprising are the main stay of CNF. The observation (4) subscribes to the widely held notion that education aids participation in CNF.

Viability of CNF vis-à-vis non-CNF

In the analysis below, we seek to answer the following questions:

(1) Are paid-out costs lower under CNF relative to non-CNF?

(2) Are yields higher under CNF relative to non-CNF?

(3) Are net returns higher under CNF relative to non-CNF?

9.4.4.2 (a) Are Paid-Out Costs Lower Under CNF Relative to Non-CNF?

Detailed data on the paid-out costs (₹/ha) for the three kharif crops of paddy, groundnut and red gram for the five years of study, separately for CNF and non-CNF farmers, are given in Appendix Table 9.1. The table also provides a statistic – paid-out costs under CNF as a per cent of non-CNF (columns 4,7, and 10) – to reflect on the viability of CNF. For CNF to be considered viable the statistic should be less than 100 and it is indeed so in respect of the three crops and in the five years under consideration, barring one exception. To better reflect the standing of CNF relative to non-CNF we may compare the paid-out costs averaged over Periods 1 and 2 (Table 9.12). The comparison unexceptionally shows that the costs in respect of the CNF are lower than in case of non-CNF for all the three crops and in both the Periods– the statistic is invariably less than 100 per cent.

That the paid-out costs of cultivation are less under CNF than under non-CNF is beyond doubt. On an examination of the individual components of paid-out cost, we notice that bulk of the saving in costs under CNF is due to the use of biological inputs in lieu of chemical fertilisers and pesticides used under non-CNF (Appendix Table 9.2). The biological inputs used by CNF farmers formed between 31.82 per cent and 53.99 per cent of chemical inputs used by non-CNF farmers during the years under study in respect of paddy. The saving in cost effected by CNF farmers in case of groundnut and red gram was less, but there was saving none-the-less.

Table 9.12: Paid-out costs (₹/ha) (current prices), yields (Qtls/ha) and net returns (₹/ha) (current prices) of selected crops in period 1 and period 2 for farmers in the cross-section study

S. No.	Variable name	Paddy		Groundnut		Red Garm	
		Period 1	Period 2	Period 1	Period 2	Period 1	Period 2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I	Avg. paid-out costs under:						
I.1	CNF	40,956	53,546	40,935	51,838	15,735	25,202
I.2	Non-CNF	51,156	66,315	43,383	54,927	25,361	28,613
I.3	CNF as % of non-CNF	80.06	80.74	94.36	94.38	62.04	88.08
II	Avg. yields under:						
II.1	CNF	50.01	50.69	17.33	20.62	6.95	6.75
II.2	Non-CNF	49.20	47.33	15.84	20.29	6.71	5.93
II.3	CNF as % of non-CNF	101.65	107.10	109.41	101.63	103.58	113.83
III	Avg. net returns under:						
III.1	CNF	49,952	49,050	45,636	54,489	21,631	18,207
III.2	Non-CNF	35,377	28,267	29,119	35,970	7,709	8,094
III.3	CNF as % of non-CNF	141.20	173.52	156.72	151.48	280.59	224.94

Source: IDSAP, APCNF Field Survey 2022-23

Table 9.13: Individual cost components of paid-out cost under CNF as per cent of non-CNF for different crops and for periods 1 and 2

Years/Inputs	Costs under CNF as % of Non-CNF		
	Paddy	Groundnut	Red Gram
(1)	(2)	(3)	(4)
I. Period 1 (1) Seeds	107.76	95.51	59.55
(2) Human labour	91.00	113.78	77.09
(3) Bullock labour	174.80	70.68	96.57
(4) Machine labour	93.97	76.64	59.91
(5) Biological inputs/Chemical inputs	35.49	73.17	48.83
(6) Others:	109.47	156.17	61.48
(7) Paid-out costs: Total	80.06	94.36	62.04
II. Period 2			
(1) Seeds	105.46	107.46	108.15
(2) Human labour	85.69	107.39	110.34
(3) Bullock labour	82.40	102.77	118.93
(4) Machine labour	94.21	77.88	86.32
(5) Biological inputs/Chemical inputs	46.09	56.92	67.31
(6) Others:	100.05	150.04	83.18
(7) Paid-out costs: Total	80.74	94.37	88.08

Source: IDSAP, APCNF Field Survey 2022-23

As was done earlier, we group our data under Period 1 and Period 2 and examine the significance of different heads of cost within each of the two periods (Table 9.13). The exercise shows that biological inputs cost much less under CNF relative to chemical inputs under non-CNF. In respect of other components of paid-out cost, there is indication that CNF farmers

incurred less expenditure compared to non-CNF farmers in respect of machine labour. Further, there is no sign that the cost of hired human labour followed a definite pattern – no sign that this cost is more under CNF relative to non-CNF.

9.4.4.3 Are Yields Higher Under CNF Relative to Non-CNF?

As with paid-out costs, yields too turned favourable under CNF. Yields (Qtls/ha) are generally higher under CNF compared to non-CNF, albeit marginally, in respect of the three crops and five years (Appendix Table 9.1). Yields averaged over the Periods 1 and 2 also signify the superior standing of CNF relative to non-CNF (Table 9.12) with the test statistic exceeding 100 per cent. Thus, the apprehension that CNF endangers food security by returning yields less than under conventional farming has no basis.

9.4.4.4 Are Net Returns Higher Under CNF Relative to Non-CNF?

While arriving at net returns (rupees per hectare) the output is valued at the respective prices realised by the CNF and non-CNF farmers. The returns are higher for CNF farmers barring one exception in case the individual years and of all the three crops (Appendix Table 9.1). While this is so, the average net returns corresponding to Periods 1 and 2 are way higher under CNF relative to non-CNF (Table 9.12). The average net returns under CNF as a per cent of those under non-CNF is 141.20 in the least and reaches 280.59 in one case.

9.5. Results and discussion: analysis of panel data

Thus, we have seen that CNF costs less, yields more, and brings in greater net returns than non-CNF not merely in any one particular year, but generally in five different points in time. This conclusion holds more vividly if we smoothen the annual fluctuations – if we consider the average picture of the early years of CNF's adoption, denoted as Period 1 or that of the more recent past, denoted as Period 2. Now the question is: do the costs, yields and net returns from CNF turn increasingly favourable as we transition from one year to the next, after the initial euphoria about its superiority over conventional farming has waned. While CNF's superiority over conventional farming may egg farmers to experiment with the practice for a start, it requires that the practice exhibits encouraging results year after year, in Period 2 over Period 1, for the farmers to not drop out of it.

In order that we gauge whether CNF, on its own, is turning increasingly favourable over time (as farmers become more and more well versed with the practices associated with it and as the beneficial effects of biological inputs used under CNF take deep roots with the passage of time) we may turn to CNF: Cross-section data on C/Y/R of different years. But as noted earlier on, the sample data drawn from a cross-section of farmers is not ideal for inter-year comparisons because the characteristics of the farmers making up the sample change from year to year. To get over this problem, we now work with a panel data of farmers of different years. In the process, we address the question if CNF compromises agroecological sustainability because, as feared by some, its soil carbon content can be low and its concoctions may not supply the nitrogen adequate for healthy growth of plant. In the analysis below we seek to answer the following queries employing panel data:

(a) Are paid-out costs decreasing over time under CNF?
(b) Are yields increasing over time under CNF?
(c) Are net returns increasing over time under CNF?

For CNF to be considered faring unexceptionally better and better over time, the panel data should point at a decreasing paid-out cost, an increasing yield and also an increasing net return over the years, and between Period 1 and Period 2.

9.4.5.1 Are Paid-Out Costs Decreasing Over Time Under CNF

Contrary to what is postulated, the panel data both at the current and constant prices shows that paid-out costs increase over the years in case of all the three crops under consideration (Appendix Table 9.3). The costs in Period 2 are seen to be much higher than in Period 1, that too by a big margin, in respect of the three crops and at current and constant prices (Table 9.14). The average paid-out cost in Period 1 as a percentage of Period 2 is noted to be less than 100. Do the higher costs translate into higher yields, because the former could have been the result of greater investment?

9.4.5.2 Are Yields Increasing Over Time Under CNF?

We notice that yields are indeed increasing over time under CNF in respect of all the three crops, albeit moderately (Appendix Table 9.3). The increase has not been systematic, however. Nevertheless, they are found to be higher in Period 2 than in Period 1 (Table 9.14). Alternatively, the average yield in Period 1 as a percentage of Period 2 is less than 100. The endeavour should, therefore, be to sustain the good job done in Period 1, and build on it and do progressively better over time. Our results, though subscribe to the hypothesis that yields under CNF are increasing over time, suggest at the need for exercising caution because the recorded increases in yields over time are marginal. Note, none the less, that one need not be apprehensive that CNF might endanger food security. The next question is: Do the higher yields translate into higher net returns?

9.4.5.3 Are Net Returns Increasing Over Time Under CNF?

It is disappointing that net returns (rupees per hectare) have in fact been decreasing over time (Appendix Table 9.3) and between the Period 1 and Period 2 (Table 9.14) at both the current and constant prices and in respect of the three crops. Put differently, the statistic average net return in Period 1 as a percentage of Period 2 is greater than 100. The noticed higher yields in Period 2 over Period 1 have not translated into higher net returns, because paid-out costs have increased significantly. Additionally, CNF outputs, though unexceptionally better in quality than non-CNF outputs, have failed to command prices higher than what is necessary to offset even the increased costs. In the absence of certification and branding, markets seem to fail to bestow higher prices on CNF outputs.

Table 9.14: Avg. paid-out cost (₹/ha) (current and constant prices), yield (Qtls/ha) and net return (₹/ha) (current and constant prices) of selected crops in period 1 and period 2 for CNF farmers in the panel study

S. No.	Variable Name	Paddy			Groundnut			Red Gram		
		Period 1	Period 2	Period 1 as % of Period 2	Period 1	Period 2	Period 1 as % of Period 2	Period 1	Period 2	Period 1 as % of Period 2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
I. Current Prices										
I.1	Avg. paid-out cost	42083	53691	78.38	41797	54003	77.40	10640	24105	44.14
I.2	Avg. yield	48.79	51.10	95.48	16.36	16.81	97.32	8.94	9.83	90.95
I.3	Avg. net return	48304	43593	110.81	51196	40629	126.01	32634	29370	111.11
II. Constant prices										
II.1	Avg. paid-out cost	39088	45160	86.55	38908	44461	87.51	9847	20057	49.10
II.2	Avg. net return	48245	43196	111.69	47020	32314	145.51	26578	21217	125.27

Source: IDSAP, APCNF Field Survey 2022-23

9.6. Conclusions

Note that there is this unambiguous conclusion from our cross-section data that C/Y/R are favourable under CNF relative to non-CNF. This should silence those who denounce CNF as unviable. Next, our panel data shows that there has been an increase over time in yields under CNF. This observation should put at rest the doubts about the agroecological sustainability of CNF. The experience with net returns, however, appears less sanguine – they have been decreasing over time, particularly in the absence of a well-placed system of certification and branding to confer higher prices on CNF outputs. The government's initiative in this regard augurs well and should help CNF farmers to reap benefits commensurate with increased costs in the least. But all this is only a part of the story because we have examined changes in net returns of merely three crops and one season (kharif). What is needed is a holistic appraisal of CNF. For a nuanced understanding of the changes in net returns we have to work with annual net returns arising to the farmer-household from all the major and minor crops, inter-/multi-cropping, trees and livestock enterprises that CNF occasions, through diversification of cropping systems (with potential to stabilise income at a higher and higher level) and through its land-augmenting character (that increases the land use efficiency). It is also necessary to account for the year-round cash-flow that CNF, together with the now popular Pre-Monsoon Dry Sowing (PMDS)[51], guarantees. There are also benefits beyond higher yields and net returns to be had from CNF in the form of surplus labour absorption and containment of debt burden of peasants. Further, CNF serves better in arresting degradation of soil, in safeguarding standing crop from vagaries of nature, in securing health of the peasant and the community at large, in begetting respect to the peasant among peers and in reducing stress in farming, compared to non-CNF. We may add that there is, however, a need to sustain and build on the promise shown by CNF, through government's patronage, because farmers are yet to adopt CNF practices spontaneously.

