

Assessing the Impact of APCNF

[Andhra Pradesh Community Managed Natural Farming]
A Comprehensive Approach Using Crop Cutting Experiments

*Third Interim Report of
Rabi Season 2021-22*

Submitted To

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Rabi Season 2021-22 Report

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Acronyms

| | |
|----------------|---|
| APCNF | : Andhra Pradesh Community Managed Natural Farming |
| BC | : Backward Caste |
| CACP | : Commission for Agriculture Costs and Prices |
| CAs | : Cluster Assistants |
| CCEs | : Crop Cutting Experiments |
| CNF | : Community Managed Natural Farming |
| CRPs | : Community Resource Persons |
| CSR | : Corporate Social Responsibility |
| CSs | : Case Studies |
| DES | : Directorate of Economics and Statistics |
| DGC | : Days Green Cover |
| DPMs | : District Project Managers |
| FCI | : Food Corporation of India |
| FGDs | : Focus Group Discussions |
| FPOs | : Farmers Producer Organizations |
| FYM | : Farm Yard Manure |
| GCA | : Gross Cropped Area |
| GDP | : Gross Domestic Production |
| GoI | : Government of India |
| GPs | : Gram Panchayats |
| HAT | : High Altitude Tribal Areas |
| HDI | : Human Development Index |
| IASRI | : Indian Agricultural Statistical Research Institute |
| ICRPs | : Internal Community Resource Persons |
| ICWD | : Integrated Child and Women Development Service |
| IDSAP | : Institute for Development Studies Andhra Pradesh |
| MA | : Mandal Anchor |
| 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 |
| NSO | : National Statistical Office |
| NSSO | : National Sample Survey Organization |
| OC | : Other Castes |
| PMDS | : Pre-Monsoon Dry Sowing |
| PNPIs | : Plant Nutrient and Plant protection Inputs |
| PRDS | : Pre-Rabi Dry Sowing |
| RP s | : Resource Persons |
| RySS | : Rythu Sadhikara Samstha |
| SC | : Scheduled Caste |
| SEAG | : 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

1. This report is a part of larger annual studies Assessing the Impact of Andhra Pradesh Community Managed Natural Farming (APCNF or CNF, in short). The present study period is Rabi season 2021-22.
2. The objectives of the study are:
 - i. To estimate and compare the cost of cultivation, cost structure, crop yields, gross and net values of output from crop cultivation under CNF¹ and under chemical-based farming, referred as non-CNF in this report and all earlier studies.
 - ii. To estimate and compare the crop yields of CNF and non-CNF, independently and scientifically through crop cutting experiments (CCEs).
 - iii. To understand the impact of CNF on the inputs use, especially, the natural resources use and consequent environmental implications.
 - iv. To know the impact of CNF on farmers' wellbeing.
 - v. To understand the issues and challenges in adoption of CNF.
 - vi. To provide the insights from the field learning for the rapid expansion of the program.
3. The study has deployed “*with and without*” method to assess the impact of Pre-Monsoon Dry Sowing (PMDS) plus CNF. In this method, the outcomes of PMDS+CNF farmers cultivating a particular crop are compared with the outcomes of the non-CNF farmers cultivating the same crop, using chemical inputs. Though 12 crops were included in the annual survey/ study, only five seasonal crops are covered in this (Rabi) report. They are: (1) Paddy, (2) Groundnut, (3) Bengal gram, (4) Black gram, (5) Maize. Further, a minimum required number of CCEs were conducted for these same five crops.
4. The study is conducted in the entire State of Andhra Pradesh. Quantitative data of 1,145 CNF and 737 non-CNF sample farmers have been used in this report. However, only 674 (59 percent) CNF sample farmers and 421 (58 percent) non-CNF sample farmers have

¹ The CNF sample is drawn from the list of farmers, who are growing Pre-Monsoon Dry Sowing (PMDS), before Kharif crop and Kharif crops under Community Managed Natural Farming (CNF) or seed to seed (S2S) without applying any chemical input, at least in one plot, i.e., PMDS+CNF farmers. In this report the words PMDS+APCNF, PMDS+CNF and CNF are used interchangeably.

cultivation during the Rabi season. However, each sample household has been visited a minimum of 2-3 times during the season, to collect the farming data and other household details such as income from other sources, experience in CNF, etc., with a minimum time gap.

5. The study has conducted 883 CCEs during the Rabi season. The number includes 465 for CNF crops, 288 for non-CNF crops and 130 for Panel farmers' crops.
6. Appropriate research tools have been used. The field teams are placed in August 2021 to collect the field data throughout the year. The household survey for the Rabi season of 2021-22 was intensively conducted from early-February 2022 to end of May 2022. Data is analysed and results are provided at the state level, agroclimatic zone wise, farm-size category wise, tenurial category wise and social category wise.

0.2. Profiles of CNF and non-CNF sample farmers

7. Nearly one-third (31%) of CNF sample farmers are from SCs and STs compared to 20% of non-CNF farmers.
8. Marginal farmers are higher in CNF over non-CNF farmers by 10 percentage points.
9. In CNF cultivators, 35 percent are female farmers. The same is 32 percent among the non-CNF cultivators.
10. The share of young farmers (up to 40 years of age) is higher in CNF sample by 6 percentage points.
11. During Kharif 2021-22, on an average, CNF farmers have cultivated 1.15 hectares per farmer compared to 1.36 hectares per farmer among non-CNF farmers, i.e., 15 percent smaller average operated area for CNF farmers. But during Rabi, CNF farmers have operational area of 0.97 hectares per farmer vis-à-vis 1.01 hectares per farmer of non-CNF farmers. It shows that the difference of average operated land between CNF and non-CNF farmers is smaller only by 4 percent in Rabi compared to 15 percent similar difference in the Kharif 2021-22. Thus, the relatively lower gap in average operated area in Rabi between CNF and non-CNF farmers indicates the potential of CNF on enhancing the cropping intensity.
12. On average, CNF farmers have cultivated 81 percent of their operational holdings during the Rabi season. On the other hand, non-CNF farmers have cultivated 72 percent of their operational holding. That is the CNF farmers have cultivated 10 percentage points more area during Rabi 2021-22 compared to non-CNF farmers.

0.3. Impact of CNF on farming conditions

13. In every crop the expenditure on Plant Nutrition and Protection Inputs (PNPIs)² under CNF, is substantially less than that of non-CNF (Table 3.1). The data, once again confirms the hypothesis that the potential to save in the expenditure on PNPIs, in absolute terms, is high in the resource intensive crops.
14. The paid-out cost under CNF is lower than that of non-CNF in four out of five crops, which are considered in this report. The savings in paid-out costs, because of CNF, are more than ₹10,000 *per hectare* in two crops (Table 3.2). Only in Maize, the paid-out cost under CNF is marginally (₹270 per hectare or 0.56 percent) higher than that of non-CNF. Harvesting of higher Maize yields under CNF could be one possible reason the observed higher paid-out cost for CNF Maize.
15. The structure of the paid-out cost data suggest that CNF uses more diversified inputs compared to non-CNF.
16. Out of five crops covered, in three crops, the CNF yields are statistically higher than non-CNF yields and statistically no difference in remaining two crops. In all three crops, viz., Bengal gram, Black gram and Maize, in which the CNF yields are higher than non-CNF, the differences between the CNF and non-CNF yields are statistically significant (at 99 percent level of confidence). In two crops, viz., Paddy and Groundnut, in which non-CNF yields are higher than the CNF yields, the differences are not statistically significant (Table 3.5).
17. In all five crops covered, the CNF output has fetched higher prices over non-CNF output (Table 3.6). This is an encouraging trend. It seems the huge demand for chemical free food and other items is finding its way to CNF food items, farmers and villages. Apart from growing consumers' interest and demand for chemical free food, efforts of RySS in roping in Tirumala Tirupati Devasthanam (TTD) to purchase its required provisions from CNF farmers, is also giving good results.
18. The per hectare gross value of CNF output is higher than that of non-CNF output, in three out of total five crops covered in this report, and less in remaining two crops. However, the differences are higher in the three crops, with higher gross values of CNF output, viz., Bengal gram (198 percent), Black gram (38 percent) and Maize (20 percent) (Table 3.7).

²For the sake of comparative analysis, the biological stimulants under CNF and chemical inputs under the non-CNF, together, are referred as the plant nutrient and protection inputs (PNPIs)

19. The net values of CNF output are higher than that of non-CNF in as many as four out of five crops analysed. In the Paddy, in which the CNF yields are lower than that of non-CNF, the net value of CNF outputs is higher than that of non-CNF (Table 3.8). Clearly the higher net value of Paddy is due to savings in the cost of cultivation. Nearly ₹10,000 (20 percent) higher net value of Paddy output, indicates that under CNF, the Paddy farmers could be better off with some lower yields also.

0.4. Impact of CNF on resource use and environmental sustainability

20. Land under CNF is increasing due to increase in number of farmers participation in the Programme and increase in average area allocated to CNF by each participating farmer.
21. A greater number of own labour days are used in CNF crops vis-à-vis non-CNF in four out of five crops covered here, in the range of 4 days per ha in Groundnut to 14 days per hectare in Paddy (Table 4.4).
22. In case of hired labour, a greater number of labour days are used under CNF in three out of five crops, in the range of 5 days per hectare in Groundnut to 22 days per hectare in Maize. On the other hand, a lesser number of hired labour days are used under CNF, in the remaining two crops, in the range of 4 days per hectare in Bengal gram to 7 days in Black gram (Table 4.4).
23. In total, a greater number of labour days are used in four crops under CNF; and equal number of days are used in the remaining crop, Black gram, under both CNF and non-CNF (Table 4.4).
24. The major reasons for higher labour requirement are preparation of biological inputs and stimulants and crop diversity- taking mixed crops, inter crops, bund crops and border crops. Even more important reason is that CNF is a knowledge intensive, in which farmers have to be vigilant and responsive to the developments in the fields. All these indicate the CNF's employment generation potential. At least it can reduce the disguised unemployment³ in agriculture and increase the labour productivity in the sector.

³ In economics text books, the term disguised unemployment is used to the workers with zero marginal productivity, in agriculture and unorganized sector. It implies their presence or absence does not impact the total production. Because of higher labour requirement in CNF, the disguised unemployed can contribute positively to the total production, as the shift occurs in total production due to personal supervisory care cum management. In a way, it is Schumpeterian innovation that causes the shift in total production.

25. Various CNF practices are expected to soften the soil and increase the carbon content in the soil. These changes in turn would increase the water/ rainfall percolation into the soils and increase the water/ moisture holding capacity of the soils. Among CNF farmers, 81 percent have reported that water-use has been decreased moderately or considerably, due to CNF. With minor exceptions, the trend holds good across almost all agroclimatic zones and all farmers' categories (Table 4.5).
26. By avoiding completely, the use of agrochemicals, the CNF farmers have been contributing immensely in halting and reversing the multidimensional pollutions of the agrochemicals, including the resource degradations. The avoided expenditure on agrochemicals, by CNF farmers, varies from ₹8.73 thousand per hectare in Black gram to ₹20.03 thousand per hectare in Paddy. The avoided expenditure on fertilizers varies from ₹1.16 thousand in Black gram to ₹13.68 thousand in Paddy. (Figure 4.4).
27. Over three-fourths of farmers, at the state level, said that soil quality has improved moderately due to CNF. Another 12 percent farmers said that the soil quality has improved considerably (Table 4.6).
28. Nealy 90 percent farmers have reported that soil softness increased moderately or considerably. Similarly, nearly 79 percent and 78 percent farmers have reported an increase in earthworms and green cover respectively in their fields. Over three-fourths have informed an increased soil moisture levels (moisture hold capacity of the soil) in their fields (Table 4.7).
29. At the state level, 86 percent of farmers reported grain weight of crops has increased, and 79 per cent reported that strength of stems of crops has increased. Further, 74 percent o, 66 percent and 70 per cent of farmers have reported that crop tolerance to dry spells, heavy rains and strong winds has increased respectively (Table 4.8).

0.5. Wellbeing of CNF farmers

30. Over 60 percent of farmers have reported a moderate improvement in the health status of the family members, due to CNF. In addition, 19 percent CNF farmers have testified a considerable improvement in their health status due to CNF (Figure 5.1).
31. Majority of CNF farmers reported a reduction in the out-of-pocket expenditure on health care. While eight percent farmers reported a considerable decline in the health expenditure, another 45 percent have experienced a moderate reduction (Figure 5.2).
32. The impact of CNF on education has come out prominently in the FGDs.

33. Nearly seven-tenths of CNF farmers confirmed an improvement in their financial position, due to CNF (Figure 5.3).
34. At the state level, 98 percent CNF farmers want to continue CNF farming. The same vary between 95 to 100 percent across the agroclimatic zones and farmers categories (Figure 5.4).
35. About 50 percent of CNF farmers have experienced or perceived that CNF has reduced their agriculture related tensions. The same is as high as 84 percent in Godavari zone and 71 percent in Krishna zone respectively. The same is 77 percent for tenant farmers and 68 percent for owner-cum-tenant farmers, among tenurial categories (Table 5.4).
36. At the aggregate level, 91 percent CNF farmers have reported that they are consuming CNF food. The same is 100 percent in Krishna zone and 99 percent in Godavari and Southern zone. Over 90 to 100 percent farmers among most of the farmers' categories, have been consuming CNF food (Figure 5.6).
37. Over 91 percent of CNF farmers, at the state level, have reported that CNF food is tastier than non-CNF food. Across all farmers categories, 90 to 94 percent farmers stated that CNF food is tasty. Further, 98 to 100 percent farmers in three agroclimatic zones have experienced that CNF food is tasty (Figure 5.7).
38. At the aggregate level, 50 percent of CNF farmers experienced a moderate reduction in the funds' requirement for agriculture. In addition, 10 percent of CNF farmers felt a considerable reduction in funds requirement for cultivation (Figure 5.8).
39. At the state level, 53 percent of farmers confirmed a moderate decline in borrowings for agriculture, due to CNF. Further, 11 percent of CNF farmers sensed a considerable reduction in borrowings for agriculture, due to CNF (Figure 5.9).
40. At the state level, 29 percent of CNF farmers witnessed a moderate increase in new output marketing channels such as *Shandis*, exhibitions, door delivery, online; selling directly to friends and relatives, local shops, etc. Further, 6 percent of CNF farmers have seen a considerable increase in new output marketing channels (Figure 5.10).
41. At the state level, 66 percent and 12 percent of CNF farmers experienced and witnessed a moderate interest and high interest, respectively, in the people, including consumers, relatives and friends and officials, in CNF and CNF food (Figure 5.11).
42. At the state level, 73 per cent of CNF farmers have enjoyed the respect from friends and relatives, during the study period. The same varies from 42 percent in North coastal zone to 93 percent in Godavari zone (Figure 5.12).