[51] a practice growing in popularity and that which ensures longer crop cover over the land

Appendix tables of chapter 9

Appendix Table: 9.1: Paid-out costs of cultivation (₹/ha) (current prices), yields (Qtls/ha) and net returns (₹/ha) (current prices) for selected crops in different years for farmers in the cross-section study

Year	Paddy under			Groundnut under			Red gram under		
	CNF	Non-CNF	CNF as % of non-CNF	CNF	Non-CNF	CNF as % of non-CNF	CNF	Non-CNF	CNF as % of Non-CNF
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1. Paid-out costs									
2018-19	36,009	41,737	86.28	29,219	29,957	97.54	NA	NA	NA
2019-20	40,734	50,429	80.77	47,047	51,745	90.92	18,164	27,233	66.70
2020-21	46,125	61,301	75.24	46,540	48,448	96.06	13,305	23,489	56.64
2021-22	54,173	65,659	82.51	50,933	55,113	92.42	31,490	28,382	110.95
2022-23	60,340	71,986	83.82	58,040	61,221	94.80	30,811	33,969	90.70
2. Yields									
2018-19	45.22	47.69	94.82	13.34	11.51	115.90	NA	NA	NA
2019-20	50.87	48.10	105.76	16.53	16.40	100.79	6.47	6.09	106.24
2020-21	53.95	51.80	104.15	22.12	19.60	112.86	7.42	7.33	101.23
2021-22	45.89	39.12	117.31	16.35	15.64	104.54	6.07	4.78	126.99
2022-23	52.22	51.06	102.27	23.40	25.64	91.26	6.76	5.68	119.01
3. Net returns									
2018-19	45,262	41,708	108.52	35,819	25,409	140.97	NA	NA	NA
2019-20	51,426	31,031	165.72	51,190	41,346	123.81	19,466	4,219	461.39
2020-21	53,168	33,392	159.22	49,899	20,602	242.20	23,795	11,199	212.47
2021-22	45,439	22,832	199.01	20,596	Loss (-9264)	---	22,673	14,923	151.93
2022-23	48,542	28,576	169.87	92,973	96,571	96.27	8,152	Loss (-1839)	---

Source: IDSAP, APCNF Field Survey 2022-23

Appendix Table: 9.2: Individual cost components of total paid-out cost under CNF as per cent of non-CNF for different crops and years

	Years/Inputs	Costs under CNF as % of non-CNF for		
		Paddy	Groundnut	Red gram
(1)	(2)	(3)	(4)	(5)
2018-19	(1) Seeds	102.35	100.61	NA
	(2) Human labour	107.85	97.61	NA
	(3) Bullock labour	458.15	106.53	NA
	(4) Machine labour	98.37	97.24	NA
	(5) Biological inputs/Chemical inputs	31.82	73.93	NA
	(6) Others:	193.74	113.73	NA
	(7) Paid-out costs: Total	86.28	97.54	NA
2019-20	(1) Seeds	93.89	67.79	95.75
	(2) Human labour	96.75	130.60	73.30
	(3) Bullock labour	85.35	74.40	89.34
	(4) Machine labour	97.58	92.16	82.62
	(5) Biological inputs/Chemical inputs	35.14	87.41	41.16
	(6) Others:	129.00	64.67	117.33
	(7) Paid-out costs: Total	80.77	90.92	66.70
2020-21	(1) Seeds	128.33	120.71	31.41
	(2) Human labour	76.77	101.01	85.06
	(3) Bullock labour	119.91	28.32	108.50
	(4) Machine labour	87.14	55.51	45.55
	(5) Biological inputs/Chemical inputs	39.64	56.71	67.63
	(6) Others:	88.38	256.94	44.26
	(7) Paid-out costs: Total	75.24	96.06	56.64
2021-22	(1) Seeds	86.88	99.26	169.70
	(2) Human labour	81.41	119.22	132.82
	(3) Bullock labour	72.73	150.29	123.81
	(4) Machine labour	106.76	76.29	108.67
	(5) Biological inputs/Chemical inputs	53.99	49.10	63.72
	(6) Others:	106.29	121.15	256.42
	(7) Paid-out costs: Total	82.51	92.41	110.95
2022-23	(1) Seeds	103.72	99.83	137.62
	(2) Human labour	100.61	102.29	102.71
	(3) Bullock labour	0.00	0.00	0.00
	(4) Machine labour	89.75	95.19	98.57
	(5) Biological inputs/Chemical inputs	44.18	62.84	69.83
	(6) Others:	110.75	133.63	83.51
	(7) Paid-out costs: Total	83.82	94.80	90.70

Source: IDSAP, APCNF Field Survey 2022-23

Appendix Table: 9.3: Paid-out cost of cultivation (₹/ha) (current and constant prices), yields (Qtls/ha) and net returns (₹/ha) (current and constant prices) for selected crops in different years for CNF farmers in the panel study

Year	Paid-out costs of			Yields of			Net Returns of		
	Paddy	Groundnut	Red Gram	Paddy	Groundnut	Red Gram	Paddy	Groundnut	Red Gram
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Current Prices									
2018-19	37,205	38,770	8,477	45.64	17.34	6.07	51,176	65,173	19,896
2019-20	40,889	45,421	9,661	50.99	21.75	8.71	57,108	82,606	31,561
2020-21*	48,154	41,201	13,783	49.73	10.00	12.05	36,628	5,810	46,446
2020-21**	48,454	39,717	13,837	52.02	9.54	11.12	41,625	5,360	41,742
2021-22	55,779	46,091	28,551	50.35	17.98	12.05	36,615	52,346	38,749
2022-23	56,841	76,202	29,927	50.92	22.9	6.31	52,540	64,180	7,618
Constant Prices									
2018-19	37,205	38,770	8,477	NA	NA	NA	51,176	65,173	19,896
2019-20	37,045	41,151	8,753	NA	NA	NA	56,930	70,752	25,884
2020-21*	43,014	36,803	12,312	NA	NA	NA	36,628	5,134	33,953
2020-21**	43,282	35,478	12,360	NA	NA	NA	41,625	4,737	30,514
2021-22	49,965	41,287	25,575	NA	NA	NA	37,607	43,517	28,751
2022-23	42,232	56,617	22,235	NA	NA	NA	50,356	48,688	4,385

* Estimates of C/Y/R reported in the row for the year 2020-21 pertain to the smaller sample of 251

** Estimates of C/Y/R reported in the row for the year 2020-21 pertain to the larger sample of 381

Source: IDSAP, APCNF Field Survey 2022-23

Chapter 10: Insights from qualitative data

10.1. Introduction

The analysis conducted in the previous chapters on the basis of quantitative data encompassing cross-section as well as panel data has shown that the cost of cultivation of crops, yields of crops and price realized for different CNF crop outputs together determine the net returns from the crops to CNF farmers. Of course, this is also true for non-CNF farmers. It has further revealed that the cost of cultivation of crops is lower and net returns are higher for crops (especially Paddy, Groundnut and Red gram) adjusted for prices and weather variability. Yields of crops are by and large higher under CNF over non-CNF after adjusting for weather variability. The analysis of qualitative data collected from the different stakeholders of CNF may throw more insights on the dynamics of the cost of cultivation, yields and net returns of crops.

10.2. Approach

Qualitative data has been collected from different stakeholders through Focus Group Discussions (FDGs) with CNF and non-CNF farmers, people's representatives and community representatives wherever possible; Case Studies (CSs) of APCNF farmers, CSs of horticulture growing farmers; and Strategic Interviews (SIs) at district level and below with APCNF Implementation Authorities are conducted. Further qualitative information has been collected from CNF sample farmers through open questions in the household schedule. All their responses have been categorized under the Strengths, Weaknesses, Opportunities and Threats (SWOT) framework. Strengths and opportunities are considered the benefits that follow CNF for farming and farmers. Weaknesses and Threats are considered as constraints for the CNF farmers in realizing the benefits from CNF. The suggestions for addressing the constraints have also been sought from all the stakeholders. The strengths; opportunities; weaknesses; threats and suggestions have been identified from each of the narrative of FGDs, Case Studies, Strategic interviews and sample farmers of CNF. Frequency tables are prepared at the aggregate level and for each category of respondents. The aggregate responses, including the CNF farmers, FGDs, CSs, CSs of horticulture farmers, and SIs with respect to the SWOT framework, are presented in Table 11.1. Further, the suggestions obtained from different sources are summarized in Table 11.2. Before discussing the results, the issues are elaborated briefly below. The disaggregated tables are given in the Appendix at the end of the chapter.

10.3. Impact of APCNF on Farming and Farmers (Strengths)

As mentioned above, the responses of the stakeholders in the qualitative data have been put into the SWOT framework. The responses in each component of the SWOT framework have been, further, grouped into usual categories such as costs, yields, marketing, extensions, input supply, etc. The impact is also analyzed in terms of the impact on farming and farmers. All the responses obtained in the qualitative survey have been summarized in Tables 11.1, 11.2, 11.3 and 11.4. As mentioned before, the frequencies of each response are also given in those tables. Not surprisingly, there are a greater number of benefits (strengths and opportunities) than constraints (weakness and threats)[52]

10.3.1. Impact on Farming

The stakeholders' responses relating to the impact of CNF on Farming have been grouped into the cost of crop production, yield, prices of crop output, returns from crops, utilization of natural resources, and opportunities thrown up by the impact of CNF on other sectors of the economy.

10.3.1.1 Cost of Production of Crops

The biological inputs for growing crops under CNF have been prepared with locally available cheaper raw materials. Hence, these inputs are much cheaper compared to industrial chemical inputs - fertilizers and pesticides. This has induced farmers to replace chemical inputs with biological inputs for cultivating crops under CNF. Moreover, farmers are able to prepare these inputs on their own - of course with adequate training. Some of them, who cannot prepare the inputs on their own, have purchased the same from NPM shops at affordable prices. They have not prepared the inputs due to scarcity of family labour and/or livestock raw materials like cow dung, cow urine. Also, RySS has helped farmers overcome the scarcity of livestock by arranging a supply of desi cows from Thirumala Thirupathi Devasthanam (TTD).

The use of cheaper biological inputs by farmers has contributed to the reduction in the cost of cultivation of crops under CNF over chemical-based non-CNF. This has led to a reduced

[52] There is some ambiguity in dividing the responses between strengths and also in opportunities and dividing the responses between weakness and threats.

demand for working capital by farmers for growing crops under CNF over non-CNF and thereby reduced the dependence of farmers on credit markets to some degree. Also, farmers have further reduced the cost of cultivation of crops under CNF by accessing credit from banks, SHGs and friends at a fair rate of interest coupled with pro-farmer terms and conditions. The supply of seeds for raising crops under CNF at subsidized price by NGOs like Rural Development Trust (RDT) and the distribution of seeds by RySS has enabled farmers further to reduce cost of cultivation of crops. The method of plantation of trap crops for the control of insects has also contributed to the reduction in the cost of cultivation of crops under CNF.

10.3.1.2 Yield of Crops

The yield of all crops grown under CNF is higher than of crops under non-CNF. The methods adopted to control pests and insects that affected the CNF crops have contributed to protect the yield of crops. Similarly, the resilience of CNF crops that helped to withstand weather variability has enabled farmers to protect the yield of crops. The yield of crops has to be measured beyond output per unit of land. The crop outputs of CNF are chemical-free, nutrition-rich and tasty in general. Moreover, it is reported that CNF helped to increase the size, colour, weight, softness, taste, and shelf life of fruit, horticulture and vegetable crops. Additionally, hollow nuts in the CNF output of groundnut crop are reported to be less. This has contributed to the rise in the yield of crop.

10.3.1.3 Prices of Crop Output

It is reported by all the stakeholders that the CNF farmers have by and large obtained remunerative prices for the crops they have grown. CNF farmers have adopted their own strategies to sell their crop produce at relatively higher prices. They also have reduced the role of middle men between them and consumers in marketing their agricultural produce. This has enabled them to obtain higher prices. Marketing linkages facilitated by RySS, with Thirumala Tirupati Devasthanam (TTD) and marketing through Health Nutrition Master Trainer (HNMT) of RySS have enabled farmers to obtain minimum support prices for their crop outputs.

10.3.1.4 Returns from Crop production

The above narrative shows that the cost of crop production has been reduced, crop yields have increased, and crop output prices have increased under CNF. All these are pointers to the increase in net returns from crop production, as reported by all stakeholders.

10.3.1.5 Efficient Utilization of Natural Resources

The efficient utilization of natural resources in agricultural production has been measured through the conservation of natural resources. Cropping systems have emerged to utilize natural resources efficiently so that farmers can organize agricultural activity efficiently by striking a balance between income to farmers and conservation of natural resources related to agriculture.

10.3.1.6 Conservation of Natural Resources

All the stakeholders have reflected on the conservation of natural resources such as agricultural land, water, power (electricity) and the environment. It is unanimously reported by all the stakeholders that the fertility (health) of the soil/land has increased under CNF. This has implications for land productivity. Increased land fertility reflects the loosening of the soil and, thereby, the improved water-holding capacity of the soil. The increased soil moisture has also provided substantial evidence to this, as reported by the stakeholders. This is why the stakeholders have reported that the increased soil moisture has decreased the water requirement for growing crops under CNF.

Conservation of water resources has been reflected through a decrease in the requirement for irrigation for growing crops under CNF. Stakeholders have reported that CNF crops are able to withstand with less wets. This provides evidence to the efficient utilization of water resources by the farmers. However, it is cautioned that the groundwater levels are volatile during summer. The adoption of micro-irrigation technology (Drip Irrigation) has contributed to the lessened use of water for irrigation and thereby resulted in lower use of power (electricity) consumption for irrigation. This technology may enable farmers to cope with the scarcity of ground water in the summer.

Natural resources such as land, water bodies and air are not polluted at the village level due to the cultivation of crops under CNF. Further, it is reported that CNF has protected the environment. The percentage of carbon has increased in the soil due to the pushing of considerable bio-mass into the soil through PMDS every year. This improves the health conditions of soils/lands, and this, in turn, leads to an increase in land productivity. Also, this has implications for arresting the formation of carbon dioxide in air and for avoiding the

emission of Green House Gases (CHGs) into the environment. The above narrative reflects the enhancement in land productivity through the efficient use of natural resources without degradation of the natural resource base.

10.3.1.7 Emerging Cropping Systems and Land Use

The percentage of farmers practicing CNF and CNF+PMDS has increased over time. Similarly, the percentage of S2S farmers has been on the increase over time. On the other hand, the percentage of cropped areas cultivated under purely CNF and PMDS+CNF has increased over time. The increase in the cropped area points conclusively to the extensive use of cultivated land. The innovation of PMDS has opened opportunities for sustainable, intensive use of land. Increase in the cropping intensity; increase in the number of farmers who have cultivated land two are more times in an agricultural year; and covering lands with greenery all 365 days on the crop land, indicate the intensive use of land.

It is also reported that the number of crops grown has increased due to CNF+PMDS. The cultivation of Papaya, Banana, Mango, Sapota and vegetables has increased. Raising bund and boarder crops along with the main crops has been revitalized and these practices are on the rise. The cultivation of vegetables and creeper crops as border crops has increased.

Different cropping systems have increased under CNF. They include: Inter-cropping system in horticulture crops; Raising more crops on less cropland; Practicing "A grade models" on cultivated land; Raising of "layer models" on crop lands; Growing vegetables under kitchen gardening; covering the land with crops for 365 days; and promoting multi-cropping systems replacing mono-cropping systems. These cropping systems have enabled extensive, intensive and sustainable use of land and helped increase land productivity. Also, these cropping systems made agriculture a year-long activity.

10.3.2. Impact on Farmers' Status

It is reported that the income of farmers has increased from crop cultivation due to CNF. The reduction in the debt of farmers, as reported by stakeholders, provides evidence of this. Moreover, sending children to schools is also another indication of the increased incomes of farmers. The consumption of CNF crop outputs including vegetables, which are chemical free, nutrient-rich and tastier, has been reported by CNF farmers. This has improved the health status and subsequently led to the reduction in health care expenditure (out of pocket expenditure) of the farmers' families. The savings from health expenditure has added to the incomes of farmers.

It has been reported that the sources of income of the farmers have also increased due to CNF. Income from bund crops, border crops, inter-crops, kitchen gardens, and from extensive and intensive use of crop land has contributed to diversified crop incomes from agricultural activity under CNF. The increase in the livestock holding of farmers, due to the availability of green fodder throughout the agricultural year has increased the income of farmers from animal husbandry. The diversification of income sources has led to an increase in cash flows to the farmers. Moreover, agricultural activity under CNF has become continuous throughout the year. This may reduce the dependence of farmers on credit markets.

Table 10.1: Strengths, Opportunities, Weakness and threats of CNF: Responses from all the stakeholders

Description of Responses	No of responses	Percentages
Reduction in cost of production of crops under CNF		
Usage of chemical inputs are reduced	78	65.0
Reduced working capital requirements for growing crops	75	62.5
Cost of cultivation of CNF crops is less compared to non-CNF crops	73	60.8
Farmers have prepared biological inputs on their own.	47	39.2
NPM shops are providing biological inputs for natural farming	39	32.5
Cost of agricultural inputs are affordable to CNF farmers	26	21.7
Others	21	17.5
There is considerable increase in the livestock holding in the villages	19	15.8
Desi cows have been provided by TTD	10	8.3
Changes In Yields of crops under CNF		
Crop-wise yields have increased considerably compared to non-CNF	66	55.0
Due to application of CNF inputs, fruit size, colour, weight, softness, taste and shelf-life of horticulture and vegetable crops have increased	36	30.0
Producing chemical free - nutrient rich more tasty crops under CNF	23	19.2
CNF crops have strength to overcome the transition of weather abnormalities.	11	9.2
Others	8	6.7
Protect from different types of pests.	6	5.0
Marketing of CNF crop outputs		
Farmers have adopted their own marketing strategies for selling of CNF products	25	20.8
Middle men system is reduced to some extent	14	11.7

Description of Responses	No of responses	Percentages
Availing good price for APCNF products by farmers	13	10.8
TTD has been giving minimum support price to the CNF products	13	10.8
Own marketing strategy adopted for selling of fruits/products by farmers	11	9.2
Others	9	7.5
Increase in the incomes of CNF farmers		
The economic status of CNF farmers has improved	32	26.7
Getting Additional income through selling of vegetables / Dairy products	19	15.8
Income from crop production has increased	15	12.5
Debits of farmers have decreased	*12*	10.0
Others	*11*	9.2
Increase in the incomes of Agriculture Labour		
Availability of work to agriculture labour in the entire agricultural year.	9	7.5
More number of Labour days have been obtained by agricultural labours	6	5.0
Income of agricultural labourers has increased	2	1.7
Improvements in the Health of Farmers Families		
Health status improved and expenditure on health care has reduced	12	10.0
CNF products have improved farmers' families' health	8	6.7
Improvements in the Health of Agriculture labour		
There are no health issues in applying CNF inputs on the farms of farmers	25	20.8
Improvement in the Education of Children of Farmers Families		
Education status of the children has improved	70	58.3
Conservation of Natural Resources		
Land fertility has increased	45	37.5
Crops of CNF are able to withstand even with less wets.	40	33.3
Carbon percentage has increased in soils	27	22.5
Village Natural resources like water bodies, land and air are not polluted due to CNF	17	14.2
Drip irrigation method is followed in CNF farming	12	10.0
Modest changes are found in ground water levels during summer.	11	9.2
Others	9	7.5
Decreased need for irrigation/ water supply.	7	5.8
Water consumption in the fields has decreased due to increased Soil moisture Levels by using the biological inputs	6	5.0
Changes in cropping system		

Description of Responses	No of responses	Percentages
Percentage of total cropped area put under purely APCNF and PMDS+APCNF has increased	88	73.3
Cultivation of Inter-cropping has increased	57	47.5
CNF farmers have increased over time CNF farmers has increased	33	27.5
Cultivated area has expanded due to CNF	32	26.7
Laying of bund, border crops, layer crops and kitchen garden crops has increased	18	15.0
Due to intervention of PMDS and RDS, cultivation of crops has increased.	17	14.2
More crops have been cultivated in less land due to CNF	17	14.2
Increase in percentage of farmers following APCNF and PMDS+APCNF	7	5.8
Laying of border crops such as vegetables & creepers has increased	6	5.0
Others	36	30.0
Extension Services		
The extension services from RySS and Agriculture officers are very adequate and appropriate	59	49.2
Awareness meetings have been organised through SHG members	10	8.3
Others	11	9.2
Improvement in soil fertility		
Soil fertility has increased	45	37.5
Inter departmental coordination		
Strategies adopted for better co-ordination with the line departments	3	2.5

Number of respondents are 120
Source: IDSAP Filed Survey 2022-23

10.4. Impact of APCNF on Other Dimensions of Agriculture (Opportunities)

The APCNF creates opportunities for farmers, agricultural labour and consumers. They are as follows:

Some of the agricultural lands that have become fallow due to intensive use under chemical-based agriculture (non-CNF) has been converted to cultivable lands through CNF. This initiative has contributed to the expansion of cropped area in the state. The intensive and extensive sustainable use of cropped area coupled with different cropping systems described above under CNF has enabled farmers to produce a wide range of crop outputs to meet increasing demand for these from consumers who have become more health consciousness.