43. Compared to 73 percent of CNF farmers, who command respect of their friends and relatives, only 50 per cent of farmers said that they got respect in markets or from general public/ consumers, during the study period (Figure 5.13). Despite being chemical free and having longer shelf life, CNF output get less recognition in markets and a smaller number of CNF farmers get respect in the market. It indicates an inadequate awareness about CNF food in the general public and consumers.
44. The above discussed 13 indicators are ranked across the agroclimatic zones and farmers categories. Then grouped under three dimensions of development, viz., (1) Human development, (2) Freedom, and (3) Dignity (Table 5.8).
45. From individual indicators' ranks, the dimensional ranks are obtained, i.e., a simple average of all the individual ranks.
46. From the dimensional ranks, the overall ranks have been obtained through simple average of dimensional ranks (Table 5.9).
47. The ranks are result of two factors, viz. (1) condition of non-CNF in each zone and each farmers category, and (2) effectiveness of the implementation of APCNF across the zones and farmers categories.
48. Interestingly, there are many common ranks among the agroclimatic zones and farmers categories.
49. The results suggest that CNF is reaching evenly every zone and every farmer's category. Another inference from the results is that the zones and categories, which, normally, make higher investments, either capital or labour, in agriculture get relatively higher benefits from CNF.

0.6. Issues, challenges and way forward

50. Nearly 60 percent of CNF farmers in the state have reported that they are facing one problem or other in adopting CNF in Rabi season. Given the nature of CNF, which is evolving; it is expected that large number of participants would encounter some issue or other (Figure 6.1).
51. The major problems such as output marketing at higher prices, non-availability of raw materials to prepare the biological inputs, inadequate knowhow to prepare the biological inputs, scarcity of labour, etc., remained the same over the years.
52. Though the problems remained common in all previous surveys, the number of persons reporting each of these problems has declined significantly in this survey.

53. The drastic reduction in the number of farmers reporting different challenges, reflect the farmers ability to master the new techniques and practices quickly. It also reflects beneficial potentials of CNF, which might have enthused the farmers to master the art and science of CNF. It also reflects a considerable improvement in the RySS's extension and support services.
54. In terms of number of farmers interacted, average number of interactions with the farmers and satisfaction levels stated by the famers, the field staff is doing a good work. At the same time, some field staff pointed out about heavy workloads and vacancies in their teams.
55. Though the programme is growing at fast pace, to cover the entire 80 lakh hectares of cropped area and all 60 lakh farmers in the near future of 8-10 years, the project has to move at even faster pace. The following measures are suggested for rapid expansion of the programme in the state.
 - a. Given criticality of the field staff in 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 to provide flexible and focussed working conditions, so that the staff can optimally use their time, resources and energy, balancing their professional and personal responsibilities.
 - b. The efforts to bring in the Tirumala Tirupati Devasthanam (TTD) for the procurement of CNF foodgrains has given good results. More such efforts are needed.
 - c. RySS may take up the evidence-based advocacy to convince the farmers to take up the CNF on a large scale; and other stakeholders to support the CNF expansion and replication. Needless to say, such evidence would come from more impact assessment studies.
 - d. RySS may also think about other methods to expand the programme. Involvement of Panchayat Raj institutions, which have larger and direct stakes in agriculture development and farmers wellbeing in their villages, is one possible option.
 - e. Another potential option is involving the corporate sector, with their Corporate Social Responsibility (CSR) funds in the implementation of the programme in some villages.
 - f. RySS may explore a thorough integration with the State Agriculture Department. Utilizing the infrastructure and personnel of Agriculture Department is one possible option. This would be an expected process, as the CNF is going to replace the non-CNF in the state in coming years.

Chapter 1: Context, Objectives and Methodology

1.1. Context

Agriculture development, which is the only source of food supply and the principal source of employment and livelihoods, is pivotal to India's development and welfare of her 140-crore population. Given the vitality of the sector, the Government of India (GoI) and State Governments have been investing and expending heavily on agriculture development and farmers' welfare. According to the Union Budget 2023-24 documents⁴, 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). Further, the GoI has spent ₹66,825crores in 2021-22 and ₹60,000 crore in 2022-23 (RE) on Pradhan Mantri Kisan Samman Nidhi (PM Kisan); and ₹98,468 crore in 2021-22 and ₹89,400 crore in 2022-23 (RE) on Mahatma Gandhi National Rural Employment Guarantee Programme (MGNREGP), which is closely linked to agriculture development.⁵ Further, the Ministry of Agriculture, GoI has spent ₹76,492 crore in 2021-22 and ₹76,279 crore in 2022-23 (RE) on agriculture and allied activities. In addition, other Ministries and Departments of GoI, for example Ministry of Water Resources, are also spending considerable amounts for the development of agriculture and allied sectors and farmers welfare. Further, the State Governments too have been spending a minimum of 10 percent of their total expenditures on agriculture and allied sectors' development and the welfare of the farmers. Normally, the State

⁴ These documents were accessed on 16 February 2023 from <https://www.indiabudget.gov.in/>

⁵ As per the provision of the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) 2005, the District Programme Coordinator is required to ensure that at least 60 per cent of the works to be taken up in a district in terms of cost shall be for the creation of productive assets directly linked to agriculture and allied activities through development of land, water, and trees. The expenditure on agriculture and allied activities is 68.5 per cent in FY23 (as of 6 January 2023) the share of "works done on individual's land" (included in the permissible work list in 2009 and expanded since then) has increased from 16 per cent of the total completed works in FY15 to 73 per cent in FY22; GoI, (2023): *Economic Survey 2022-23*, Ministry of Finance, New Delhi, <https://www.indiabudget.gov.in/economicsurvey/> [Accessed on 16 February 2023]

Governments spend on irrigation, power subsidy, farm loan waivers, cash transfers, interest subventions, marketings, warehouses/ cold-storages, etc.

Despite all these investments and expenditure, the condition of farmers in India in general and in Andhra Pradesh (AP) in particular is deteriorating. As agriculture is growing at slow pace vis-à-vis secondary and tertiary sectors, the people dependent on agriculture, especially the cultivators, are becoming relatively poorer year after year. This is reflected in various indicators of wellbeing. The monthly per capita expenditure (MPCE) at constant prices grew faster for agricultural labour (4.8%) and all rural households (3.9% per annum) than that of self-employed households in agriculture [SEAG] (2.9%) during 2004-05 and 2011-12. The pattern in MPCE growth rate was similar whether measured at constant or current prices.⁶ The incidence of poverty has declined by 12.4 percent in AP during 2004-05 and 2011-12. But the same was 5.7 percent for self-employed in agriculture, 17.8 percent for self-employed in non-agriculture, 13.0 percent for agriculture labour, 16.8 percent for other labour and 14.1 percent for others.⁷ At the same time, compared to other sections, the improvement in secondary and higher education outcomes are slow for the self-employed in agriculture (SEAG). Between 2004-05 and 2011-12, there is no change in the percentage of graduates among 21+ aged male SEAG (cultivators); however, there was some improvement of 1.13 percentage points (improvement from 0.77 percent in 2004-05 to 1.9 percent in 2011-12) for female SEAG. At the same time the rural households in the state experienced an increase of 1.18 percentage points in male graduates and 1.52 percentage points in female graduates. On the other hand, the urban households experienced an increase of 5.90 percentage points in male graduates and 3.22 percentage points in female graduates.⁸ In fact, the farmers, in the state, are also becoming poorer in absolute terms. *“The growth prospects of agriculture in the State depend upon the trends in net income both in absolute and in relative terms. The last decade (TE 2002 to TE 2010) witnessed a steep increase in the cost of farming particularly of traditional crop..... The increase in cultivation costs was not compensated for by output price increases and thus agriculture became almost unviable.”*⁹ The Radhakrishna Commission pointed out that *“Almost all crops considered for the analysis have incurred losses during 1965-2014. Crops such as sugarcane and urad (black gram) were profitable in most years. The remaining crops, including*

⁶ As quoted in Radhakrishna R, et al, (2016): *Report of the Commission on Inclusive and Sustainable Agricultural Development of Andhra Pradesh*, Submitted to THE GOVERNMENT OF ANDHRA PRADESH, Centre for Economics and Social Studies, Hyderabad

⁷ Ibid

⁸ Ibid

⁹ Ibid

the principal food grain crops, incurred losses. Of these, jowar, ragi, maize and groundnut suffered losses in greater number of years during this time period."¹⁰The income from cultivation and animal husbandry combined was not adequate to cover actual consumption expenditure of the households self-employed in agriculture.¹¹

The information on the website of Andhra Pradesh Community Managed Natural Farming (APCNF)¹² indicates that young people are migrating from rural areas to urban areas, often for low paid jobs, as they do not see much future in agriculture livelihoods. On the other hand, the food, which is being consumed, is not safe and it is not as nutritious as it used to be in the past. There is a huge crisis on the soil front as it lost vast amounts of soil organic matter and continue to lose soil organic matter at a rapid pace. There is a severe water stress. There is very widespread loss of biodiversity. All these are going to exacerbate further on account of global warming.

In response to these multiple crises in agriculture, the Government of Andhra Pradesh turned to Natural Farming, known as Andhra Pradesh Community Managed Natural Farming (APCNF)¹³, as a way of solving these multiple crises. The Government is looking at enhancing farmers' net incomes by reducing their costs of cultivation, improving their yields, reducing their risks and enabling them to get remunerative prices. The Government believes that these can be delivered through farming in harmony with nature, and not through use of high-cost synthetic fertilisers, pesticides, herbicides and weedicides. Government also believes that the nutritional integrity of food should be enhanced and free from chemical residues. Further, Government is very concerned about the risks to agriculture because of the loss of soil organic matter, water stress and the worsening climate change crisis. The adoption of natural farming by the Government is not just environment friendly but is also aimed at protecting the interests of the farmers and the consumers, given that it enhances climate change resilience, soil organic matter, soil fertility, water holding capacity of soils, and biodiversity (above ground and below ground). Considering all these, and towards farmers' welfare, the Government of Andhra Pradesh have established "Rhythu Sadhikara Samstha" (RySS), an integrated institutional mechanism for all programmes, schemes and activities intended for farmer's empowerment, encompassing welfare, development, and capacity enhancement.¹⁴

¹⁰ Ibid

¹¹ Ibid

¹² <https://apcnf.in/about-apcnf/> Accessed on 2.12.2022

¹³ The programme was formerly known as Zero Budget Natural Farming (ZBNF)

¹⁴ <https://apcnf.in/about-apcnf/> Accessed on 2.12.2022

1.2. Pre-Monsoon Dry Sowing

Recently RySS made one of the major breakthroughs in Andhra Pradesh Community Managed Natural Farming (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 exact science is yet to be established. The enhancement of soil biology through APCNF practices and raising of 8 to 15 diverse crops create some special conditions, which enable seed germination with very little water/ moisture. PMDS is mostly practiced before the advent of monsoon, during summer and also before the beginning of the Rabi season crops. This system believes that land should always be covered with vegetation and farmers should not depend on rainy season alone for growing crops. It contributes to continuous green cover while increasing cropping intensity, agricultural incomes, and soil fertility.

While the benign microbes are introduced into soils through biological stimulants, under CNF, which convert the natural elements available in the soils and atmosphere into plant nutrients; PMDS provides food¹⁵ 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/ plots, which were put under PMDS during pre-monsoon period of 2021. The study selected CNF farmers who have raised PMDS during 2021. More details about APCNF and PMDS can be seen at APCNF website <https://apcnf.in/about-apcnf/> and in the earlier studies, particularly the first and second interim reports of 2021-22 study, which are available at <https://apcnf.in/about-apcnf/> and <https://www.idsap.in/reports.html>.

1.3. Objectives

The current study is a continuation of the Assessing the Impact of APCNF studies for 2019-20, and 2020-21, undertaken by Institute for Development Studies Andhra Pradesh (IDSAP), Visakhapatnam. This is the third interim report of 2021-22 study, covering the Rabi 2021-22 season.

¹⁵It is well known that through photosynthesis, plants convert sunlight, water and carbon dioxide (CO₂) into sugar, called Glucose. Plants store 40 percent of Glucose in above ground biomass, 30 percent in roots and exudates 30 percent into the soil, 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.

The major objective of the study is to assess the impact of Andhra Pradesh Community Managed Natural Farming (APCNF or CNF) in terms of economic sustainability¹⁶, social sustainability¹⁷ and environmental sustainability¹⁸ and to delineate its contributions in enhancing the welfare and wellbeing of farmers and people in the state. 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 CNF and under chemical-based farming, referred as non-CNF in this report and all studies.
- ii. To estimate and compare the crop yields obtained under CNF and non-CNF, independently and scientifically through crop cutting experiments (CCEs).
- iii. To understand the impact of CNF on the inputs use, especially, the natural resources use and consequent environmental implications.
- iv. To know the impact of CNF on farmers' wellbeing.
- v. To understand the issues and challenges in adoption of CNF.

1.4. Methodology

1.4.1. The Basic Approach

This study is a continuation of the previous impact studies conducted in 2018-19¹⁹, 2019-20 and 2020-2021 on APCNF. Earlier studies assessed the effectiveness of APCNF (also known as Seed to seed [S2S] Farming) with the help of field surveys on various aspects. This study covers the same aspects with a fresh random sample of farmers adopting PMDS+CNF (Henceforth called CNF farmers in this report) and non-APCNF farmers in 2021-22

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 the outcomes of the non-APCNF farmers cultivating the same crop but using chemical inputs. Costs and returns data for the crops considered for the analysis were obtained from the farmers through farmer household

¹⁶Economic sustainability means that APCNF is profitable, i.e., able to generate surpluses after covering the entire cost of cultivation

¹⁷ Social sustainability implies that the poor and vulnerable sections are able to adopt and get benefitted from APCNF.

¹⁸ Environmental sustainability implies that APCNF is environmentally benign. That is, the programme is expected to halt and reverse the degradation of the natural resources, especially the soil. It is also expected to make the agriculture resilient to the climate change.

¹⁹ Though 2018-19 study was conducted by the Centre of Economics and Social Studies (CESS), Hyderabad, almost all members of present team have conducted that study also. All subsequent studies are being conducted by IDSAP with almost same team of professionals.

survey. Crop Cutting Experiments (CCEs) have been conducted to assess the yields of the crops scientifically and independently.