The suburban areas and villages in the neighborhood provide the demand for these outputs. The wide range of crop outputs of CNF unlocks opportunities to promote agro-processing industries in rural areas for preparing ready-to-eat and ready-to-cook agricultural products. This brightens the chances for CNF farmers (especially young and women) to emerge as entrepreneurs to participate in post-production processes through the promotion of their collective institutions such as farmers' producer companies. CNF also makes available chemical free green fodder continuously for the livestock for undertaking diary activity that fetches farmers higher prices for dairy products free from chemical residuals. Livestock also provide the raw material required for the preparation of biological inputs for growing crops under CNF. This reflects the strong linkage between animal husbandry and agriculture. The interlinkages between agriculture and animal husbandry facilitate higher income for the farmers. As mentioned above, extensive and intensive sustainable agriculture under different cropping systems of CNF provides continuous employment to agricultural labour. This enhances the income of agricultural labour and arrests migration to district capitals and state capital. The increased income enables agricultural labour to consume ready-to-eat and ready-to-cook products of CNF that can improve their health status. This also increases their productivity. Small, marginal and landless tenant farmers have participated in CNF. This shows that CNF is inclusive farming. On the whole, the qualitative data collected from different stakeholders has shown that the CNF has evolved into higher growth-inclusive-sustainable agriculture in the state.

Table 10.2: Opportunities in CNF: Responses from all the stakeholders

Description of Responses	No of responses	Percentage
Health issues and expenditure on health are declined	57	47.5
The feeling of belongingness and oneness is more in CNF practising families.	34	28.3
CNF crops have strength to overcome the transition of weather abnormalities.	31	25.8
Customers are showing utmost interest to the CNF products for improving their health	19	15.8
CNF crop outputs are found to be chemical free, nutrient rich, tastier and hence improves the immunity of the consumers	14	11.7
There is a significant change in the livestock holding in the villages	14	11.7
CNF products are useful for improving family health	13	10.8
Others	8	6.7

Description of Responses	No of responses	Percentage
Usage of the agriculture inputs like fertilizers and pesticides is reduced in CNF villages	6	5.0

Number of respondents are 120
Source: IDSAP Filed Survey 2022-23

10.5. Constraints encountered by Farmers of CNF (Weaknesses and Threats)

The constraints CNF farmers encountered, reported by all the stakeholders, relate to preparation of biological inputs; seeds availability; weed control; natural resources use; yields of crops; land lease transactions; participation of farmers in CNF; marketing of CNF crop outputs; extension service; and linkages of RySS with MGNREGS.

All the stakeholders have reported that farmers have faced difficulties in preparing biological inputs due to three factors, viz., the absence of equipment that reduces drudgery and time; lack of family labour; and higher wages for hired labour. They have also suggested that the latter two factors relating to labour can be addressed by promoting NPM shops in villages. They have further recommended that equipment may be provided at least to NPM shops instead of to individual farmers. Further, it is also proposed that awareness creation is necessary on the preparation of biological inputs to the farmers. Scarcity of raw material relating to livestock has been reported for preparing biological inputs. It has been proposed by farmers that they be provided desi cows on subsidy or arrange them through "Goshalas", wherever they are situated. The facilitation of RySS in arranging desi cows from TTD to farmers is a case in point. The timely availability of biological inputs is also demanded. The scarcity of mulching material is reported by farmers in some villages. Non-availability of seeds free of chemical residues for growing PMDS crops as well as CNF crops has also been reported. Weed control is found to be a problem in crops grown under CNF. There is no improvement in the conservation of water resources for its optimal utilization to increase the yields of crops. All the factors described above result in partial adoption of practices of CNF by farmers, higher cost of growing crops and inefficient utilization of natural resources. This ultimately leads to lower yields which may be lower compared to non-CNF. This is evident from the reporting of farmers that yields of crops under CNF are lower compared to that of non-CNF in some villages. Moreover, it is reported by all the stakeholders that the farmers have not realized remunerative prices to crop outputs of CNF because they do not have a distinct identity in markets. Further, the extension services provided by RySS are found to be inadequate in some villages due to shortage of staff.

Furthermore, the linkage of MGNREGS with CNF to work on private lands of farmers could have reduced of the cost of production. This has not taken shape yet. Otherwise, this could have acted as an incentive for the farmers to take up CNF. All these constraints discourage farmers in some villages from taking up CNF. Land lease markets in villages have not been impacted due to CNF. The stakeholders have suggested that the realization of potential benefits by tenant farmers from CNF requires rental agreements for a period of three to five years between the owner of the land and the tenant. Many owner farmers felt that such lease agreements are not acceptable as farmers may lose their land ownership. However, some farmers who are mostly absentee landlords came forward to enter into lease agreements of this nature with the expectation that their land would turn fertile due to CNF. The highlight of this agreement is that land has been leased out at lower rental payments. This is reported by tenants in some villages. However, this is not widespread in the villages. The proven benefits from CNF may influence land owners and tenants in course of time.

Table 10.3: Weakness of CNF: Responses from all the secondary stakeholders

Description of Responses	No of responses	Percentages
Extension		
Shortage of RYSS staff for providing extension services	32	26.7
Less awareness of farmers on APCNF	10	8.3
Others	2	1.7
Input Preparation		
Consuming quite a bit of time for the preparation of CNF inputs.	31	25.8
Less Number of NPM shops are available across villages	29	24.2
Shortage of family labour for the preparation of biological inputs in CNF	25	20.8
Biological inputs are not available in time for urgent / immediate problems	8	6.7
Others	7	5.8
Scarcity of raw material for the preparation of inputs		
Scarcity of raw materials such as cow dung, urine for preparation of biological inputs	54	45.0
Lack of mulching materials	3	2.5
Shortage of tools/ instruments for the preparation of inputs		
Shortage of tools / instruments for the preparation of biological units.	52	43.3
Weed control		
Control of weed through biological inputs has been found to be difficult	3	2.5
Resource use		

Description of Responses	No of responses	Percentages
No changes in water requirement for irrigations in cultivating crops under CNF	6	5.0
Marketing		
Lack of remunerative prices for CNF products	31	25.8
Lack of awareness on marketing strategies for CNF farmers	29	24.2
Market channels are not increased even after CNF	8	6.7
Others	6	5.0
Seeds		
All types of PMDS seeds are not available for growing crops	17	14.2
Non availability of all types of crop seeds	4	3.3
Coordination with line departments		
Lack of coordination with the line departments	1	0.8
Weather Variabilities		
CNF crops can withstand Weather Variabilities	1	0.8
Cropping System		
Use of fish/fish Kashayam causes a bad smell on the farm this led to the problem of stray dogs disturbing crops	3	2.5
Intercropping has not been practised due to the shade of mango trees	1	0.8

Number of respondents is 120
Source: IDSAP Filed Survey 2022-23

Table 10.4: Threats to CNF: Responses from all the stakeholders

Description of Responses	No of responses	Percentage
Reduction in land lease practices	11	9.2
Non availability of all types of seeds of crops	7	5.8
There are less yields when compared to non-CNF	6	5.0
Farmers are less inclined to practice natural farming due to their illiteracy	4	3.3

Number of respondents are 120
Source: IDSAP Filed Survey 2022-23

10.6. Suggestions to overcome the constraints farmers encountered

Subsidies; incentives; technology; institutional arrangements; extension services; and employment opportunities constitute the inventory of suggestions. All these are suggested by all the stakeholders, directly or indirectly, to reduce cost of cultivation of crops, to improve the yield of crops, to realize remunerative prices for CNF crop outputs; to improve the utilization of natural resources and to increase the incomes of farmers (young and women) as well as agricultural labour in rural areas.

All the stakeholders have proposed that desi cows be supplied on subsidy by RySS to ensure the availability of livestock related raw materials for the preparation of biological inputs. Further, farmers recommended that community cattle sheds should be constructed in villages so as to enable better animal care and collection of dung and urine at one place efficiently. Equipment like mixers and grinders required to prepare biological inputs with ease (without drudgery) should be provided on subsidy to CNF farmers. Farmers have also asked for the supply of equipment like drums etc., to prepare biological inputs. Moreover, farmers wanted equipment like sprayers to be supplied to apply biological inputs on fields. Also, it is proposed that that this equipment should be provided to NPM shops to meet the growing demand for biological inputs. At the same time, it is advised that more NPM shops should be promoted to ensure the supply of biological inputs to farmers who wish to purchase. It is opined that Rythu Bharosa Kendras (RBKs) should be involved in supplying biological inputs. Ways and means should be explored to enable farmers to have permanent fencing and mulching material on their fields in some villages.

The availability of suitable seed supply to CNF farmers has been flagged as one of the issues to be addressed. The stakeholders have wished-for a seed bank at the village level to ensure the supply of suitable seeds free of chemical residues to farmers. Stakeholders have offered the suggestion that loans with zero interest should be extended to CNF farmers, including tenants. Borewells that can be operated with solar energy should be provided on subsidy to farmers. This helps farmers to save electricity and generate power that can be connected to a grid. This in turn enables farmers to earn income through the sale of solar power generated. Stakeholders have wanted APCNF to be integrated with MGNREGS so that agricultural labour can work on the fields of farmers and the government would pay the wages for this work. This reduces the cost of cultivation of growing crops under CNF as the cost of hired labour accounts for a considerable proportion of the cost of cultivation. This in turn would increase the income of farmers. This also increases the viability of CNF.

There are very pertinent proposals put forward by stakeholders in regard to marketing of CNF crop outputs at a premium price. The realization of premium price is a very important dimension of CNF, since it attracts non-CNF farmers towards CNF and keeps CNF farmers continuously engaged with CNF. CNF farmers demand a premium price for their crop outputs.

It has to be recalled here that the farmers have reported that they have not obtained a premium price for their crop outputs. In this backdrop, the stakeholders have offered suggestions that include: there should be a separate area for CNF crop outputs in the existing market yards; new market yards should be promoted for the exclusive sale of CNF products; Rythu Bazars should be utilized for the sale of crop the outputs; CNF outputs should be procured through RBKs; marketing CNF outputs through the network of women SHGs; food melas should be organized by RySS to market CNF outputs; market linkages should be promoted with local government institutions such as schools and hospitals; cold storage facilities should be provided in villages to store crops to enable farmers to market them at an appropriate time for realizing higher prices; RySS should issue CNF certificate to farmers for marketing their crop outputs individually; and create more awareness among consumers to enhance the demand for CNF crop outputs.

It is also advised by the stakeholders that agro-processing industries should be promoted to process CNF crop outputs for producing ready-to-eat and ready-to-cook products for capturing local, state, national and international markets. This provides opportunity for farmers, especially young and women farmers to participate in post-production process for emerging as entrepreneurs and thereby to obtain higher incomes. Moreover, more employment can be provided to agricultural labour. Thus, the income of agricultural labour also can be enhanced and thereby migration to district capitals, sate capital and other states, can be avoided.

Extension services have been provided to farmers through a well-designed network of RySS staff at district and below district level throughout the agricultural year. Also, RySS has involved the existing women SHGs network at village level for extending extension services to farmers. However, it has been reported that the extension services on CNF are inadequate in some villages. The proposed suggestion to correct the inadequacies in extension services include: more awareness programs on CNF should be organized; training programs should be organized for preparation of biological inputs; literature on CNF should be made available to farmers; more exposure visits should be organized for CNF farmers; interaction between CNF and non-CNF should be organized to attract non-CNF farmers towards CNF; ICRPs should be available in the field at all times; success stories should be telecast in all important channels; and awareness meetings should be organized at RBK centers every month.

The stakeholders have also asked for crop insurance for CNF crops and for an act to ensure a minimum support price for CNF crop outputs and welfare benefits to the CNF community. The

savings in subsidies that arise due to the avoidance of chemical input use in growing crops under CNF can be utilized for providing subsidies and incentives. Similarly, farmers of CNF may be provided an incentive for their enhancement of carbon sequestration in soils in rural areas.

Table 10.5: Suggestions on CNF: Responses from all the stakeholders

Description of Responses	Total Responses	Percentage
Inputs	1,421	93.1
Extension	694	45.5
Marketing	381	25.0
Implements / tools	242	15.9
Loans	120	7.9
Incentives	52	3.4
Seeds	18	1.2
Inter Developmental Coordination	8	0.5
Establishment of Agro Processing units	3	0.2
Increased Participation	2	0.1
Insurance	1	0.1

Number of respondents are 1,451
Source: IDSAP Filed Survey 2022-23

10.7. Conclusions

The responses of different stakeholders highlight the potential of CNF, despite inadequacies in its implementation. The analysis has indicated that the cost of production of crops can be reduced through the provision of zero-interest loans to CNF farmers from banks (SHGs-Bank Linkages); by making labour engaged in MGNREGS to work on the fields of farmers practicing CNF; by the effective utilization of natural resources; by promoting diversified food systems for optimum utilization of land. The guarantee of premium prices for CNF outputs can be ensured through the promotion of farmers' producer organizations (more specifically with the women SHG networks) in the context of raising social capital among CNF farmers. The existing extension services also need to be further strengthened to realize the potential benefits of CNF. Tables 11.1 and 11.2 provide substantial evidence for these conclusions. In addition to this, farmers of CNF may be provided incentives for their contribution to the enhancement of carbon sequestration in soils. This can expedite the penetration of CNF among farmers.

Appendix Tables of Chapter 10

Appendix Table 10.1: Strengths of CNF: Responses from Focus Group Discussions

Category	Description of Responses	No of responses	Percentage
Cost of cultivation	Reduced working capital requirements for CNF crops grown	35	100.0
	Usage of chemical inputs has declined	31	88.6
	Farmers are not able to prepare biological inputs on their own.	15	42.9
	NPM shops have provided Bi-logical inputs for natural farming	11	31.4
	Others	9	25.7
Yields	Crop-wise yields have increased considerably compared to non-CNF	24	68.6
	CNF crops have strength to overcome the transition of weather abnormalities.	18	51.4
	Quality of product including shelf life has increased in case of horticulture crops	2	5.7
Marketing	Farmers have adopted their own marketing strategies for selling of CNF products	13	37.1
	Middle men system is reduced to some extent	9	25.7
	Reasonable prices have been obtained by farmers for CNF products	6	17.1
	TTD has given minimum support price to the CNF products	4	11.4
	Employees and sellers have approached the garden of farmer to buy the fruits and vegetables on reasonable price	3	8.6
	Customers are showing utmost interest to the CNF products for improving their health	13	37.1
Increase in the incomes	*Debits of farmers have decreased*	*10*	28.6
	Farmers have got additional income through selling of vegetables	*4*	11.4
	Farmers income has increased due to cultivation of model crops	2	5.7
	Income of agricultural labour has increased	2	5.7
	Availability of work to agriculture labour in the entire agricultural year.	2	5.7
	More number of Labour days have been obtained by agricultural labours	2	5.7
Health	Health status improved and expenditure on health care are declined	26	74.3
	There are no health issues in applying CNF inputs on the farms of farmers	5	14.3
	Producing Chemical free nutrient rich and tasty agricultural produce of CNF	18	51.4
Education	Education status of the children has improved	29	82.9
Conservation of Natural Resources	Land fertility has increased	20	57.1
	Declined of water need for the crops grown	15	42.9
	Village Natural resources like water bodies, land and air are not polluted due to CNF	15	42.9
	Carbon Percentage in soil has increased	8	22.9
	Crops of CNF are able to with stand even with less wets.	6	17.1
	Increased moisture in the soil reduced water requirements for growing CNF crops	2	5.7

Category	Description of Responses	No of responses	Percentage
Changes in cropping system	Percentage of total cropped area put under purely APCNF and PMDS+APCNF has increased	34	97.1
	CNF farmers have increased over time CNF farmers has increased	33	94.3
	Cultivation of Inter-cropping has increased	16	45.7
	Number of crops are increased due to intervention of PMDS	13	37.1
	Cultivated area has expanded due to CNF	8	22.9
	More crops have been cultivated in less land due to CNF	6	17.1
	Increasing the farmers number who are cultivating twice in a year due to PMDS	4	11.4
	Number of S2S farmers has increased every Year.	4	11.4
	Crop intensity has increased after CNF	2	5.7
	Cultivation of Vegetables has increased	1	2.9
Extension Services	The extension services from RySS and Agriculture officers are very adequate and appropriate.	25	71.4
	Awareness meetings have been organised with CNF farmers by RySS	1	2.9
	Awareness meetings have been organised with SHG members	1	2.9
Others	The feeling of belongingness and oneness is more in CNF practising families.	30	85.7
	There is considerable increase in the livestock holding in the villages	19	54.3
	Drip irrigation method is followed in CNF farming to conserve water resources	4	11.4
	Rental payment significantly decreased	3	8.6
	Fodder from APCNF crops has been used	2	5.7

Number of respondents 35; *Source: IDSAP Filed Survey 2022-23*

Appendix Table 10.2: Constraints (Weakness and threats) of CNF: Responses from FGD

S. No	Description of Responses	No of responses	Percentages
Extension	Less awareness about APCNF	20	57.14
	Shortage of RySS staff for providing extension services	17	48.57
CNF Inputs	Less number of NPM shops are available to provide biological inputs in villages	21	60.00
	Consuming quite a bit of time for the preparation biological inputs	18	51.43
	Shortage of family labour to prepare biological inputs	6	17.14
	Preparation of biological inputs is not economically viable with hired labour	3	8.57
	Scarcity of raw materials such as cow dung, urine for preparation of biological inputs	20	57.14
	Lack of mulching materials	1	2.86
Tools	Shortage of tools / instruments for the preparation of biological units.	24	68.57
Weed control	Control of weed through biological inputs has been found to be difficult	3	8.57
Resource use	No changes in water requirement for irrigations in cultivating crops under CNF	4	11.43
Marketing	Lack of remunerative prices special price for CNF products in the markets	22	62.86
	Lack of awareness on marketing strategies for CNF farmers	13	37.14

S. No	Description of Responses	No of responses	Percentages
	Market channels are not increased even after CNF	8	22.86
	There is no separate identity for CNF products in the markets	1	2.86
Seeds	All types of PMDS seeds are not available for growing crops	17	48.57
Other	Farmers are less inclined to practice natural farming due to their illiteracy	3	8.57

Number of respondents 35

Source: IDSAP Filed Survey 2022-23

Appendix Table 10.3: Suggestions on CNF: Responses from Focus Group Discussions

S. No	Description of Responses	No of responses	Percentages
Inputs	NPM shops should established in villages	29	82.86
	Supply of Desi Cows to the CNF farmers on subsidy	12	34.29
	Biological inputs should be provided through Rythu Bharosa Kendras	6	17.14
Loans	Loans to be provided on zero interest to the CNF farmers including Tenant farmers	8	22.86
Seeds	CNF seeds / PMDS seeds to be supplied by RySS	11	31.43
Marketing	CNF crops should be procured through RBKs at higher prices	34	97.14
	Government should be provided a certificate to CNF farmers to market their agricultural produce at higher prices	16	45.71
	Special Prices should be given to CNF products	7	20.00
	Cold Storage facility to be provided by the government to store an agricultural product	3	8.57
	Food mela to be organised with APCNF farmers	2	5.71
	CNF products should be marketed through the Rythu Bazar	1	2.86
Extension	More awareness programs to be organised on APCNF.	16	45.71
	More exposure field visits to be organized for the CNF farmers	8	22.86
	Group meetings to be conducted with farmers	6	17.14
	Provide Extension services for the Preparation of inputs	4	11.43
	Videos of successful APCNF farmers to be telecasted in various news channels	4	11.43
	ICRP's should be available in the field all the time	3	8.57
	Training programs to be conducted to the APCNF farmers	3	8.57
	Agricultural authorities should provide advice in sowing the seeds	3	8.57
Tools	Implements to be provided for the farmers on subsidy for the preparation of biological inputs	12	34.29
Other	Incentives should be provided to CNF farmers	8	22.86
	Debates to be organised for both CNF and non-CNF Farmers for encouraging non-CNF farmer to adopt CNF	2	5.71
	Govt should provide special crop insurance to the CNF farmers	1	2.86
	Integrate APCNF program with MGNREGS.	1	2.86

Source: IDSAP Filed Survey 2022-23

Appendix Table 10.4: Strengths of CNF: Responses from Case Studies

S. No	Description of Responses	No of responses	Percentages
Reduction in the cost of production	Dependency on credit markets has declaimed	1	3.13
	CNF farmers have availed credit through banks and SHGs	4	12.50
	NPM shops have provided biological inputs for CNF	14	43.75
	The pest has been controlled through biological inputs	5	15.63
	Plantation of trap crops for control of insects	2	6.25
	Framers have prepared biological inputs on their own	19	59.38
	Usage of the agriculture inputs like fertilizers and pesticides has reduced in CNF villages.	15	46.88
	The cost of agricultural inputs is affordable to CNF farmers	11	34.38
	The cost of cultivation of CNF crops is less compared to non-CNF crops	20	62.50
	Reduction in requirement of working capital for growing crops	16	50.00
Changes in yields	Crop-wise yields have increased under CNF over non-CNF	9	28.13
	Producing free chemical-free - nutrient-rich more tasty crops under CNF	7	21.88
Marketing	Farmers have obtained remunerative prices for CNF products	3	9.38
	Middlemen system is reduced to some extent	4	12.50
	Farmers have adopted their own Strategies for the expansion of marketing of CNF products	4	12.50
	TTD has been giving minimum support price to the CNF products	1	3.13
Increase in income of farmers	Income from crop production has increased	13	40.63
	Farmers' income has increased due to the cultivation of model crops	1	3.13
	Getting Additional income through selling vegetables and Dairy products	12	37.50
	Improvement in the economic status of farmer	4	12.50
Increase in income of Agriculture labour	Availability of work to the labour in the entire year.	3	9.38
Improvement in health of Agriculture Labour	There are no health issues in applying biological inputs on farms farmers	7	21.88
Improvements in educational status of children of farmers families	The education status of the children has improved.	22	68.75
	Money for children's education has been saved from the increased income	3	9.38
Conservation of Natural Resources	Carbon percentage has increased in the soil	2	6.25
	Decline of wets for the crops	5	15.63
	Decreased in the irrigations.	1	3.13

S. No	Description of Responses	No of responses	Percentages
	The drip irrigation method is followed in CNF farming	2	6.25
	Modest increases in ground water levels during summer.	2	6.25
	Village water bodies, land and air are not polluted due to CNF	2	6.25
	Moisture in the soil has increased	2	6.25
Improvement in soil fertility	Soil fertility has increased	32	100
Changes in cropping system	A Grade model crops have been cultivated	2	6.25
	Laying of bund, border crops, layer crops, kitchen garden crops have been practised	9	28.13
	Crop intensity has increased after CNF	1	3.13
	Due to intervention of PMDS and RDS, cultivation of crops has increased.	10	31.25
	Cultivated area has expanded	10	31.25
	Cultivation of Papaya, Banana, Mango, Sapota Trees and vegetables has increased	2	6.25
	Inter cropping system by APCNF has increased	7	21.88
	More crops have been cultivated in less land	5	15.63
	Number of CNF farmers have increased over time	1	3.13
	Percentage of total cropped area put under purely APCNF and PMDS+APCNF has increased	7	21.88
	Increase in percentage of farmers following APCNF and PMDS+APCNF	7	21.88
Extension Services	Awareness meetings have been organized with the help of RBK	1	3.13
	Awareness meetings have been organised with SHG members	4	12.50
	The extension services from RySS and Agriculture officers are very adequate and appropriate	19	59.38