The study is focussed on 12 major crops that are identified based on the cropped area in the state. For these 12 crops, costs, yield and returns are analysed. These crops together account for more than 75% of the gross cropped area (GCA) in the state. The crops include: (1) Paddy, (2) Groundnut, (3) Cotton, (4) Bengal Gram, (5) Black Gram, (6) Maize, (7) Red Gram, (8) Chillies, (9) Green Gram, (10) Jowar, (11) Ragi and (12) Tomato. While the first 10 are cultivated on large areas in the state, the last two were selected as the special cases. Given the seasonality the cropping pattern in the state, the survey could not get adequate sample for some crops. Therefore, some of sample crops were not included in this report. Out of total 12 sample crops, survey could not get adequate number of observations for Red gram, Cotton, Chillies, Jowar and Tomato. Further, adequate number of CCEs could not be conducted for Green gram and Ragi, apart from above mentioned five crops. Therefore, only five crops covered in this report. The crops include: (1) Paddy, (2) Groundnut, (3) Bengal gram, (4) Black Gram, and (5) Maize.

In this report, the term ‘Community Managed Natural Farming (CNF)’ is used interchangeably to mean APCNF as well as PMDS+CNF. Similarly non-APCNF or non-CNF is used interchangeably.

1.4.2. Sample Design

The study was conducted in all the 13 districts of the State of Andhra Pradesh. For the CNF sample, the coverage of the study is the entire area where CNF is practiced while the rest of Andhra Pradesh is covered under non-CNF. All the GPs, where CNF practices are followed, constituted the sample frame for drawing CNF samples. A list of CNF Gram Panchayats (GPs) with number of cultivators, who adopted CNF in PMDS plots (referred as PMDS+CNF), as of April 2021, is provided by RySS. According to the data provided by RySS, the universe for PMDS+CNF consists of 2,816 GPs with 1,72,661 cultivators and 1,27,447 acres. The remaining GPs, where APCNF is yet to begin, form the sample frame for non-CNF sample or control sample. The

detailed description of sample selection process was given in the first and second interim reports.²⁰The same is summarised below:

1. The study proposed a total sample of 169 GPs with 104 GPs for the CNF sample and 65 GPs for non-CNF sample. Given the sample size, it was decided to limit the disaggregate analysis to six agroclimatic zones only.
2. The total 104 CNF sample GPs were allocated to each agroclimatic zone in proportion to the number of CNF of farmers in that zone.
3. In case of non-CNF, the total sample size of 65 GPS was allocated to all six zones according to the farmers size obtained in 2020-21 listing.
4. A household listing was conducted in each of sample CNF and non-CNF GPs.
5. From the list PMDS+CNF farmers, crop wise CNF sample was drawn. For each sample crop, the sample size is fixed at a minimum of 50 depending on the availability of cultivators of that crop.
6. After eliminating duplications, 1,186 CNF sample farmers were selected. The number was about 14 percent higher than the planned sample size of 1,040.
7. Non-CNF sample farmers were selected from the list of all farming households in the non-CNF GPs. Same crop wise sample selection process, which was adopted in CNF sample farmers, was adopted in the selection of non-CNF farmers. To get the required minimum number of observations for each of selected crops, the total non-CNF sample size was also increased by 15 percent over the original plan of 650.
8. 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. Except a few SIs with DPMs, data has been collected as planned. The information was processed

²⁰IDSAP (2022): *Assessing the Impact of APCNF [Andhra Pradesh Community Managed Natural Farming]: A comprehensive Approach Using Crop Cutting Experiments: First Interim Report of 2021-22: Pre-monsoon Dry Sowing (PMDS)*, Institute for Development Studies Andhra Pradesh (IDSAP), Visakhapatnam.

<https://apcnf.in/wp-content/uploads/2022/05/IDS-2021-2022-APCNF-PMDS-Report.pdf>
or <https://www.idsap.in/assets/reports/12%20PMDS%20Report%2021-22.pdf>

IDSAP (2022): *Assessing the Impact of APCNF [Andhra Pradesh Community Managed Natural Farming]: A comprehensive Approach Using Crop Cutting Experiments: Second Interim Report of 2021-22: Kharif Season*, Institute for Development Studies Andhra Pradesh (IDSAP), Visakhapatnam. https://apcnf.in/wp-content/uploads/2023/02/Final-APCNF-Kharif-Season-Report-2021-22_17012022.pdf
or <https://www.idsap.in/assets/reports/13%20APCNF%20Kharif%20Season%20Report%202021%2022%2031%20Dec%202022.pdf>

and developed as an independent document. Some of the insights, from the qualitative data have been incorporated in this report. The remaining insights will be incorporated in the Final reports.

Though it was planned to cover every sample household during the Rabi survey a few sample households could not be contacted due to their migration and a few questionnaires could not be included in the analysis, due to incomplete information. In total 1,145 CNF farmers and 737 non-CNF farmers are covered in this report.²¹ After surveying all the sample farmers, it was found that 674 CNF farmers and 421 non-CNF farmers have cultivated at least one crop during Rabi 2021-22. At the state level, 59 percent of CNF farmers and 57 percent of non-CNF farmers have cultivated Rabi crops. However, there are notable variations across agroclimatic zones and farmers categories. Considerably a higher percentage of CNF farmers have cultivated during Rabi in North coastal zone (22 percentage points) and Southern zone (14 percentage points). On the other hand, considerably a higher proportion of non-CNF farmers have cultivated during Rabi 2021-22 in Krishna zone (22 percentage points) and Godavari zone (9 percentage points).

Among the farm-size categories, almost equal percentages of marginal CNF (56 percent) and non-CNF (57 percent) farmers have Rabi cultivation. However, a higher percentage of CNF small farmers (4 percentage points) and CNF other farmers (11 percentage points), which include medium and large farmers have Rabi cultivation during the study period. Among tenurial categories, lesser proportion of CNF tenant farmers (29 percentage points) and CNF owner-cum-tenant farmers (17 percentage points) have cultivated during the Rabi season 2021-22. However, among the owner farmers, who are larger in number among both CNF and non-CNF sample, 3 percentage points higher CNF farmers have cultivated during the study season. Among social categories, a higher percent of CNF Scheduled Castes (SC) [7 percentage points], Scheduled Tribes (ST) [19 percentage points] and Backward Castes (BC) [9 percentage points] have cultivation during the Rabi 2021-22. However, relatively lesser percentage of CNF Open Categories (OC) farmers (9 percentage points) have cultivated in Rabi season, compared to their counterparts in non-CNF sample (Table 1.1 and Figure 1.1).

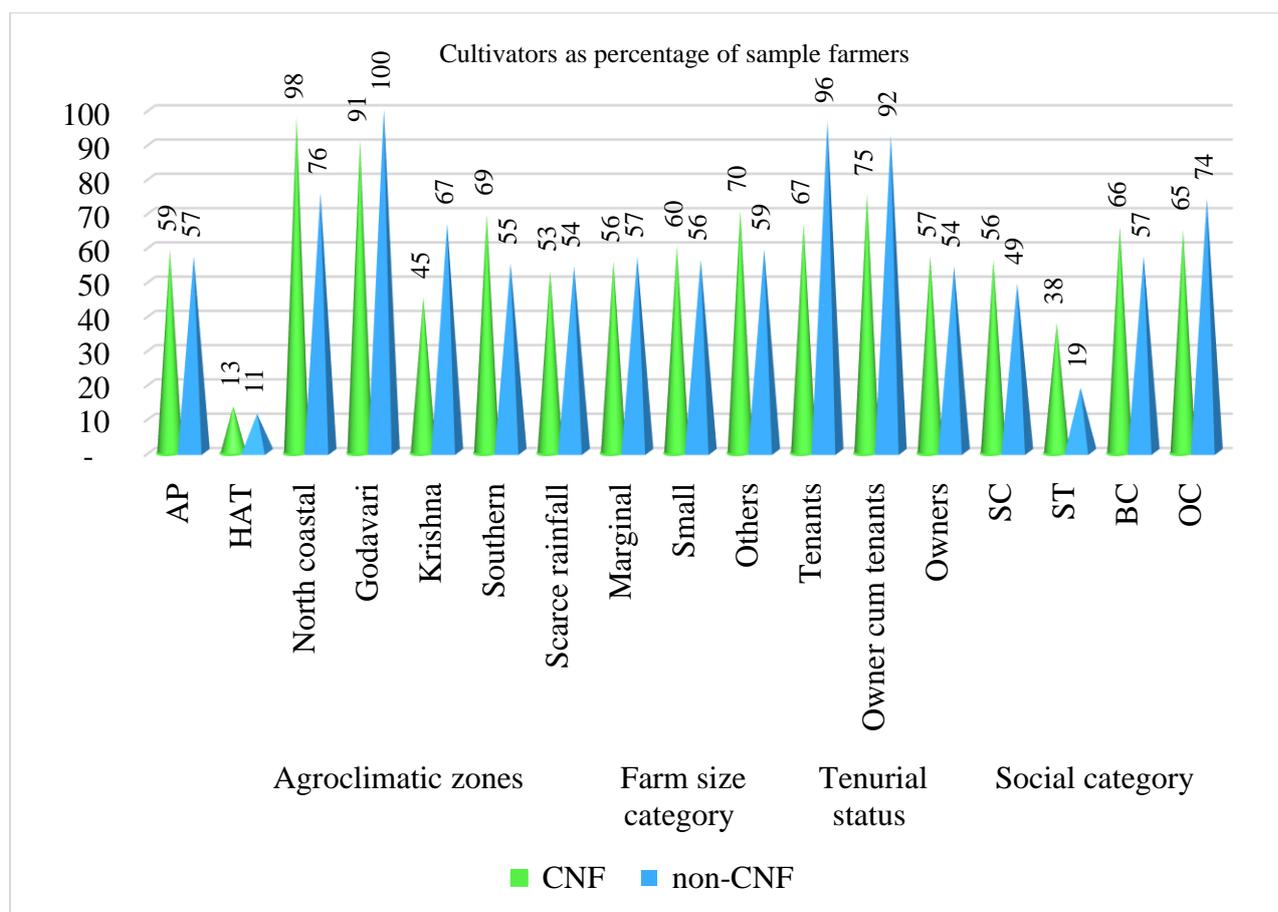
²¹Even after some attrition of sample farmers due to variety of reasons, these numbers are higher than originally planned sample size of 1,040 CNF farmers and 650 non-CNF farmers.

Table 1.1: Sample size and Rabi cultivators during 2021-22

| Geographic Units & Farmers' categories | Sample size (number) | | Farmers cultivated in Rabi (number) | | Rabi cultivators as a % of Sample | |
|--|----------------------|------------|-------------------------------------|------------|-----------------------------------|-----------|
| | CNF | non-CNF | CNF | non-CNF | CNF | non-CNF |
| Agroclimatic zones | | | | | | |
| HAT | 142 | 72 | 19 | 8 | 13 | 11 |
| North coastal | 82 | 41 | 80 | 31 | 98 | 76 |
| Godavari | 155 | 50 | 141 | 50 | 91 | 100 |
| Krishna | 228 | 159 | 103 | 106 | 45 | 67 |
| Southern | 281 | 149 | 195 | 82 | 69 | 55 |
| Scarce rainfall | 257 | 266 | 136 | 144 | 53 | 54 |
| AP | 1,145 | 737 | 674 | 421 | 59 | 57 |
| Farm size categories | | | | | | |
| Marginal | 706 | 376 | 393 | 214 | 56 | 57 |
| Small | 270 | 219 | 162 | 123 | 60 | 56 |
| Others | 169 | 142 | 119 | 84 | 70 | 59 |
| All | 1,145 | 737 | 674 | 421 | 59 | 57 |
| Tenurial categories | | | | | | |
| Tenants | 42 | 28 | 28 | 27 | 67 | 96 |
| Owner-cum-tenants | 85 | 26 | 64 | 24 | 75 | 92 |
| Owners | 1,018 | 683 | 582 | 370 | 57 | 54 |
| All | 1,145 | 737 | 674 | 421 | 59 | 57 |
| Social categories | | | | | | |
| SC | 155 | 61 | 87 | 30 | 56 | 49 |
| ST | 218 | 91 | 82 | 17 | 38 | 19 |
| BC | 476 | 347 | 313 | 198 | 66 | 57 |
| OC | 296 | 238 | 192 | 176 | 65 | 74 |
| All | 1,145 | 737 | 674 | 421 | 59 | 57 |

Source: *IDSAP, Field Survey 2021-22*

Figure 1.1: Percentage of CNF and non-CNF farmers have cultivation during Rabi 2021-22



Source: IDSAP, Field Survey 2021-22

1.5. Selection of crops

As mentioned elsewhere in this report, most of the crops, in the state and also in the country, are seasonal crops. Hence it is not possible to cover all crops in any one season's report. Because of this reason, the study got 13 or more observations for each of CNF and non-CNF farming, for five crops only (Table 1.2). The leftover crops are Red gram, Cotton, Chillies, Green gram, Jowar Ragi and Tomato. The crops covered, the number of available observations for the estimation of crop wise costs of cultivation, yields, prices and returns are shown in Table 1.2. Not surprisingly, Paddy has the highest number of observations. However, its share is less than one-third in both CNF and non-CNF crops. It may be noted the share of Paddy in Rabi cropped area is much less than that of Kharif season in the state. The number of sample observations varies from 46 for CNF Bengal gram to 197 for CNF Paddy. In the case of non-CNF, the sample observations vary from 13 in Groundnut to 145 for Paddy (Table 1.2). Barring Groundnut, each of crops has a good number of observations to provide robust estimates. This is due to crop wise sample selection strategy that was adopted for this year.

Table 1.2: Crop wise CNF and non-CNF sample observations for the cost and returns analyses during Rabi 2021-22

| Crop | CNF | non-CNF | Total |
|--------------------|-----|---------|-------|
| Paddy | 197 | 145 | 342 |
| Groundnut | 72 | 13 | 85 |
| Bengal gram | 46 | 39 | 85 |
| Black gram | 122 | 61 | 183 |
| Maize | 101 | 47 | 148 |
| <i>Sub-total</i> | 538 | 305 | 843 |
| <i>Other crops</i> | 87 | 137 | 224 |
| Total | 625 | 442 | 1,067 |

Source: IDSAP Field Survey 2021-22

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

Crop Cutting Experiments (CCEs) were conducted scientifically to get an independent estimate of crop yields under CNF and non-CNF. For each of the selected farmer, a plot where the farmer is growing the sample crop was identified. From this parcel of land, a plot of *size²² as required by the procedure* has been selected at random for estimating yield through CCEs. It is to be noted that the study has adopted standard methodology developed and recommended by Indian Agricultural Statistical Research Institute (IASRI), which is followed by National Statistical Office (NSO) and Directorate of Economics and Statistics (DES) of all states, including Andhra Pradesh, for conducting the CCEs.