Number of respondents = 32

Source: IDSAP Filed Survey 2022-23

Appendix Table 10.5: Constraints (Weakness) and Threats of CNF: Responses from Case Studies

S. No	Description of Responses	No of responses	Percentages
Extension	Less awareness of farmers on APCNF	3	9.38
	Shortage of RYSS staff	2	6.25
Input Preparation	Consuming quite bit of time for preparation biological inputs	7	21.88
	Lack of awareness on preparation of biological inputs	1	3.13
	Wages of hired labour is more for input preparation	1	3.13
	Lack of mulching materials	2	6.25
	Less Number of NPM shops are available across villages	7	21.88
	Shortage of family labour for the preparation of biological inputs in CNF	5	15.63
Tools and implements	Shortage of tools instruments for preparation of biological inputs.	15	46.88

S. No	Description of Responses	No of responses	Percentages
Scarcity of raw materials	Scarcity of raw materials such as cow dung, urine for preparation of biological inputs	14	43.75
Marketing	Lack of awareness on marketing strategies for CNF farmers	6	18.75
	Lack of ruminative prices for CNF products	1	3.13
	No new market channels for CNF products came in to existence	1	3.13
	There is no special price for CNF crops in the markets	4	12.50
Seeds	Non availability of all types of crop seeds	4	12.50
Threats	Reduction in Land lease practice	3	9.38

Number of responses = 32

Source: IDSAP Filed Survey 2022-23

Appendix Table 10.6: Opportunities of CNF: Responses from Case Studies

Category	*Description of Responses*	*No of responses*	*Percentages*
Increase in demand for APCNF Products	Customers are showing utmost interest to the CNF products for improving their health	7	21.88
	Health issues and expenditure on health are reduced due to consumption of CNF products	17	53.13
Conservation of Natural Resources	Increase in the ground water due to cultivation of CNF.	2	6.25
Increase in livestock in holding	There is increase in the livestock holding in CNF villages	9	28.13
Changes in inputs	Usage of the agriculture inputs like fertilizers and pesticides is reduced in CNF villages	6	18.75
Increase in social capital	The feeling of belongingness and oneness is more in CNF practising families.	4	12.50
Withstand weather variabilities	CNF crops have strength to overcome weather variabilities	12	37.50

Source: IDSAP Filed Survey 2022-23

Appendix Table 10.7: Suggestions for CNF: Responses from Case Studies

Category	*Description of Responses*	*No of responses*	*Percentages*
Input	NPM shops should be promoted in villages	32	100
	Supply of Desi Cows to the CNF farmers has to be taken up	5	15.63
Loans	Government should support the CNF farmers with financial assistance through banks with low interest rates or Zero interest rates.	4	12.50
Seeds	CNF seeds / PMDS seeds to be supplied	1	3.13
	Govt should control supply of fake seeds	1	3.13
	Supply of high yielding seeds	2	6.25

Category	*Description of Responses*	*No of responses*	*Percentages*
Marketing	Government should develop marketing channels to the CNF products and also provide a certificate to the CNF farmers for marketing products on their own	21	65.63
Extension	Need to create more awareness on CNF products to the public	11	34.38
	Organize more awareness programs on APCNF.	2	6.25
	Training programs to be conducted to the APCNF farmers	1	3.13
Implements	Supply of tools / instruments to the CNF farmers	2	6.25
Incentives	Government should provide incentives to encourage farmers to adopt CNF	6	18.75
Inter Department of Coordination	Integrate APCNF program with MGNREGS.	3	9.38

Number of respondents = 32

Source: IDSAP Filed Survey 2022-23

Appendix Table 10.8: Strengths & Opportunities of CNF: Responses from Horticulture Case Studies

Category	Description of Responses	No of responses	Percentages
Reduction in cost of production of crops	CNF farmers are availing benefit of credit service through banks and relatives.	5	16.67
	Reduced working capital requirements for growing crops	17	56.67
	Usage of chemical inputs is reduced	15	50.00
	NPM shops are providing biological inputs for natural farming	6	20.00
	Preparation of biological inputs on their own by farmers	4	13.33
	Cost of agricultural inputs are affordable to CNF farmers	8	26.67
	Cost of cultivation of crops has decreased compare with non-CNF	21	70.00
Changes in yields of crops	Application of biocides in guava trees did not show insects in guava fruits	1	3.33
	Increase in yields of mango crop due to CNF	1	3.33
	CNF crops have strength to overcome the transition of weather abnormalities.	11	36.67
	Crop quality improved in CNF	5	16.67
	Crop-wise yields have increased considerably compared to non-CNF	27	90.00
	Due to application of CNF inputs, the fruit size, colour, weight, softness, taste and shelf life have increased in case of horticulture and vegetables crops	32	106.67
	Nuts do not get Hollow nuts have decreased in case of crops like Ground nut	1	3.33
	Producing chemical free, nutrient rich, tasty healthy crops	5	16.67
	Protecting from different types of pests.	5	16.67
Marketing of CNF crop outputs	Employees and sellers have come to the gardens of farmers to buy fruits and vegetables on reasonable price	2	6.67
	Availing good price for APCNF products	10	33.33
	Middle men system is reduced to some extent but still existed in villages	1	3.33

Category	Description of Responses	No of responses	Percentages
	Own marketing strategy adopted for selling of fruits	6	20.00
	Strategies are adopted for expansion of marketing for CNF products	2	6.67
Increase in the income	Debts have declined	2	6.67
	Economic status of CNF farmers has improved	28	93.33
	Income of farmers has increased in guava cultivation	1	3.33
	Getting Additional income through selling of vegetables / Dairy products.	7	23.33
	Income has increased in mango cultivation	3	10.00
	Availability of works to the labour in the entire year.	4	13.33
	More number of Labour days available	4	13.33
Health	Health status improved and expenditure on health care has reduced	5	16.67
	There are no health issues in applying the biological inputs on the farms of farmers	9	30.00
Education	Education status of the farmers children has improved.	8	26.67
Conservation of Natural Resources	Carbon percentage in the soils has increased	1	3.33
	Crops can withstand even with less wets.	8	26.67
	Decline of wets for the crops	8	26.67
	Decreased water irrigations.	6	20.00
	Water consumption in the fields has decreased due to increased Soil moisture Levels by using the biological inputs	6	20.00
	Drip irrigation method is followed in CNF farming	6	20.00
	Modest increase in ground water levels during summer.	2	6.67
	Land fertility is increasing	25	83.33
	Protecting environment	4	13.33
Changes in cropping system	Corn is the main Inter-crop between orchard and sorghum	1	3.33
	Cultivation of Inter-cropping has increased	6	20.00
	Cultivated area is expanded	5	16.67
	Cultivating the grass in between the guava trees	1	3.33
	cultivating vegetables at home for self-consumption	1	3.33
	Cultivation of marigold crops in mango crops protects the mangoes from different pesticides	1	3.33
	Inter-cropping has increased and benefitted by growing of marigold	1	3.33
	Cultivation of Mosambi (Sweet lemon), Jowar are the crops which provide additional income to the CNF farmers.	1	3.33
	Cultivation of PMDS crops have increased	1	3.33
	Cultivation of crops are increased.	2	6.67
	Intercropping has been practiced with vegetables	2	6.67
	Percentage of total cropped area put under purely APCNF and PMDS+APCNF has increased	17	56.67
	Fish / Chepa Kashayam for vegetables aided flower survival compared to non-CNF farming.	3	10.00
	More crops are cultivating in less land	5	16.67

Category	Description of Responses	No of responses	Percentages
	Greenery of the land has increased as well mango trees have grown well	2	6.67
	Laying of border crops such as vegetables & creepers has increased	6	20.00
	Laying of bund, border crops, layer crops and kitchen garden crops has increased	3	10.00
	Cultivation of vegetables has increased	4	13.33
Extension Services	Awareness meetings are organised with SHG members	2	6.67
	The extension services from RySS are very adequate and appropriate	7	23.33
Demand	CNF products are useful for improving family health	13	43.33
	Health issues and expenditure on health are declined	16	53.33
	There is a significant change in livestock holding in CNF villages	1	3.33

Number of respondents =30

Source: IDSAP Filed Survey 2022-23

Appendix Table 10.9: Constraints (Weakness) and Threats of CNF: Responses from Horticulture Case Studies

Description of Responses		No of responses	Percentages
Extension	Inadequate awareness of farmers on APCNF	1	3.33
	Shortage of RYSS staff	1	3.33
Input Preparation	Biological inputs are not available in time for urgent / immediate problems	3	10.00
	Biological inputs take longer time to prepare	5	16.67
	Shortage of family labour in CNF has declined opportunities for the preparation of biological inputs	6	20.00
	Less Number of NPM shops	1	3.33
Raw Material	Scarcity of raw materials such as cow dung, urine for preparation of biological inputs	5	16.67
Tools/ Instruments	Shortage of tools or instruments for preparation of biological units.	1	3.33
Resource Conservation	No change in water irrigations.	1	3.33
Marketing	Lack of awareness on marketing strategies for CNF farmers	4	13.33
	Market channels not increased even after CNF	3	10.00
	Lack of ruminative prices for CNF products	1	3.33
Cropping system	Intercropping has not been practiced due to shade of mango trees	1	3.33
	Use of fish/fish Kashayam causes bad smell in the farm this led to the problem of stray dogs disturbing crops	3	10.00
Threats	Reduction in land lease practices	5	16.67

Number of respondents =30

Source: IDSAP Filed Survey 2022-23

Appendix Table 10.10: Suggestions of CNF: Responses from Horticulture Case Studie

Category	Description of Responses	No of responses	Percentage
Inputs	Biological inputs should be provided through Rythu Bharosa Kendras (RBKS)	4	13.33
	NPM shops should be promoted in villages	7	23.33
	Provide permanent fencing facilities	4	13.33
	Usage of the agriculture inputs like fertilizers and pesticides has reduced in CNF villages	2	6.67
Loans	Government should support the CNF farmers with financial assistants through banks with low interest rates or Zero interest rates	1	3.33
Seeds	High Yielding variety seeds should be distributed by RySS	1	3.33
	CNF seeds / PMDS seeds to be supplied by RySS	2	6.67
Marketing	CNF products demand premium prices	5	16.67
	Government should develop marketing to the CNF products and provide a certificate to the CNF farmers for marketing their products on their own	11	36.67
	Need to create more awareness on CNF products to the public	6	20.00
Extension Services	Group meetings to be conducted with farmers	2	6.67
	ICRP's should be available in the field all the time	1	3.33
	More awareness programs to be organised on APCNF.	8	26.67
Implements	Government should provide tools to prepare biological inputs	5	16.67
Inter-departmental coordination	Integrate APCNF program with MGNREGS.	1	3.33

Number of respondents =30

Source: IDSAP Filed Survey 2022-23

Appendix Table 10.11: Strengths and Opportunities of CNF: Responses from Strategic Interviews

Category	Description of Responses	No of responses	Percentage
Reduction in the Cost of Production of crops	NPM shops have provided inputs for CNF	8	34.78
	Desi cows have been provided by TTD	5	21.74
	Seeds to the farmers on subsidy price with support of Rural Development Trust (RBT)	1	4.35
	Supplying seeds and providing stalls for CNF inputs	1	4.35
	Usage of chemical inputs are reduced	17	73.91
	Cost of agricultural inputs are affordable to CNF farmers	5	21.74
	Cost of cultivation of crops of CNF decreased compared to non-CNF	15	65.22
	Requirement of working capital has reduced	7	30.43
	Farmers have prepared biological inputs on their own.	8	34.78
	Kashayams have been prepared by farmers	1	4.35
	Due to application of CNF inputs, fruit size, colour, weight, softness, taste and shell-life of horticulture and vegetable crops have increased	2	8.70
	Protect from different types of pests.	1	4.35
	Producing chemical free, nutrient rich, and tasty healthy crops,	4	17.39
Marketing	Availing good price for APCNF products by farmers	3	13.04

Category	Description of Responses	No of responses	Percentage
	Own marketing strategy adopted for selling of fruits/products by farmers	5	21.74
	TTD has given minimum support price to the CNF products	8	34.78
Increase in Income of Farmers	Farmers income has increased due to cultivation of model crops	1	4.35
	Net income has increased from crops grown under CNF	1	4.35
Improvement in Health	CNF products have improved farmers family's health	4	17.39
	Consumers have shown utmost interest to the CNF products for improving their health	2	8.70
	Health issues and expenditure on health are declined	7	30.43
	There are no health issues in applying biological inputs to the fields of farmers	4	17.39
Education	Education status of the children has improved.	8	34.78
Conservation of Natural Resources	Carbon percentage has increased in soils	8	34.78
	Declined of pests in the crops	7	30.43
	Modest changes are found in ground water levels during summer.	7	30.43
	Protecting environment	1	4.35
	Land fertility has increased	13	56.52
Changes in cropping systems	Covering of the lands with Greenery in 365 days	1	4.35
	Cultivated area has expanded	9	39.13
	Cultivation of Inter-cropping has increased	4	17.39
	Cultivation of PMDS crops has increased	4	17.39
	Due to intervention of PMDS and RDS, cultivation of crops has increased.	7	30.43
	Laying of bund, border crops, layer crops, kitchen garden crops, have been practiced	6	26.09
	More crops are cultivating in less land	1	4.35
	Percentage of total cropped area put under purely APCNF and PMDS+APCNF has increased	10	43.48
	Rental payment significantly decreased towards leased land	1	4.35
	Gained profit by laying of border crops such as vegetables & creepers	2	8.70
	Small and marginal farmers have been motivated towards natural farming	2	8.70
Extension Services	Awareness has been created by cultivation of CNF crops in Complex plots	1	4.35
	Awareness meetings have been organised through RBKs	2	8.70
	Awareness meetings have been organised through SHG members	3	13.04
	Awareness programmes have been organised	2	8.70
	Rallies have been organised and Seed have been distributed to farmers Kits to the farmers	1	4.35
	Putting efforts to educate the farmers for adopting CNF practises	1	4.35
	The peasants campaigned to each of the home in village and explained the importance of CNF farming	2	8.70
	The extension services from RySS are very adequate and appropriate.	8	34.78
Inter departmental coordination	Strategies adopted for better co-ordination with the line departments	3	13.04
Opportunities	CNF has created oneness among farmers	4	17.39

Category	Description of Responses	No of responses	Percentage
	CNF crops have strengthened to withstand weather variability	1	4.35

Number of respondents =23
Source: IDSAP Filed Survey 2022-23

Appendix Table 10.12: Constrains (Weakness) and Threats of CNF: Responses from Strategic Interview

Category	Description of Responses	No of responses	Percentages
Extension	Less awareness of farmers on APCNF	2	8.70
	Non availability of literature on CNF to the farmers	1	4.35
	Shortage of RySS staff	12	52.17
Input preparation	Consuming quite a bit of time for preparation of CNF inputs.	6	26.09
	Non availability of mulching materials	2	8.70
	Shortage of family labour/hired in CNF	8	34.78
Tools/ Machinery	Shortage of tools / instruments for preparation of biological inputs.	12	52.17
Scarcity of Raw Materials	Scarcity of raw materials such as cow dung, urine for preparation of biological inputs	15	65.22
Resource - Use	No changes in water irrigations.	1	4.35
Marketing	Lack of awareness on marketing strategies for CNF farmers	6	26.09
	Lack of ruminative prices for CNF products	7	30.43
	Market channels are not increased even after CNF	5	21.74
Coordination with line departments	Lack of coordination with the line departments	1	4.35
Yield of crops	CNF crops are also vulnerable to the weather anomalies	1	4.35
	There are less yields when compared to non-CNF	6	26.09
Farmers inclined to patriciate	Farmers are less inclined to practice natural farming	1	4.35
Seeds	Non availability of all types of seeds of crops	7	30.43

Number of respondents - 23
Source: IDSAP Filed Survey 2022-23

Appendix Table: 10.13: Suggestions of CNF: Responses from Strategic Interviews

Category	Description of Responses	No of responses	Percentages
Inputs	Biological inputs should be provided through Rythu Bharosa Kendras	1	4.35
	CNF and PMDS seeds to be supplied	8	34.78
	Promote NPM shops in villages	16	69.57
	Every village should have seed Bank	1	4.35
	Govt should provide CNF inputs on subsidy price.	3	13.04

Category	Description of Responses	No of responses	Percentages
	Provide equipment to the NPM shops to meet the demand for biological inputs	1	4.35
	Supply of Desi Cows to the CNF farmers by RySS	5	21.74
	Govt should control fake seeds	1	4.35
Loans	Government should support the CNF farmers with financial assistants through banks with low interest rates or Zero interest rates	10	43.48
Marketing	CNF crop output should be procured through RBKs at remunerative prices	1	4.35
	Government should develop marketing ways to the CNFs and provide certificate to CNF farmers	18	78.26
	Marketing of CNF products through SHG's	1	4.35
	Separate marketing facility should be provided for CNF output	1	4.35
	CNF output for the supply to local schools, hospitals and organizations	1	4.35
	Special Price to the CNF Products	20	86.96
Extension	Awareness to be created through various departments like RBK's and Agriculture	2	8.70
	Debates to be organised for both CNF and non-CNF farmers to enthuse non-CNF farmers to shift to CNF	2	8.70
	Success stories of CNF farmers should be telecasted through various channels of media.	2	8.70
	Group meetings to be conducted with farmers	1	4.35
	ICRP's should be available in the field all the time.	1	4.35
	More field visits to be organized.	3	13.04
	Need to create more awareness on CNF products to the public	11	47.83
	Organize more awareness programs on APCNF.	4	17.39
	Provide extension services for Preparation of inputs	3	13.04
	Provide permanent fencing facilities	1	4.35
	Training programs to be conducted to the APCNF farmers	6	26.09
Incentives	Tools and instruments for preparation of CNF inputs should be provided	6	26.09
	Government should bring a natural farming act having provisions for health safety, welfare and marketing to the agricultural families of farmers	9	39.13
	Incentives should be provided to CNF farmers	6	26.09
Agro-Processing units	Processing units have to be established for CNF outputs	3	13.04

Number of respondents is 23

Source: IDSAP Filed Survey 2022-23

Appendix Table 10.14: Suggestions of CNF: Responses from Sample CNF farmers

S. No	Description of Responses	No of responses	Percentages
Inputs	CNF and PMDS Seeds and seed kits should be supplied by RySS	563	42.3
	Supply of desi cows to the CNF farmers by RySS	301	22.6
	Biological inputs should be provided by RySS	261	19.6
	NPM Shops to be promoted	96	7.2
	Agriculture instruments like pump, sprayers motors, drums should be provided	81	6.1
	Fencing material to be provided	62	4.7
	Mulching material to be supplied through RBKS	11	0.8
	Sub-total	***812***	***61.0***
Marketing	Need more marketing channels for CNF products	178	13.4
	Special price to the CNF Farmers should be arranged	37	2.8
	Need to increase market yards	18	1.4
	Cold storage should be constructed in villages	7	0.5
	Sub-total	***240***	***18.0***
Extension	Awareness Programs should be conducted for CNF	215	16.2
	Training programs to be conducted to the CNF farmers	169	12.7
	More Filed visits required with ICRPs for CNF farmers	85	6.4
	Awareness for CNF farmers through tv shows, multimedia be increased	80	6.0
	Awareness' meetings should be organized in RBK centre every month	32	2.4
	Exposure visits to farmers	4	0.3
	Advise farmers to cultivate inter crops, wherever possible	1	0.1
	Sub-total	***586***	***44.0***
Government support	Loans should be provided to the CNF framers including tenant farmers	97	7.3
	Farmers wants solar borewells on subsidy	88	6.6
	Farmer is have asked for special incentives to CNF Farmer	23	1.7
	MGNREGA work should be provided on CNF farmers' fields	3	0.2
	Community cattle sheds have to be established in villages	2	0.2
	Sub-total	***213***	***16.0***

Source: IDSAP Filed Survey 2022-23

Chapter 11: Issues, challenges and way forward

11.1. Introduction

The issues and challenges in implementation of CNF have been identified and elaborated in the Kharif and Rabi reports of 2022-23. The issues and challenges identified in both reports have been almost the same. Therefore, the issues and challenges identified in the Rabi report, which is more recent and updated, are summarized below. The tables and figures used in that chapter are given in the appendix for ready reference and use.

11.2. Issues and challenges

1. About 40 per cent of CNF farmers have allocated their entire operated area to CNF during Rabi 2022-23. Shortage of CNF inputs is a major issue according to 24 per cent of farmers in allocating cultivated area under CNF. Farmers, under non-CNF, are habituated to readily available inputs. Hence, farmers want such accessible inputs under CNF also. Further, there is a need for readymade inputs, especially the *Asthrams* and *Kashayams* for real-time application.
2. Inadequate extension services are another problem cited by 16 per cent of farmers. These constraints led to wide variations across the Agro-climatic Zones and the farmers' categories.
3. Shortage of suitable equipment such as mixers, blenders, stirrers, drums, etc., is cited as problem by 59 per cent of farmers.
4. The real issue for CNF farmers is getting a higher price for CNF produce than that for non-CNF output.
5. Scarcity of labour and scarcity of family labour have been encountered by 46 and 34 per cent of the farmers respectively.[53]
6. Scarcity of raw materials to make biological inputs and inadequate knowledge to prepare the biological inputs are the issues reported by 44 and 34 per cent of farmers respectively.

It is important to note that though the problems remained common in all previous surveys, the number of persons reporting each of these problems has declined significantly in this year's survey compared to previous years. This decline reflects the improvement in the RySS's extension and support services and the increased ability of farmers to master the new techniques and practices of CNF.

Given the critical role of field staff in implementing and expanding the programme, RySS must strengthen the field staff. The vacancies need to be filled. Apart from filling the vacancies and strengthening the cadre, RySS may consider providing flexible and focussed working conditions so that the staff can optimally use their time, resources, and energy while balancing their professional and personal responsibilities.