The study could conduct 883 CCEs during the Rabi season 2021-22. The number includes 465 CNF crops, 288 non-CNF crops and 130 for Panel farmers. Compared to total cultivators in Rabi 2021-22, the number of CCEs is equal to 64 percent. In the case of CNF cross-section farmers, the number of CCEs is equal to 69 percent of farmers. The same is 68 percent for non-CNF farmers and 46 percent for the Panel farmers (Table 1.3). The major reason for conducting a smaller number of CCEs vis-à-vis number of cultivators, is that some sample cultivators did not cultivate the sample crops. Another reason is that crop harvesting date and time are profoundly influenced

²² Normally, 5 metres by 5 metres, (5² metres) plots are used for CCEs. However, in few crops 2 metres by 2 metres (Onion) or 10 metres by 10 metres (Red gram) are used.

by the availability of harvesting machines. Sometimes farmers prepone the crop harvesting if the machine is available earlier.

Table 1.3: Number of CNF, non-CNF and Panel cultivators and respective CCEs conducted during Rabi 2021-22

| Indicator | PMDS+CNF | Non-CNF | Panel | Total |
|--------------------------------------|----------|---------|-------|-------|
| Total number of cultivators | 674 | 421 | 283 | 1,378 |
| Total number of CCEs | 465 | 288 | 130 | 883 |
| Total CCEs as % of total cultivators | 69 | 68 | 46 | 64 |

One of the interesting factors about CCEs is that though total number of CCEs is less than expected number, they are mostly confined to five crops, which enable the study to provide more reliable estimates to five crops in this report. The crop wise number of CCEs conducted during Rabi 2021-22 are shown in the Table 1.4 below. The number of CNF CCEs varies from minimum of 52 for Bengal gram to maximum of 141 for Paddy. The number of non-CNF CCEs varies from 16 for groundnut to 84 for Paddy. For all these five crops, reliable estimates are also feasible for Panel farmers.

Table 1.4: Crop wise and type of farming wise number of CCEs conducted during Rabi 2021-22

| Crop | PMDS+CNF | Non-CNF | Panel | Total |
|--------------------|----------|---------|-------|-------|
| Paddy | 141 | 84 | 47 | 272 |
| Groundnut | 61 | 16 | 29 | 106 |
| Bengal gram | 52 | 23 | 17 | 92 |
| Black gram | 70 | 54 | 10 | 134 |
| Maize | 78 | 55 | 20 | 153 |
| <i>Sub-total</i> | 402 | 232 | 123 | 757 |
| <i>Other Crops</i> | 63 | 56 | 7 | 126 |
| Total | 465 | 288 | 130 | 883 |

Source: IDSAP Field Survey 2021-22

1.7. Data Collection and Management Process

In all, eleven research tools, viz. (1) Household listing schedule for the CNF GPs, (2) Household listing schedule for the non-CNF GPs, (3) Village survey schedule for CNF GPs, (4) Village survey schedule for non-CNF GPs (5) PMDS schedule to collect the data from CNF household

about PMDS details, (6) Questionnaire for CNF households, (7) Questionnaire for non-CNF households, (8) Checklist for Case Studies, and (9) Checklist for Strategic Interviews, (10) Checklist for Focused Group Discussions, (11) Schedule to record the CCE related details, were used. Further, the Kharif CNF and non-CNF households' schedules were revised for the Rabi survey. The quantitative field-based instruments have in-built checks with appropriate skip patterns over and above the supportive manual with instructions and clarification for all questionnaires. The research tools were finalized through a series of brainstorming consultations. An intensive training and field testing were carried out to train the field investigators and supervisors at Andhra University, Visakhapatnam during last week of September 2021. 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 period, from September 2021 to May 2022. 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 survey period.

The household survey for the Rabi season of 2021-22, was conducted since November 2021, more intensively conducted from early- February 2022 till the end of May 2022. As per the design, each sample farmer was visited a minimum of two times during the season to collect household and farming data and to conduct the Crop Cutting Experiments (CCEs). Senior team members have visited the field and cross-checked the information collected and filled and participated in data collection processes; conducted SIs with DPMs and a few field staff of RySS; and also participated in the FGDs, by visiting fields especially of the model farmers and social entrepreneurs, for obtaining information on various farm practices

This year, the field data was digitalized with the help of a technical agency known as "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 the use of the Tabs and Apps and data entry. The agency provided technical support throughout the year along with data to IDSAP in an excel form. The data was collated and processed using the R programme and Excel software. Descriptive statistics, frequency distributions and cross tabulation are

generated at state level, agroclimatic zone²³ wise, farm-size category wise, tenurial category wise and social category wise.

1.8. Structure of the Report

The context, objectives and methodology of the study have been presented in chapter 1. Chapter 2 summarizes profiles of CNF (PMDS+CNF) and non-CNF households, which was discussed in detail in the previous Kharif season report 2021-22.²⁴ Chapter 3 covers the impact of APCNF on farming conditions. The impact of CNF on agriculture inputs uses and, on the environment, and natural resources are covered in chapter 4. The issues of e farmers wellbeing are covered in chapter 5. The issues and challenges in implementation of APCNF and way forward are covered in chapter 6. Apart from these six chapters, an Executive Summary of the study is also presented at the beginning of the Report.

²³ See details in IDSAP (2022): *Assessing the Impact of APCNF [Andhra Pradesh Community Managed Natural Farming]: A comprehensive Approach Using Crop Cutting Experiments: Second Interim Report of 2021-22: Kharif Season*, Institute for Development Studies Andhra Pradesh (IDSAP), Visakhapatnam. https://apcnf.in/wp-content/uploads/2023/02/Final-APCNF-Kharif-Season-Report-2021-22_17012022.pdf or <https://www.idsap.in/assets/reports/13%20APCNF%20Kharif%20Season%20Report%202021%2022%2031%20Dec%202022.pdf>

²⁴ Ibid.

Chapter 2: Profiles of CNF and non-CNF farmers

2.1. Introduction

In the Second Interim (Kharif Season) 2021-22 Report, the profiles of CNF and non-CNF farmers were discussed in detail. The indicators covered in that report are social composition, farm size categories, tenurial status, average area cultivated during Kharif 2021-22, age, education and gender composition of CNF and non-CNF farmers. As the present field survey was conducted with the same set of sample farmers, there would be no difference in the social, economic and demographic profiles of the sample farmers in this survey. Only one potential difference would be the area cultivated during the Rabi season by CNF and non-CNF farmers. In this chapter, apart from summary the profiles chapter of the Second Interim (Kharif Season) 2021-22 Report, the average area cultivated CNF farmers vis-à-vis non-CNF farmers is shown.

2.2. Profiles of CNF and non-CNF farmers

- A higher percentage of CNF sample farmers hail from vulnerable communities compared to non-CNF sample farmers. Nearly one-third (31.20%) of CNF sample farmers are from SCs and STs compared to 19.52% of non-CNF farmers.
- Marginal farmers are higher in CNF over non-CNF farmers by 10 percentage points.
- In CNF cultivators, 35 percent are female farmers. The same is 32 percent among the non-CNF cultivators.
- The share of young farmers (up to 40 years of age) is higher in CNF sample by 6 percentage points.

2.3. Average operational area

It may be noted that in some regions, farmers may not put their entire area under cultivation during Kharif season. In some other regions, farmers may not cultivate their entire area during Rabi season. It implies that the operational area of a farmer may or may not equal to his/ her operational area in Kharif and/ or operational area in Rabi season. During Kharif 2021-22, on an average, CNF farmers have cultivated 1.15 hectares per farmer compared to 1.36 hectares per farmer among non-

CNF farmers, i.e., 15 percent smaller average operated area for CNF farmers. But during Rabi, CNF farmers have operational area of 0.97 hectares per farmer vis-à-vis 1.01 hectares per farmer of non-CNF farmers. It shows that the difference of average operated land between CNF and non-CNF farmers is smaller only by 4 percent in Rabi compared to 15 percent similar difference in the Kharif 2021-22. Thus, the relatively lower gap in average operated area in Rabi between CNF and non-CNF farmers indicates that Rabi equally suits well to the CNF on par with non-CNF. Under one of its core strategies of “365 days green cover” on the fields, APCNF is promoting and facilitating a higher cropping intensity. Another factor contributing to a higher cropping intensity under CNF is the reduction in the cost of cultivation.

Though at the state level, the CNF in three out of total six Agroclimatic zones, the average operational holdings of CNF farmers is smaller than that of non-CNF farmers. Similarly, CNF farmers have smaller operational holdings than non-CNF farmers in majority of farmers categories (Table 2.1). However, there are a few notable exceptions. The data shows that among the marginal farmers in farm size categories, the tenant farmers in tenurial categories have larger operational holdings of CNF compared to their counterparts in non-CNF. Among social categories, the BC, SC and ST farmers have higher operational holdings of CNF than their counterparts of non-CNF.

Table 2.1: Average operational area of CNF and non-CNF farmers across Agroclimatic zones and Farmers' categories during Rabi 2021-22

| Agroclimatic zones and farmers' categories | | CNF (ha) | non-CNF (ha) | Difference between CNF & non-CNF | |
|--|------------------|-------------|--------------|----------------------------------|---------------|
| | | | | in ha | in percentage |
| AP | AP | 0.97 | 1.01 | -0.04 | -3.9 |
| Agroclimatic zones | HAT | 0.72 | 0.49 | 0.23 | 47.1 |
| | North coastal | 0.96 | 0.47 | 0.49 | 105.2 |
| | Godavari | 1.20 | 1.00 | 0.20 | 19.8 |
| | Krishna | 0.83 | 1.08 | -0.25 | -22.9 |
| | Southern | 0.91 | 0.98 | -0.07 | -6.7 |
| | Scarce rainfall | 1.11 | 1.20 | -0.10 | -8.1 |
| Farm size categories | Marginal | 0.57 | 0.49 | 0.08 | 16.2 |
| | Small | 1.05 | 1.08 | -0.03 | -3.1 |
| | Others | 2.04 | 2.28 | -0.24 | -10.5 |
| Tenurial categories | Tenant | 1.34 | 1.07 | 0.27 | 25.0 |
| | Owner-cum-Tenant | 1.73 | 1.75 | -0.02 | -1.1 |
| | Owner | 0.87 | 0.96 | -0.09 | -9.5 |

| Agroclimatic zones and farmers' categories | | CNF (ha) | non-CNF (ha) | Difference between CNF & non-CNF | |
|--|----|----------|--------------|----------------------------------|---------------|
| | | | | in ha | in percentage |
| Social categories | SC | 0.75 | 0.64 | 0.11 | 16.9 |
| | ST | 0.92 | 0.50 | 0.42 | 84.9 |
| | BC | 0.91 | 0.84 | 0.07 | 8.4 |
| | OC | 1.20 | 1.38 | -0.17 | -12.7 |

Source: IDSAP Survey 2021-22

The above is the average cultivated area of the sample farmers during the Rabi season. Usually, the farmers leave a part of their land holding as fallow, during the Rabi season. But the share of fallow lands in the operational holding may not be equal across the state, i.e., across the agroclimatic zones and farmers' category. The CNF farmers have an average holding of 1.2 hectare and non-CNF farmers have average operational holding of 1.42 hectare. On average, CNF farmers have cultivated 81 percent of their operational holdings during the Rabi season. On the other hand, non-CNF farmers have cultivated 72 percent of their operational holding. That is the CNF farmers have cultivated 10 percentage points more area during Rabi 2021-22 compared to non-CNF farmers. Among six agroclimatic zones, in five zones, the CNF farmers have cultivated higher percentage of their operational holdings during the study period. Only exception is the Scarce rainfall zone. Among 10 farmers' categories, in nine categories, the CNF farmers have cultivated a higher percentage of their operational holdings during Rabi 2021-22. Only exception is 'other farmers' consists of medium and large farmers (Table 2.2). Despite some location and farmers categories specific variations, the data clearly shows that CNF has positive contribution for the higher cropping intensity in the state.

Table 2.2: Average Rabi cultivated as a percentage of average operational holding.

| Agroclimatic zones and farmers' categories | | CNF | non-CNF | Differences in percentage points |
|--|-----------------|-----|---------|----------------------------------|
| AP | AP | 81 | 72 | 10 |
| Agroclimatic zones | HAT | 78 | 30 | 48 |
| | North coastal | 97 | 79 | 18 |
| | Godavari | 91 | 89 | 2 |
| | Krishna | 95 | 84 | 11 |
| | Southern | 78 | 70 | 8 |
| | Scarce rainfall | 59 | 67 | -8 |
| Farm size categories | Marginal | 97 | 89 | 8 |
| | Small | 77 | 74 | 4 |

| Agroclimatic zones and farmers' categories | | CNF | non-CNF | Differences in percentage points |
|--|------------------|-----|---------|----------------------------------|
| | Others | 63 | 72 | -9 |
| Tenurial categories | Tenant | 88 | 78 | 11 |
| | Owner-cum-tenant | 91 | 82 | 9 |
| | Owner | 81 | 71 | 10 |
| Social categories | SC | 94 | 84 | 10 |
| | ST | 71 | 40 | 31 |
| | BC | 79 | 71 | 8 |
| | OC | 88 | 77 | 11 |

Source: *IDSAP Survey 2021-22*

2.4. Conclusions

Higher presence of SC and ST farmers, marginal farmers, women cultivators and young-age cultivators in CNF compared to non-CNF, is indicating the positive inclusive policy of RySS. It is also indicating that APCNF is attracting the marginalised sections and youth. Relatively a higher proportion of operated area under Rabi cultivation for CNF farmers is demonstrating the APCNF's potential in raising the cropping intensity. The data clearly shows the CNF's potential contributions in enhancing the cropping intensity in the state.

Chapter 3: Impact of CNF on the farming conditions

3.1. Introduction

The impact of CNF on the farming conditions is covered in this chapter. The major intervention under CNF is the replacement of artificial agrochemicals, i.e., fertilizers, weedicide, herbicide and pesticides, with the ecological principles, through application the biological stimulants such as Beejamrutham, Ghanajeevamrutham, Dravajeevamrutham, Kashayams and Asthrams and practices. The farming conditions considered, in this chapter, include changes in the cost of cultivation, crop yields, gross value of crop output and net value of crop output, due to CNF. In other words, the chapter deals with the economic sustainability of the CNF. The CNF programme will be economically sustainable, if and only if, it results in positive farm produce surpluses or profits. The programme will expand, if and only if, it gives higher surpluses or profits than those from the non-CNF. Higher surpluses under CNF can be obtained by reducing cost of cultivation, increasing crop yield and obtaining higher prices vis-à-vis non-CNF. As mentioned in the chapter 1, Adequate number of sample observations and CCE results are available for five crops, viz., Paddy, Groundnut, Bengal gram, Black gram and Maize. The costs and returns are analysed for these five crops, in this chapter.