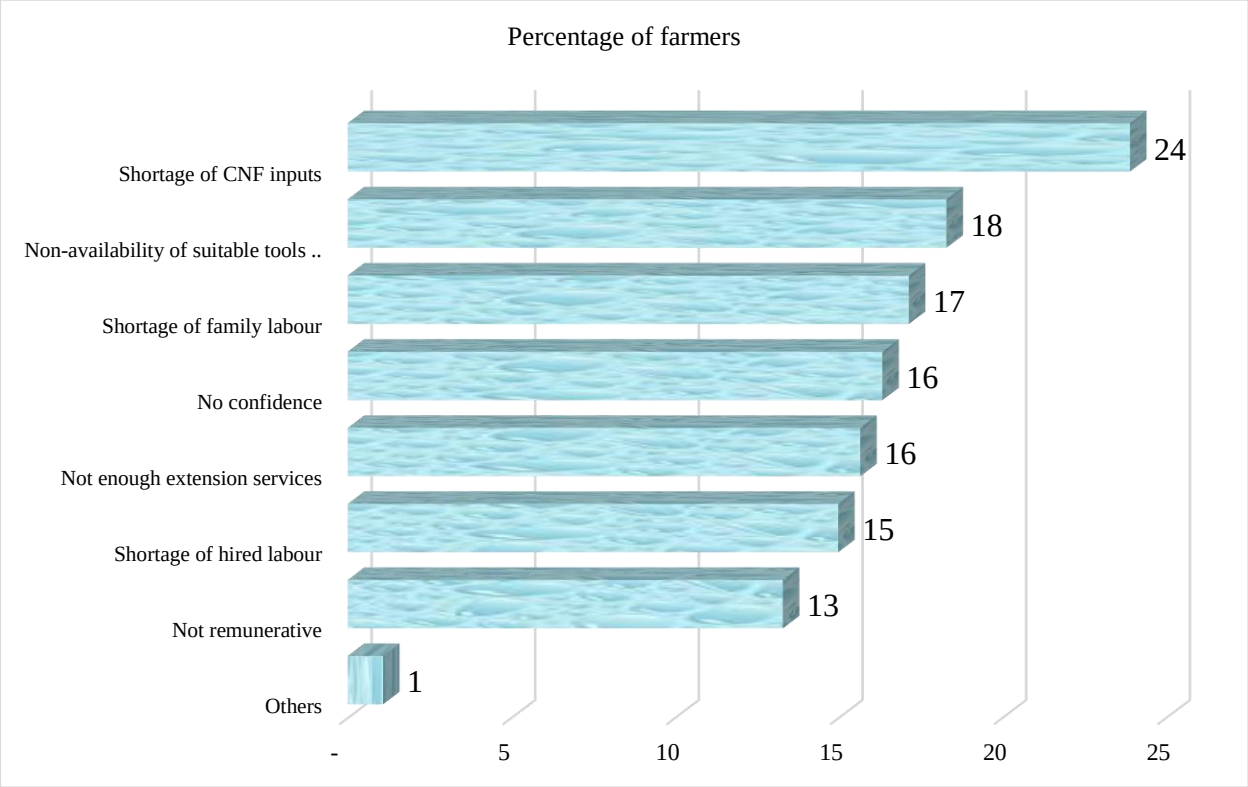
RySS may strengthen evidence-based advocacy to convince the farmers to take up CNF on a large scale. and other stakeholders to support the CNF expansion and replication.

The implementation of CNF without any incentives and subsidies to the farmers in the policy environment, which is characterised by incentivized and subsidized chemical-based farming, throws up challenges for the expansion of the adoption of CNF by farmers in the state.

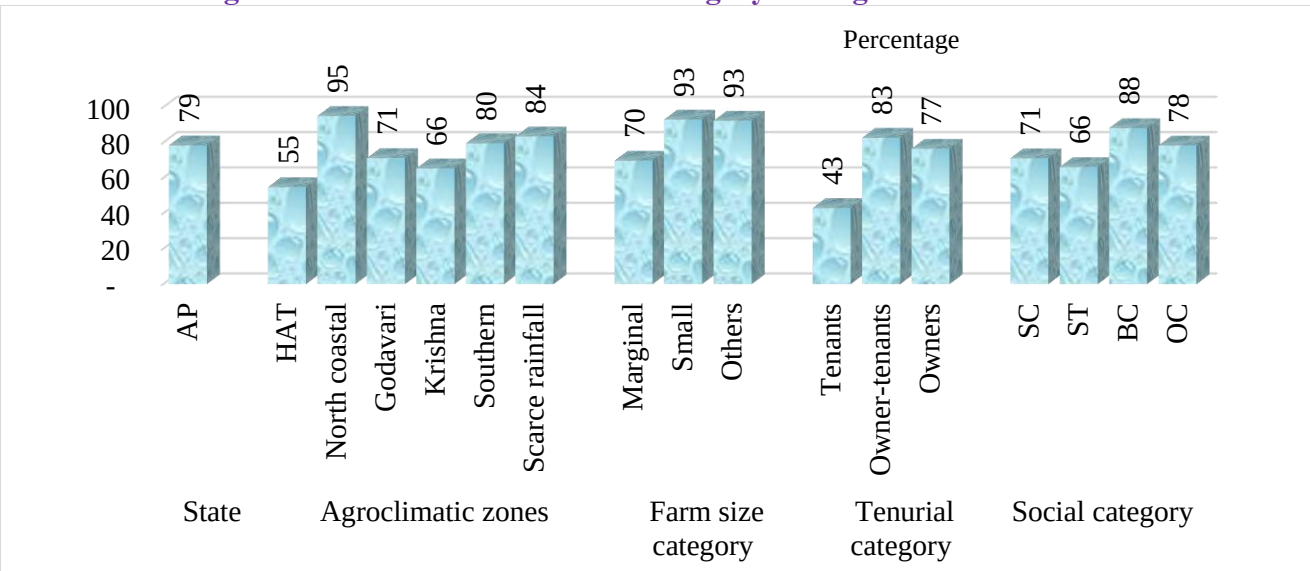
[53]Whether the labour scarcity is due to CNF or due to local labour market conditions needs to be examined thoroughly.

Appendix tables and figures of chapter 11

Appendix figure 11.1: Percentage of farmers cited reasons for not allocating their entire operated area to CNF during Kharif 2022-23

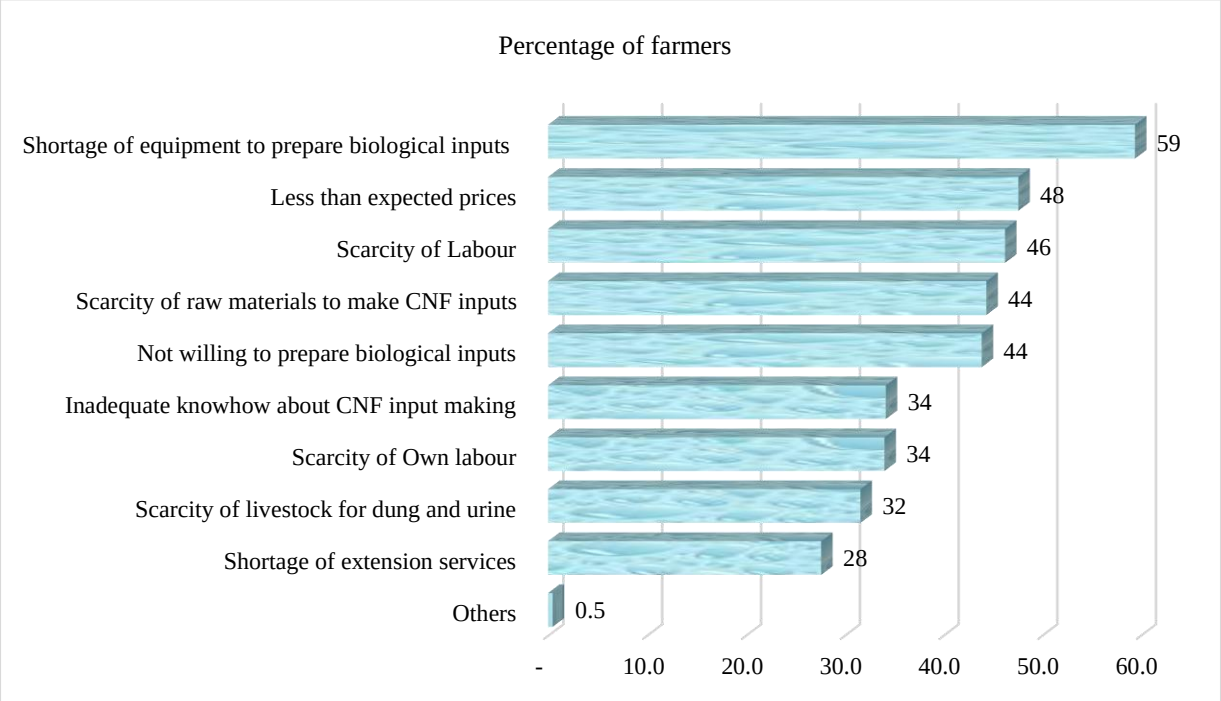


Appendix figure 11.2: Percentage of farmers experienced any problem in adopting CNF across Agroclimatic Zone and farmer's category during Rabi 2022- 2023



Source: *IDSAP, Field Survey 2022-23.*

Appendix figure 11.3: Major problems reported by the CNF farmers in adoption of CNF, during Rabi 2022-23



Source: *IDSAP, Field Survey 2022-23.*

Appendix Table 11.1: Extension Services Received by CNF Farmers according to sources and quality of services During Rabi 2022-2023

Source of advice/ extension services	Percentage of farmers availed services	Average Number of interactions*	Satisfaction level**
Master farmer/ ICRP	99	8	4
RySS staff -CRP, CA, MA, etc.	90	5	4
Fellow farmers	81	5	4
Electronic media TV/ Videos	34	5	3
SHG/ VO members/ leaders	33	3	3
Formal training by RySS	26	2	3
Newspapers and magazines	11	3	3
Exposure visits	7	1	3
Booklets given by RySS and others	5	3	3
NGO	1	9	4
Others	0	0	0

** Note: All the interactions need not be individual interactions. Some might be group interactions*

*** 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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The Institute for Development Studies Andhra Pradesh is a leading institution for Economic and Social Studies focusing on Andhra Pradesh from national and global perspectives. It is an autonomous institute, supported and funded by Government of Andhra Pradesh. It undertakes development research, teaching, capacity building and policy advocacy. It serves as a Think Tank of Government of Andhra Pradesh and Government of India. It is registered under Andhra Pradesh Society Act 2001 vide Reg.No.101/2019. Centre for Tribal Studies has also been established as a part of IDSAP.

The vision of Development Studies is to build an inclusive society, ensuring that the people of Andhra Pradesh are free from hunger, poverty and injustice. It envisaged that IDS would emerge as a centre of excellence engaged in cutting edge policy research and creation of evidence-based knowledge for shaping social progress.

It conducts research on network mode involving eminent experts drawn from state, national and international centres of excellence to work towards social progress. It builds data base and documentation on Andhra Pradesh Economy accessible to researchers. Its faculty is a mix of core residential faculty, adjunct faculty, visiting faculty and affiliates drawn from other centres of excellence. The residential faculty is a mix of established senior scholars and potential and motivated young scholars.

Institute for Development Studies Andhra Pradesh

Madhurawada, Visakhapatnam 530041

www.idsap.in