3.2. Plant nutrient and protection inputs

One of the principal objectives of CNF is to replace agrochemicals, viz., fertilisers and pesticides with biological stimulants such as Beejamrutham, Ghanajeevamrutham, Dravajeevamrutham, Kashayams and Asthrams. For the sake of comparative analysis between CNF and non-CNF costs, the biological stimulants and other natural inputs such as Kashayams and Asthrams under CNF, on the one hand, and the chemical inputs under non-CNF on the other hand, are together referred as Plant Nutrient and Protection Inputs (PNPIs). The crop-wise expenditure on PNPIs under CNF and non-CNF are shown in Table 3.1 and Figure 3.1. In every crop the expenditure on PNPIs under CNF, is substantially less than that of non-CNF. The data in the table, once again confirms the hypothesis that the potential to save in the expenditure on PNPIs, in absolute terms, is high in the resource intensive crops. However, the savings appeared to be high in relative terms in less resource intensive crops like pulses. In absolute terms, the savings vary from ₹6,192 per hectare in Black gram to ₹14,763 per hectare in Paddy. In all five crops, the saving in the expenditure on PNPIs is more than ₹6,000 per hectare. These savings are sizable amounts, in the present context of agriculture and farmers

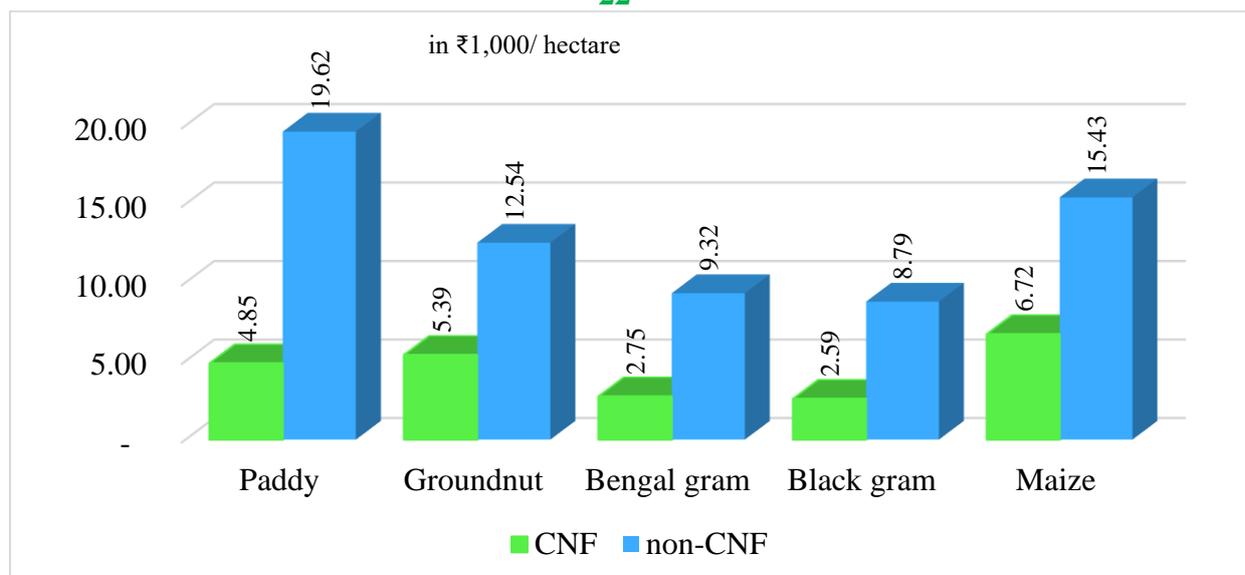
conditions in the state. In relative terms, the savings are 70 percent and above in three crops, more than 56 percent in two crops.

Table 3.1: Crop wise expenditure on PNPIs under CNF & non-CNF and differences during Rabi 2021-22

| Crop | ₹/hectare | | Difference between CNF & non-CNF | |
|-------------|-----------|---------|----------------------------------|---------------|
| | CNF | non-CNF | in ₹ | in percentage |
| Paddy | 4,853 | 19,616 | -14,763 | -75 |
| Groundnut | 5,390 | 12,539 | -7,148 | -57 |
| Bengal gram | 2,748 | 9,323 | -6,575 | -71 |
| Black gram | 2,593 | 8,786 | -6,192 | -70 |
| Maize | 6,717 | 15,429 | -8,712 | -56 |

Source: *IDSAP, Field Survey 2021-22.*

Figure 3.1: Crop wise expenditure on PNPIs under CNF & non-CNF during Rabi 2021-22



Source: *IDSAP, Field Survey 2021-22.*

3.3. Paid-out costs

Apart from PNPIs, the farmers invest considerable amount on different farm inputs, such as (1) seeds, (2) farmyard manure (FYM), including penning²⁵, (3) human labour, (4) bullock labour, (5) machine labour, (6) implements and (7) irrigation. Both own and hired or purchased inputs and services are used in the cultivation. In this study, the monetary values of own and

²⁵ Penning means keeping livestock, particularly the small ruminants, in the field for their dung/ droppings. The livestock owner gets some payment either in cash or kind for this service.

purchased/ hired inputs; own and purchased PNPIs are included in the paid-out costs of cultivation. But the value of family labour is not included in the paid-out cost. The paid-out cost used, in this study, is close to the cost of cultivation concept of ‘A1’²⁶. Other cost items normally referred and used in different concepts of cost of cultivation are actual rent paid on the leased-in land, imputed rental value of own land, imputed value of family labour, depreciation of machinery, interest on fixed and variable costs paid (including imputed), etc. In order to reduce the complications in the estimations, the study used the paid-out cost as defined above. Further, as the study compares CNF and non-CNF, and the concepts are used uniformly for both types of farming. As discussed in chapter one, higher and raising cost of cultivation under non-CNF is one of the major contributory factors for the farmers’ distress in the state and also in the country, in recent decades. The major benefit observed in all previous studies, including the studies by others on the subject indicate that the reduction in the cost of cultivation is the major contribution of CNF.

Crop wise paid-out costs under CNF and non-CNF during Rabi 2021-22 are shown in Table 3.2 and Figure 3.2. The paid-out cost under CNF is lower than that of non-CNF in four out of five crops, which are considered in this chapter. The savings in paid-out costs, because of CNF, are more than ₹10,000 per hectare in two crops. As mentioned above these levels savings are substantial in the present context of agriculture in the state and also in the country. The savings vary from ₹890 to ₹3,090 per hectare in two other crops. Only in Maize, the paid-out cost under CNF is marginally higher than that of non-CNF, by ₹270 (0.56 percent) per hectare²⁷. In relative terms, the savings in the paid-out costs due to CNF is 40 percent in Black gram, and 16 percent in Paddy.

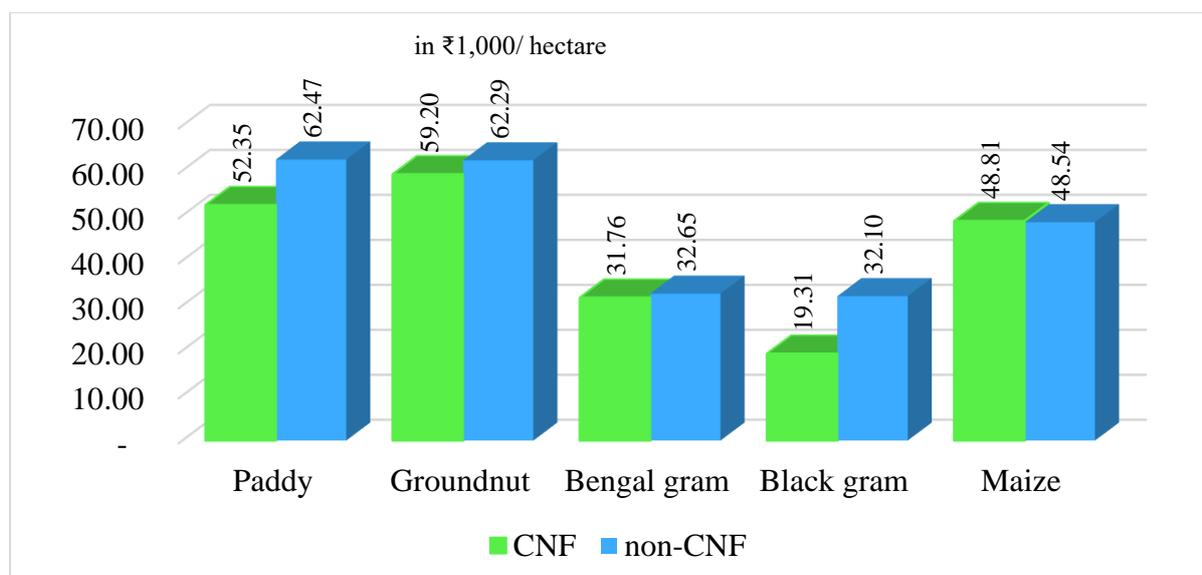
Table 3.2: Crop wise paid-out costs under CNF and non-CNF and their differences in Rabi 2021-22

| Crop | ₹/hectare | | Difference between CNF & non-CNF | |
|-------------|-----------|---------|----------------------------------|---------------|
| | CNF | non-CNF | in ₹ | in percentage |
| Paddy | 52,350 | 62,474 | -10,124 | -16 |
| Groundnut | 59,202 | 62,293 | -3,090 | -5 |
| Bengal gram | 31,761 | 32,651 | -890 | -3 |
| Black gram | 19,312 | 32,098 | -12,786 | -40 |
| Maize | 48,808 | 48,538 | 270 | 1 |

²⁶Cost –A1: Actual paid out costs for owner cultivator. This cost approximates to the actual expenditure incurred in cash and kind.

²⁷ One of reasons for higher paid-out cost in CNF crops could be the additional costs related to harvesting of higher crop output (yields). It can be seen in the next section that CNF Maize yields are significantly higher than that of non-CNF. Higher Maize yields involves a greater number of person days to pluck the additional cobs and transport them to the drying/ harvesting place.

Figure 3.2: Crop wise paid-out costs under CNF and non-CNF during Rabi 2021-22



Source: *IDSAP, Field Survey 2021-22*.

3.4. Changes in the structure of paid-out costs

As mentioned above, the study has collected data for eight major agriculture inputs. Out of these eight, four inputs, viz., seeds, PNPIs, human labour and machine labour account for the lion's-share of the paid-out costs. Other four items, viz., FAM, including penning, bullock labour²⁸, implements and irrigation, together, account for a smaller proportion in the paid-out costs. These four items are clubbed together and referred as 'others' in this section/ report. Percentage share of four major inputs and others are given in Table 3.3 and Figure 3.3. Out of eight inputs included in the survey, the four identified major inputs, viz., human labour, PNPIs, machine labour and seeds, account for 90 percent in Groundnut to 100 percent in Bengal gram, under non-CNF. But, under CNF, the same four major inputs account for 83 percent in Maize to 92 percent in Paddy. The data suggest that CNF uses more diversified inputs compared to non-CNF. While the cost of PNPIs has priority first or second rank under non-CNF, in majority of crops; it is relegated to third (penultimate) or fourth (last) position in all crops, under CNF. Under CNF, cost of human labour assumes first position in three out of five crops and it takes second position in the remaining two crops. This implies that more employment can be generated with CNF. A few possible reasons for the requirement of higher doses of human

²⁸ Though bullock labour has a smaller share in paid-out costs at the state level, it has a larger share in HAT zone and Tribal farmers. Data also indicate that machine and bullock labour are substitutable. It implies, both can be added in this kind of analysis. However, it is included in other in this report.

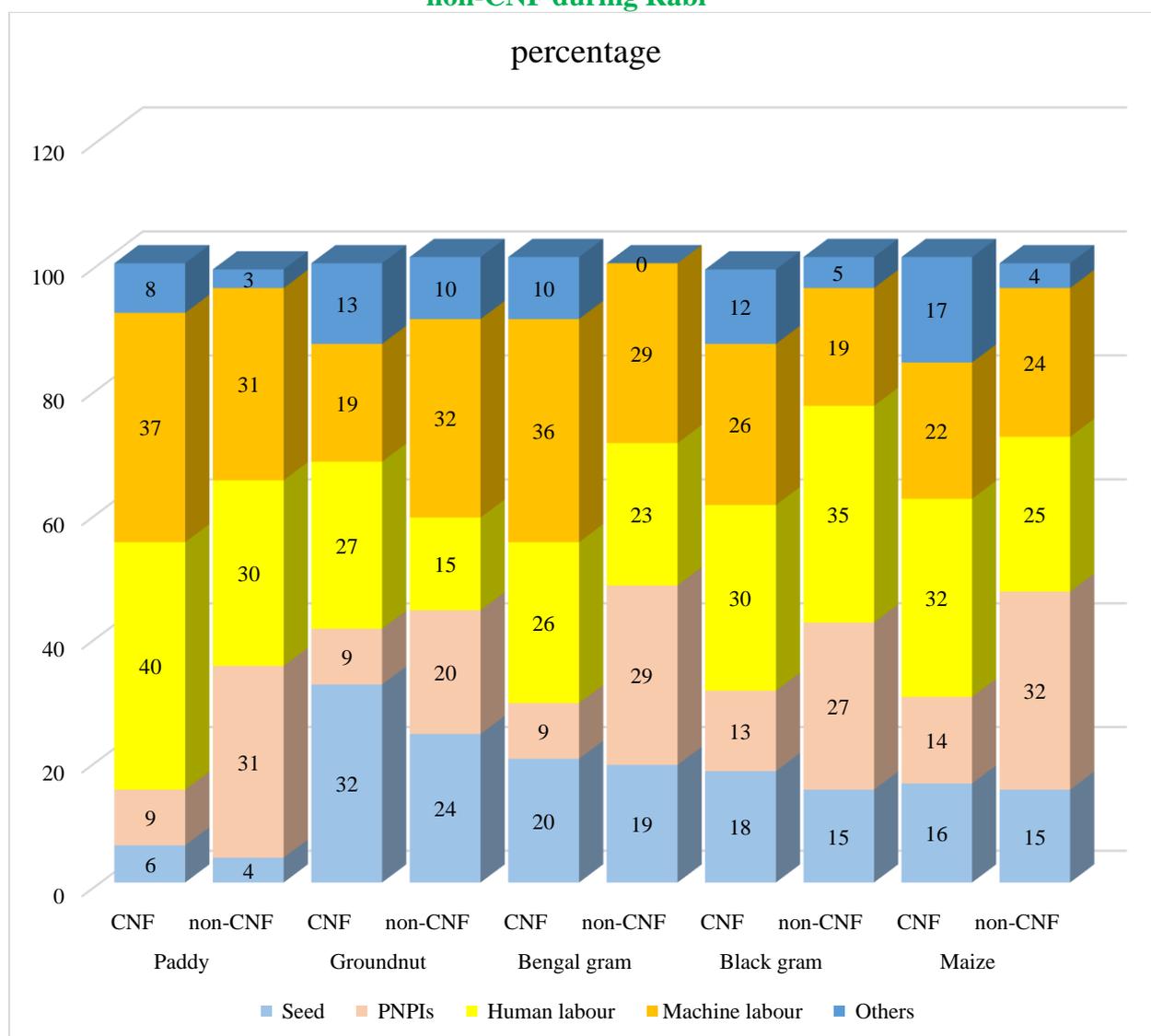
labour, under CNF, are (1) preparation of the biological stimulants, (2) cultivation of mixed crops, bund crops, border crops, and (3) processes related to higher crop yields.

Table 3.3: Crop wise percentage share of major inputs in paid-out cost under CNF and non-CNF during Rabi 2021-22

| Input | Paddy | | Groundnut | | Bengal gram | | Black gram | | Maize | |
|----------------|-------|---------|-----------|---------|-------------|---------|------------|---------|-------|---------|
| | CNF | non-CNF | CNF | non-CNF | CNF | non-CNF | CNF | non-CNF | CNF | non-CNF |
| Seed | 6 | 4 | 32 | 24 | 20 | 19 | 18 | 15 | 16 | 15 |
| PNPIs | 9 | 31 | 9 | 20 | 9 | 29 | 13 | 27 | 14 | 32 |
| Human labour | 40 | 30 | 27 | 15 | 26 | 23 | 30 | 35 | 32 | 25 |
| Machine labour | 37 | 31 | 19 | 32 | 36 | 29 | 26 | 19 | 22 | 24 |
| Others | 8 | 3 | 13 | 10 | 10 | 0 | 12 | 5 | 17 | 4 |

Source: IDSAP, Field Survey 2021-22

Figure 3.3: Crop wise percentage share of major inputs in paid-out cost under CNF and non-CNF during Rabi



Source: IDSAP, Field Survey 2021-22

As the total (paid-out) costs, under CNF and non-CNF, are different, comparison of percentage shares of each cost item gives a limited picture. An analysis of absolute expenditure on major agriculture inputs gives additional insights and complete picture. The absolute expenditure on major agriculture inputs under CNF and non-CNF and their absolute and relative differences are shown in Table 3.4 and Figure 3.4. As pointed out above, the expenditure on PNPIs is significantly less under CNF in all five crops. The expenditure on machine labour is less under CNF in three out of five crops considered in this chapter. The expenditure on human labour under CNF is higher than that of non-CNF in four out total five crops. The expenditure, in absolute terms, on other items under CNF is higher than that of non-CNF in all five crops covered in this report. The data once again indicate that CNF leads to diversification in the agriculture inputs usage.

Table 3.4: Crop wise expenditure on major inputs under CNF and non-CNF and differences between them during Rabi 2021-22

| Input | Paddy | | | | Groundnut | | | | Bengal gram | |
|----------------|----------------------|---------|----------------------------------|-------|----------------------|---------|----------------------------------|-------|----------------------|---------|
| | In ₹1000 per hectare | | Difference between CNF & non-CNF | | In ₹1000 per hectare | | Difference between CNF & non-CNF | | In ₹1000 per hectare | |
| | CNF | Non-CNF | In ₹1000 | in % | CNF | non-CNF | In ₹1000 | in % | CNF | non-CNF |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| Seed | 3.1 | 2.8 | 0.3 | 9.5 | 19.1 | 14.6 | 4.4 | 30.3 | 6.4 | 6.1 |
| PNPIs | 4.9 | 19.6 | -14.8 | -75.3 | 5.4 | 12.5 | -7.1 | -57 | 2.7 | 9.3 |
| Human Labour | 20.9 | 18.9 | 2 | 10.5 | 16 | 9.3 | 6.7 | 71.7 | 8.2 | 7.6 |
| Machine labour | 19.4 | 19.3 | 0.1 | 0.8 | 11.2 | 19.8 | -8.6 | -43.4 | 11.4 | 9.5 |
| Others | 4.1 | 1.8 | 2.2 | 122.3 | 7.5 | 6 | 1.6 | 26.5 | 3 | 0.1 |
| Total | 52.3 | 62.5 | -10.1 | -16.2 | 59.2 | 62.3 | -3.1 | -5 | 31.8 | 32.7 |

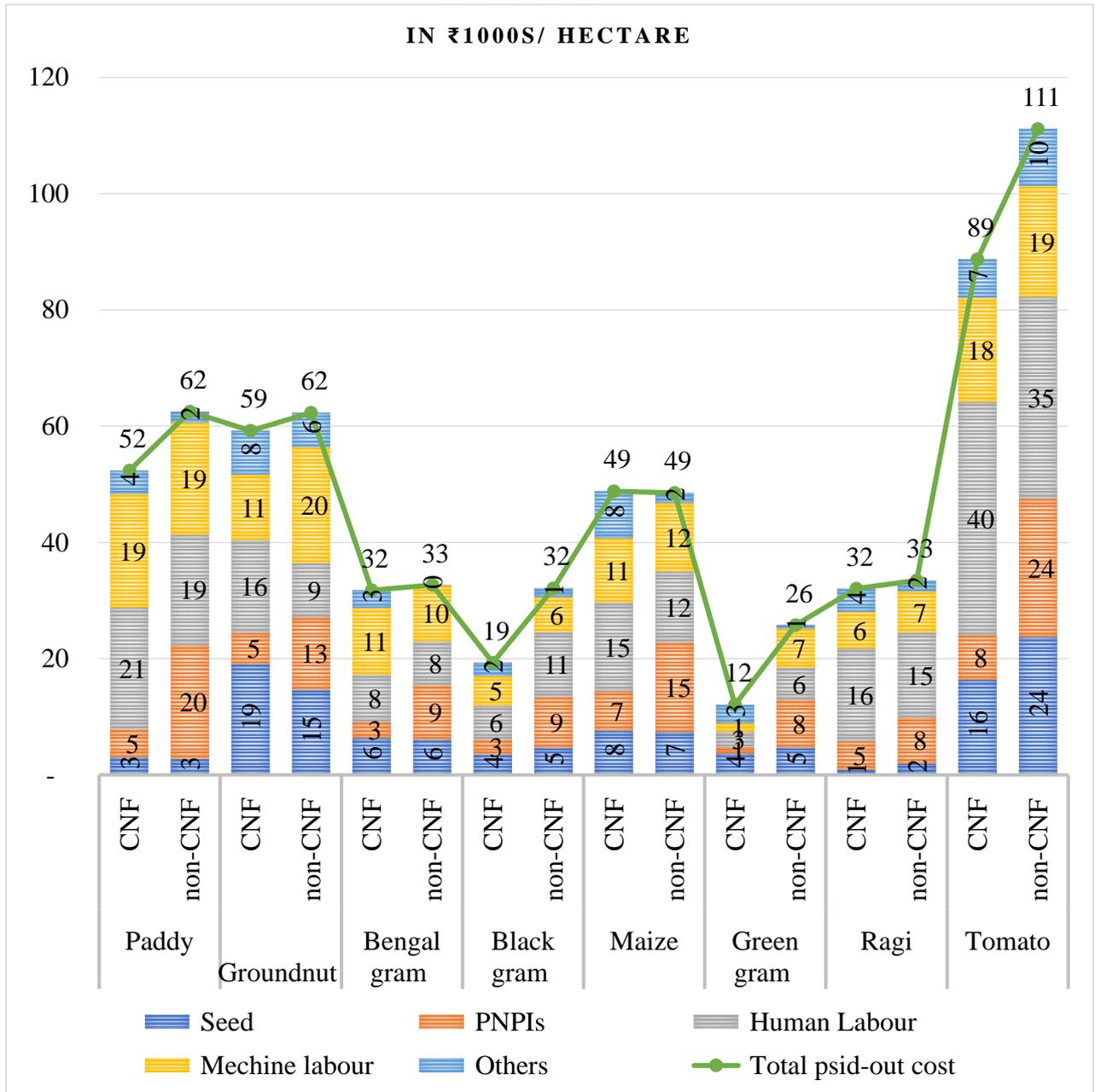
Source: IDSAP, Field Survey 2021-22

Table 3.4. Continued

| Input | Bengal gram | | Black gram | | | | Maize | | | |
|----------------|----------------------------------|----------|----------------------|---------|----------------------------------|-------|----------------------|---------|----------------------------------|-------|
| | Difference between CNF & non-CNF | | In ₹1000 per hectare | | Difference between CNF & non-CNF | | In ₹1000 per hectare | | Difference between CNF & non-CNF | |
| | In ₹1000 | in % | CNF | non-CNF | In ₹1000 | in % | CNF | non-CNF | In ₹1000 | in % |
| 1 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| Seed | 0.3 | 4.3 | 3.6 | 4.7 | -1.1 | -24.1 | 7.6 | 7.4 | 0.2 | 3.1 |
| PNPIs | -6.6 | -70.5 | 2.6 | 8.8 | -6.2 | -70.5 | 6.7 | 15.4 | -8.7 | -56.5 |
| Human Labour | 0.6 | 7.7 | 5.7 | 11.2 | -5.4 | -48.5 | 15.4 | 12.2 | 3.2 | 26.5 |
| Machine labour | 1.9 | 19.7 | 5.1 | 6 | -0.9 | -14.6 | 11 | 11.8 | -0.8 | -6.8 |
| Others | 3 | 3,824.60 | 2.3 | 1.5 | 0.8 | 54.8 | 8.1 | 1.8 | 6.3 | 357.6 |
| Total | -0.9 | -2.7 | 19.3 | 32.1 | -12.8 | -39.8 | 48.8 | 48.5 | 0.3 | 0.6 |

Source: IDSAP, Field Survey 2021-22

Figure 3.4: Crop wise expenditure on major inputs under CNF and non-CNF during Rabi 2021-22



Source: *IDSAP, Field Survey 2021-22*

3.5. Crop yields

Though CNF's major contribution is in reducing the cost of cultivation, the popular interest is always on its potential impact on crop yields. Given the importance of measuring the impact of CNF on crop yields, the study is mandated to conduct CCEs to assess the yield scientifically and independently. Crop wise estimated yields, through CCEs, are shown in Table 3.5 and Figure 3.5. Out of five crops covered in this chapter, three CNF crops' yields are higher than non-CNF yields and lower in the remaining two crops. In all three crops, viz., Bengal gram, Black gram and Maize, in which the CNF yields are higher than non-CNF, the differences

between the CNF and non-CNF yields are statistically significant (at 99 percent level of confidence). In other two crops, viz., Paddy and Groundnut, in which non-CNF yields are higher than the CNF yields, the differences are not statistically significant.

Groundnut has given higher yields under CNF during last two years. But in Kharif 2019-20 the Groundnut CNF yields were lower.²⁹ During the current season also, its yields are lower than that of non-CNF. These results indicate that there could be variations even under CNF, from year to year, location to location and crop to crop. It needs time to stabilize. In recent years, RySS has introduced PMDS as an integral part of CNF. One of the major purposes of PMDS is to protect and nourish the microorganisms in the soil. It seems, PMDS is giving good results. The significant higher CNF yields in Bengal gram, Black gram and Maize indicate the impact of PMDS in enhancing the crop yields and improving crops' resilience³⁰. The overall data show, that CNF has proved that without application of agrochemicals, a significantly higher yields can be achieved at least in few crops and same level of yields in other crops. However, the transition may not be smooth, at least in the short term and in some crops.

Table 3.5: Crop wise CCE yields under CNF & non-CNF and differences during Rabi 2021-22

| Crop | Quintals/hectare | | Difference between CNF & non-CNF | |
|-------------|------------------|---------|----------------------------------|---------------|
| | CNF | non-CNF | in quintals | in percentage |
| Paddy | 59.74 | 60.31 | -0.57 | -0.95 |
| Groundnut | 24.09 | 26.41 | -2.33 | -8.80 |
| Bengal gram | 19.90 | 7.24 | 12.66*** | 174.88 |
| Black gram | 14.00 | 10.71 | 3.29*** | 30.71 |
| Maize | 52.66 | 45.36 | 7.30*** | 16.09 |

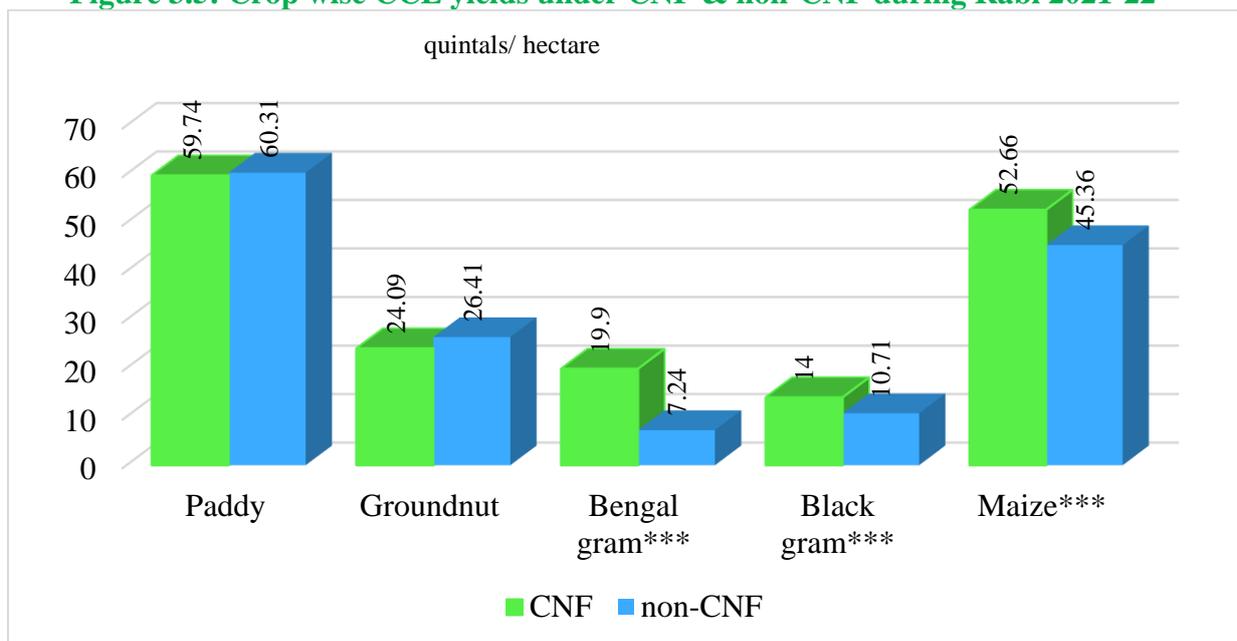
Note: *** = significant at 1% level, ** = significant at 5% level and * = significant at 10% level, of significant respectively

Source: *IDSAP, Field Survey 2021-22.*

²⁹ In Kharif 2019-20, it was pointed out that “Groundnut is being cultivated on the most degraded soils and harsh conditions in Anantapuramu and other Rayalaseema districts, mostly under the rainfed conditions. Microorganism may not survive and function effectively under those harsh environment and degraded soils. Special efforts may be needed in those conditions and soils. Promoting the tree-based farming may be one good possible solution for those soils and conditions”. See, <https://www.idsap.in/assets/reports/5%20APCNF%20Kharif%20Final%20Report%202019-20.pdf>

³⁰ An analysis of the difference in the yields between CNF and non-CNF crops during last three years indicate a positive impact of PMDS in enhancing the CNF crop yields and crop resistance to weather anomalies. See <https://www.idsap.in/assets/reports/11%20Final%20Report%20Assessing%20the%20Impact%20of%20APCNF%202020-21.pdf>

Figure 3.5: Crop wise CCE yields under CNF & non-CNF during Rabi 2021-22



Note: *** = significant at 1% level, ** = significant at 5% level and * = significant at 10% level, of significant respectively

Source: *IDSAP, Field Survey 2021-22*

3.6. Prices

Prices are one of the important factors for the expansion of CNF in the state. Though the major benefit from CNF is the reduction in the cost of cultivation, farmers expect higher pricing for their CNF produces. Further, they usually devote more family time for CNF and expect higher prices for CNF food grains and non-food items also. Some of the CNF farmers, albeit small number have been putting in extra efforts, such as selling in the *Shandis* (temporary markets organized on a fixed day and/ or time), and exhibitions, selling as retail trader, supplying to the retail shops, processing – milling, packing, etc., door delivery, online selling, etc., to obtain higher prices for their CNF produce. On the other hand, there is high and growing demand for chemical free food items. The demand in the urban areas, particularly in the cities for chemical free food items is conspicuous, but the rural demand remains invisible. APCNF is not only providing chemical-free food to the rural areas, but also propagating awareness about the benefits of the chemical-free food in the rural areas in general, and farming community in particular. According to the field notes and qualitative information gathered in two Godavari districts and Krishna districts, villagers are paying up to 50 percent higher price for CNF rice. In other districts also, people are preferring CNF to non-CNF food items.

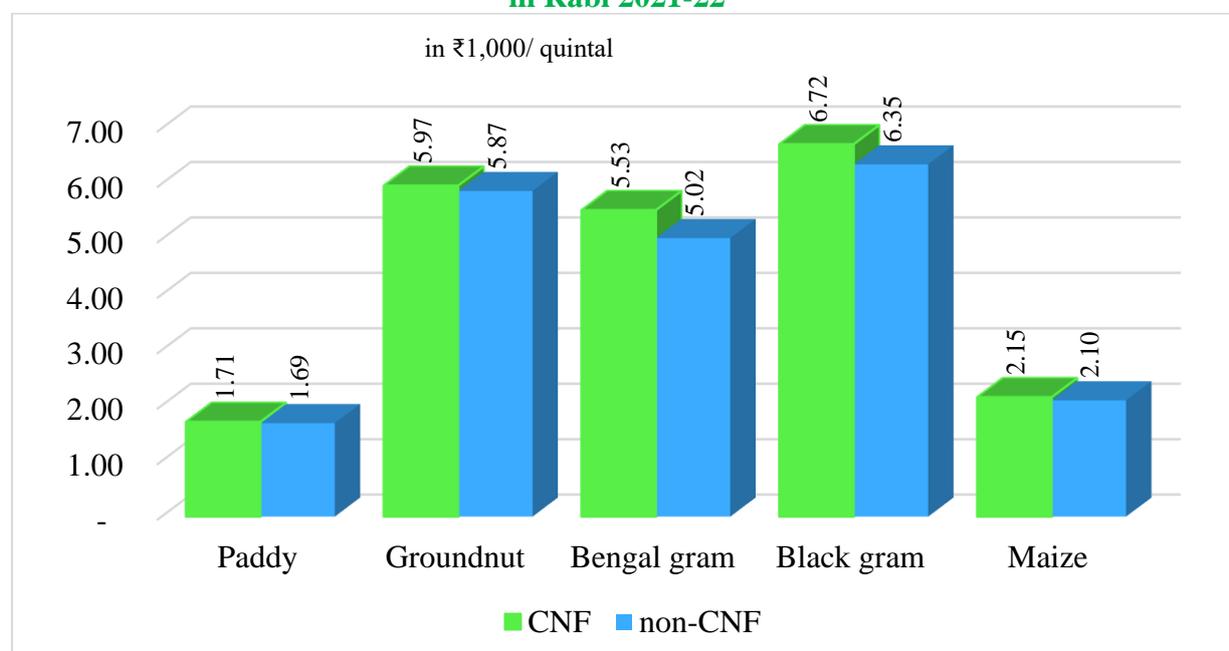
The crop wise prices obtained for CNF and non-CNF output are given in Table 3.6 and Figure 3.6. In all five crops covered, the CNF output has fetched higher prices over non-CNF output. This is an encouraging trend. It seems the huge demand for chemical free food and other items is finding its way to CNF food items, farmers and villages. The difference between CNF and non-CNF output prices, in absolute terms, is as high as ₹505 in Bengal gram and ₹363 in Black gram. In relative terms, the prices of CNF output are higher than non-CNF prices by 10.1 in Bengal gram. Apart from growing consumers' interest and demand for chemical free food, efforts of RySS in roping in Tirumala Tirupati Devasthanam (TTD) to purchase its required provisions from CNF farmers, is also giving good results.

Table 3.6: Crop wise prices realised by the farmers for their CNF and non-CNF output and their differences in Rabi 2021-22

| Crop | ₹/quintal | | Difference between CNF & non-CNF | |
|-------------|-----------|---------|----------------------------------|---------------|
| | CNF | non-CNF | in ₹/ quintal | in percentage |
| Paddy | 1,709 | 1,686 | 23 | 1.4 |
| Groundnut | 5,969 | 5,872 | 97 | 1.7 |
| Bengal gram | 5,528 | 5,023 | 505 | 10.1 |
| Black gram | 6,716 | 6,353 | 363 | 5.7 |
| Maize | 2,154 | 2,098 | 57 | 2.7 |

Source: IDSAP, Field Survey 2021-22

Figure 3.6: Crop wise prices realised by the farmers for their CNF and non-CNF output in Rabi 2021-22



Source: IDSAP, Field Survey 2021-22

3.7. Gross value of output

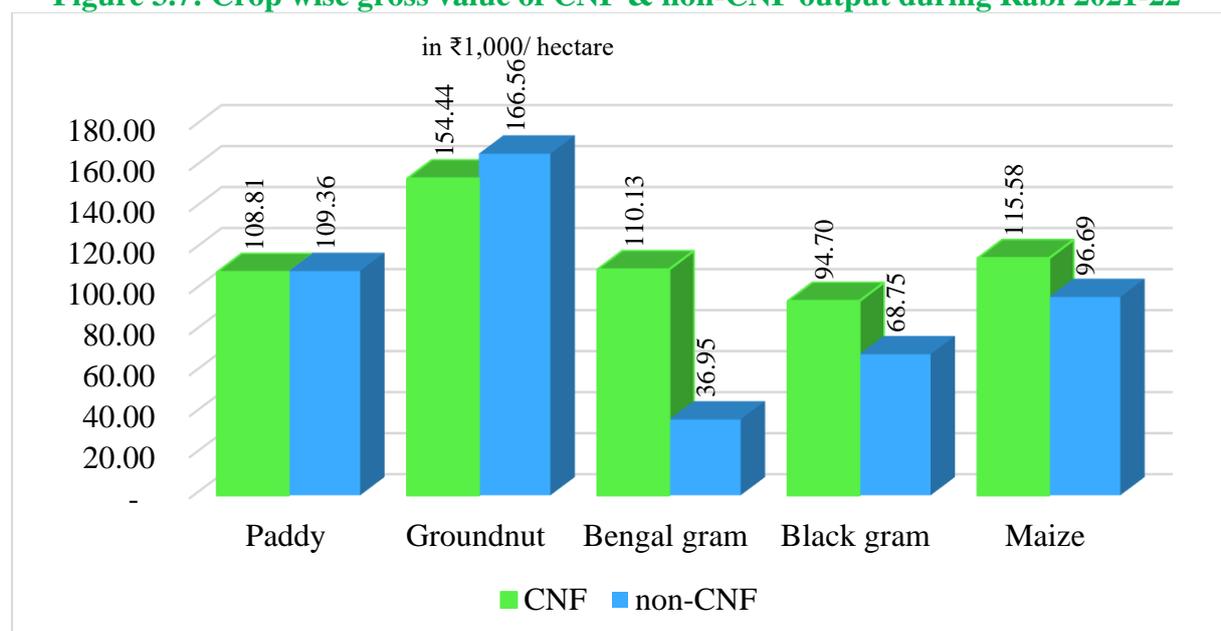
In this chapter, the gross values of crop output, are estimated by multiplying the ‘crop yield’, which are obtained through CCEs, with ‘realized or locally prevailing price’ as reported by the sample farmers, and adding the ‘value of by-products’, as reported by the farmers. As expected, the gross values of crop output reflected the trends observed in CCE yields. The per hectare gross value of CNF output is higher than that of non-CNF output, in three out of total five crops covered in this chapter, and less in the remaining two crops. However, the differences are higher in the three crops, with higher gross value of CNF output, viz., Bengal gram (198 percent), Black gram (38 percent) and Maize (20 percent). On the other hand, in three crops, in which the gross value of non-CNF output is higher than that of CNF output, the variations are small; 0.5 percent in Paddy and 7 percent in Groundnut (Table 3.7 and Figure 3.7).

Table 3.7: Crop wise gross value [based on CCE yields] of CNF& non-CNF output and differences during Rabi 2021-22

| Crop | ₹/hectare | | Difference between CNF & non-CNF | |
|-------------|-----------|----------|----------------------------------|---------------|
| | CNF | non-CNF | in ₹/ hectare | in percentage |
| Paddy | 1,08,810 | 1,09,362 | -551 | -0.50 |
| Groundnut | 1,54,440 | 1,66,556 | -12,116 | -7.27 |
| Bengal gram | 1,10,131 | 36,948 | 73,183 | 198.07 |
| Black gram | 94,697 | 68,747 | 25,950 | 37.75 |
| Maize | 1,15,581 | 96,690 | 18,892 | 19.54 |

Source: *IDSAP, Field Survey 2021-22.*

Figure 3.7: Crop wise gross value of CNF & non-CNF output during Rabi 2021-22



Source: *IDSAP, Field Survey 2021-22*

3.8. Net value of crop output

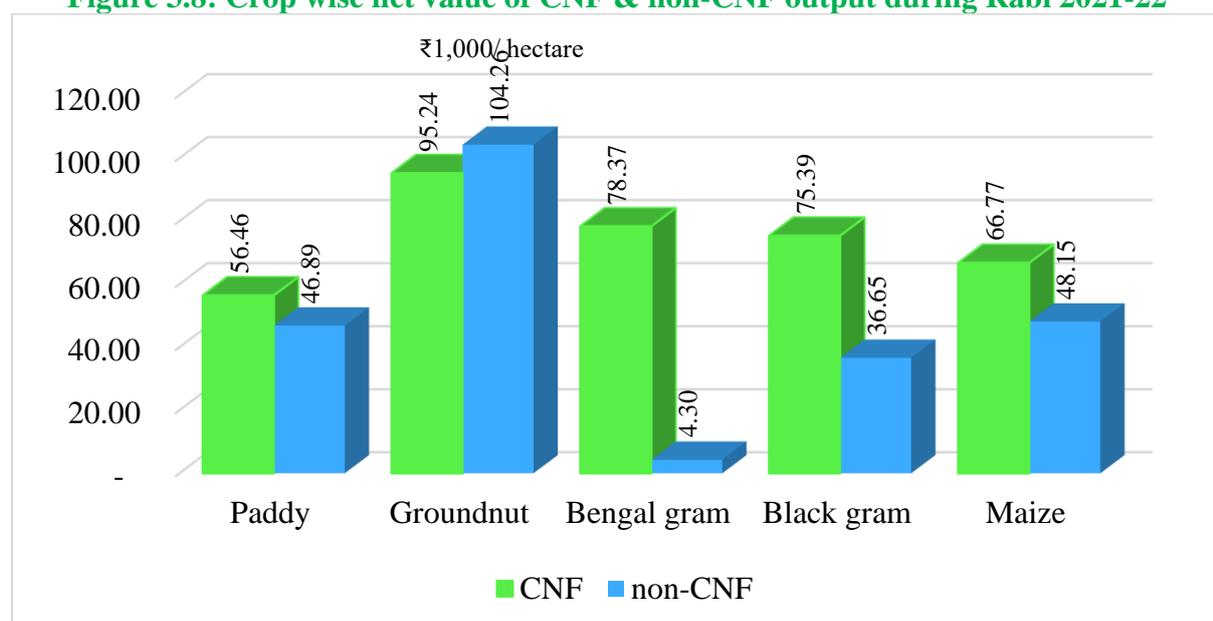
The crop wise net value of output is obtained by subtracting the ‘paid-out cost’ of a crop from the ‘gross value’ of that crop. Crop wise net value of CNF and non-CNF outputs are given in Table 3.8 and Figure 3.8. The net values of CNF output are higher than that of non-CNF in as many as four out of five crops analyzed in this chapter. Apart from three crops of Bengal gram, Black gram and Maize, in which CNF yields are higher, the net value of CNF Paddy output is higher than that of non-CNF by over 20 percent. Clearly the higher net value of Paddy is due to savings in the cost of cultivation. Nearly ₹10,000 (20 percent) higher net value of Paddy output, indicates that under CNF, the Paddy farmers could be better off with some lower yields also.

Table 3.8: Crop wise net value of CNF & non-CNF output and differences during Rabi 2021-22

| Crop | ₹/hectare | | Difference between CNF & non-CNF | |
|-------------|-----------|----------|----------------------------------|---------------|
| | CNF | non-CNF | in ₹/ hectare | in percentage |
| Paddy | 56,460 | 46,888 | 9,572 | 20.41 |
| Groundnut | 95,238 | 1,04,263 | -9,026 | -8.66 |
| Bengal gram | 78,370 | 4,297 | 74,073 | 1,723.84 |
| Black gram | 75,385 | 36,649 | 38,736 | 105.70 |
| Maize | 66,773 | 48,152 | 18,621 | 38.67 |

Source: *IDSAP, Field Survey 2021-22*

Figure 3.8: Crop wise net value of CNF & non-CNF output during Rabi 2021-22



Source: *IDSAP, Field Survey 2021-22*

3.9. Conclusions

The results in this chapter have provided clear evidence about the effectiveness of CNF in reducing the cost of cultivation and increasing farm income. CNF yields are significantly high in three crops, and statistically, no difference in two crops. They show that without application of the powerful agrochemicals, same level, if not, higher level yields can be obtained in the Rabi season also. CNF has given to the farmers ₹10,000 to ₹74,000 per hectare higher net value of output in four out of five crops. In Groundnut also the CNF yields have been higher, and more profitable, than non-CNF in most of the previous surveys. As pointed out in 2019-20 Kharif report that Groundnut is being cultivated in the state in most degraded soils and harsh conditions. Needs special efforts to improve the soil quality in such challenging conditions. Recently, RySS has introduced PMDS. As mentioned above, there are clear indications that PMDS would improve all kinds of soils and improve the crop yields in coming years.

In all surveys conducted so far, this is the first time that all CNF crops got higher prices. This is reassuring trend. It reflects a growing demand for CNF crop outputs. It is also due to the success of RySS efforts in convincing the TTD to procure its provisions from CNF farmers. These developments may contribute for further expansion of CNF in the state. RySS may continue the efforts to rope in other agencies like the Food Corporation of India (FCI) and Integrated Child Development Services (ICWD) to procure their provisions from CNF farmers.

Chapter 4: Impact of CNF on resource use and environmental sustainability of agriculture

4.1. Introduction

As mentioned in the previous reports, APCNF is a paradigm shift in agriculture, for generating a production system of crops with social, economic and environmental sustainability. Social sustainability has been analysed, through representation of marginalized and vulnerable social and economic groups, in CNF in the chapter 2 of the Kharif 2021-22 report.³¹ The same is summarized in the chapter 2 of this report. Economic analysis has been covered in Chapters 3 and 4 of this report to reflect on economic sustainability of APCNF. In this chapter, the issues of the environmental sustainability have been discussed. Specifically, changes in natural resources, such as land, labour and water use, and changes in the quality of natural resources, especially land, are covered. Further, the contribution of CNF in reducing the pollution of natural resources, including land, water and atmosphere, is also discussed. Finally, the cascading effects CNF principles and practices on soil quality and crop quality are also covered in this chapter. Both the quantitative and qualitative data collected through household survey during Rabi 2021-22 are used in this chapter.

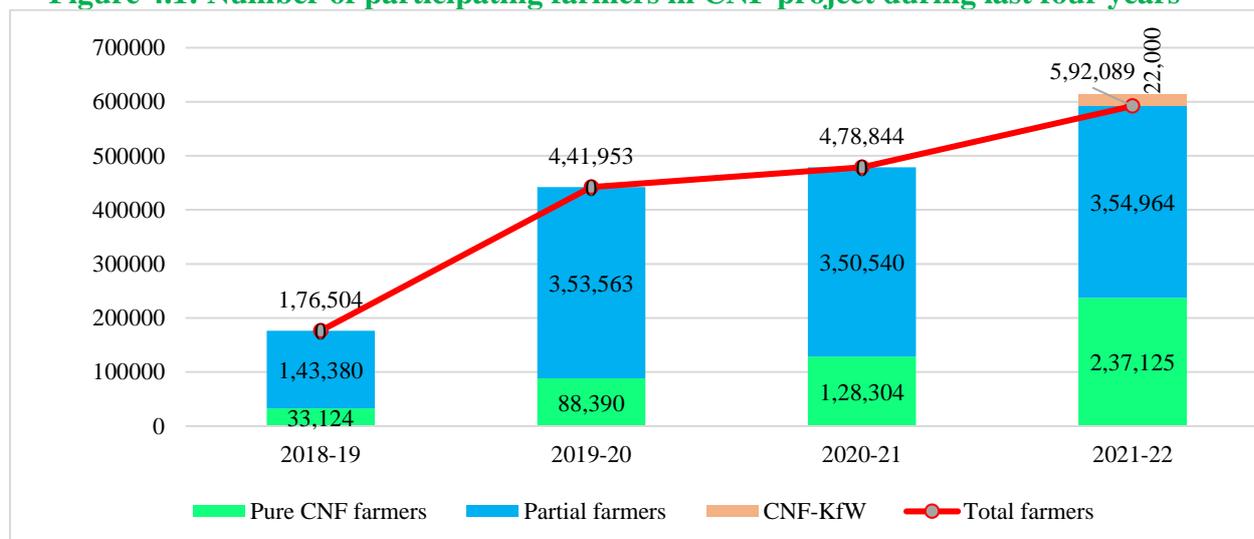
4.2. Land-use and Environmental sustainability

Expansion of area under CNF is a reliable indicator about the positive impact of CNF and its sustainability. Area under CNF would expand, if more and more farmers take up CNF, which is referred as “**expansion of the programme**”; and if the existing CNF farmers increase their allocation of area towards CNF, which is referred as “**intensification of the programme**”. It is encouraging to note that the area under CNF is expanding in recent years because of both expansion and intensification of CNF. As per the data provided by RySS, the number of APCNF project participant farmers has been increasing at rapid pace. As of now, RySS is

³¹See details in IDSAP (2022): *Assessing the Impact of APCNF [Andhra Pradesh Community Managed Natural Farming]: A comprehensive Approach Using Crop Cutting Experiments: Second Interim Report of 2021-22: Kharif Season*, Institute for Development Studies Andhra Pradesh (IDSAP), Visakhapatnam. https://apcnf.in/wp-content/uploads/2023/02/Final-APCNF-Kharif-Season-Report-2021-22_17012022.pdf or <https://www.idsap.in/assets/reports/13%20APCNF%20Kharif%20Season%20Report%202021%2022%2031%20Dec%202022.pdf>

recording the CNF project participants under two categories, viz., (1) Pure CNF farmers or seed to seed (S2S) farmers, who cultivate crops with only CNF inputs and practices, without applying any chemical inputs, at least on a part of their operational holdings (at least one plot); and (2) Partial CNF farmers, who apply both biological and chemical technology inputs in their fields. The number of farmers adopting CNF as the pure CNF/ S2S farmers and partial CNF farmers together, has reached 6.14 lakh in 2021-22 (including 22,000 households covered under KfW Development Bank [a German bank, in short KfW]) assisted villages. The number of total participants has increased by 3.35 times during last four years; from 1.77 lakh farmers in 2018-19 to 5.92 lakh farmers in 2021-22. It is interesting to note that the number of pure CNF/ S2S farmers are increasing at a rapid pace during last four years; from 33,124 in 2018-19 to 2,37,125 in 2021-22. But the number of partial farmers has stagnated just above 3.5 lakh during last three years (Figure 4.1). Further, the project has covered another 22,000, in about 700 new villages, as pure CNF farmers in 2021-22, in collaboration with KfW. It implies that the project has covered over 10% of farmers in the state. Needless to say, more participants in the programme imply more area under CNF.

Figure 4.1: Number of participating farmers in CNF project during last four years



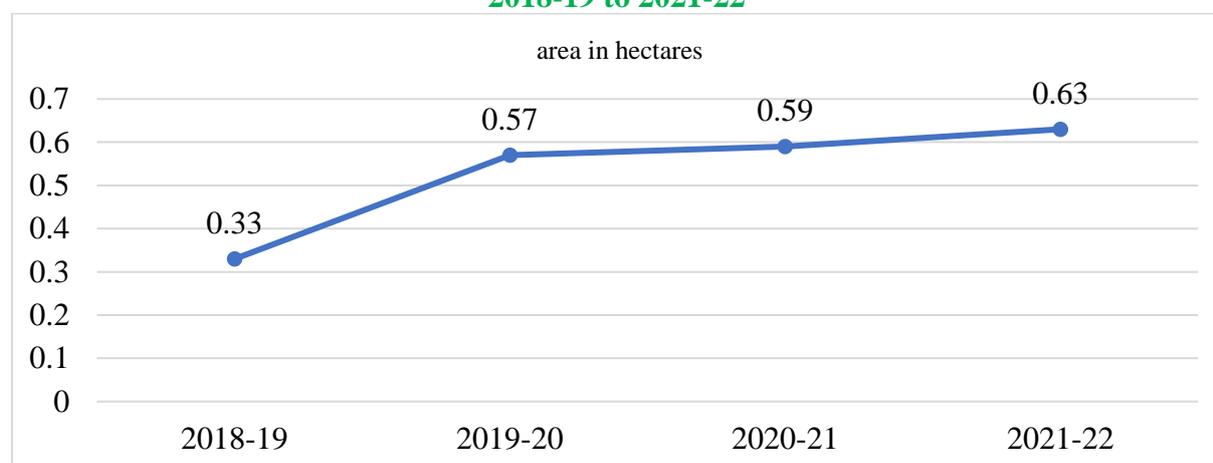
Source: RySS

The data from previous surveys also indicate that the area under CNF is growing season by season and year by year. For example, the area allocated for CNF has been increased during the last four Kharif seasons, that is, from 2018-19 to 2021-22. The average area per farmer under CNF has increased from 0.48 hectares during Kharif of 2018-19 to 1.07 hectares in Kharif of 2021-22.³² During the Rabi seasons also, the average area allocated to CNF has increased from 0.33 hectares in Rabi 2018-19 to 0.63 hectares in Rabi 2021-22, at the state

³² Ibid.

level (Figure 4.2). The area allocated to CNF has increased by 91 percent at the state level, during last four years. But the change/ increase is quite uneven across the agroclimatic zones and farmers categories. The increase across the agroclimatic zones varied from 42 to 146 percent, i.e., 42 percent in Krishna zone, 43 percent in North coastal zone, 128 percent in Scarce rainfall zone and 146 percent in Southern zone respectively. The same varied across the farm size categories, from 50 percent for marginal farmers to 149 percent for other farmers, including medium and large farmers; among tenurial categories, the same varied from 49 percent for tenant farmers to 132 percent for owner-cum-tenant farmers; and among social categories, the same varied from 51 percent for OC farmers to 156 percent for BC farmers (Table 4.1).

Figure 4.2: Average area allocated to CNF, by CNF farmers during Rabi season of 2018-19 to 2021-22



Source: IDSAP, Field Survey 2021-22

Table 4.1: Agroclimatic zone wise and farmer category wise average area allocated to CNF, by CNF farmers during Rabi season of 2018-19 to 2021-22 [in hectares]

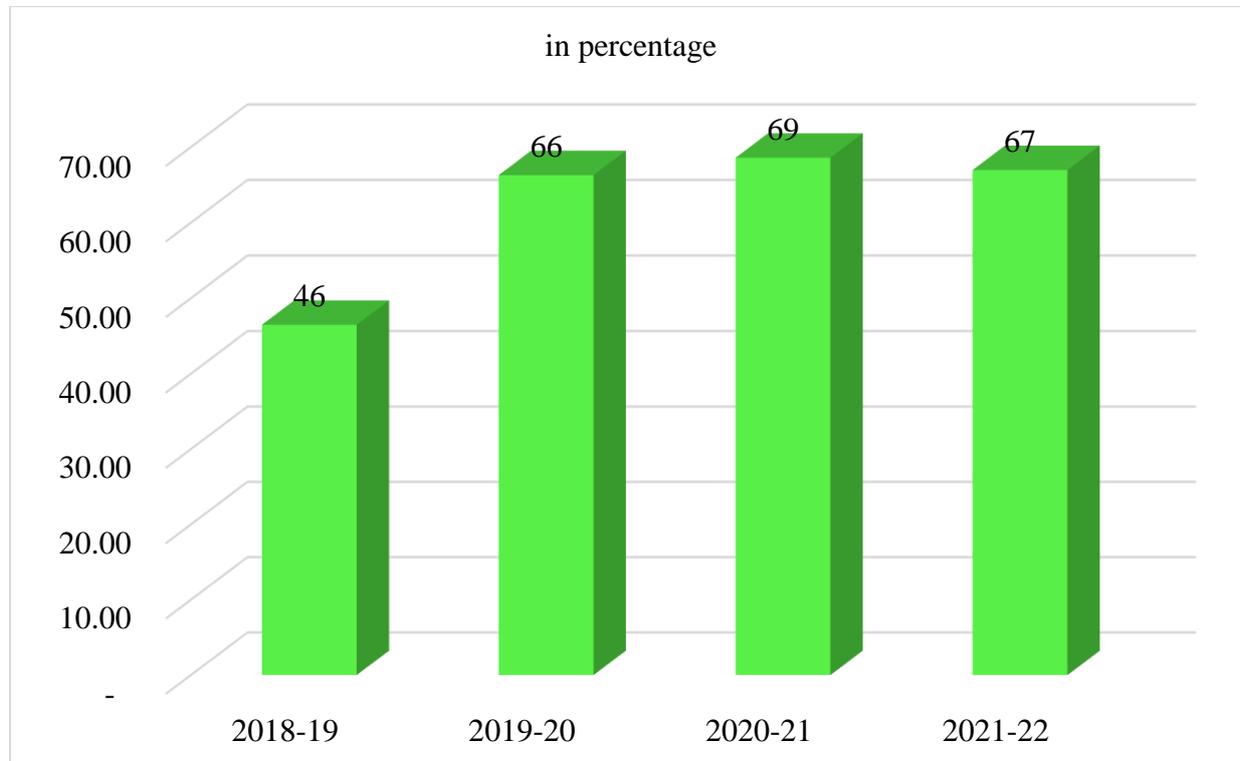
| Agroclimatic Zones & Categories of farmers | | 2018-19 | 2019-20 | 2020-21 | 2021-22 | Change in 2021-22 over 2018-19 (%) |
|--|-----------------|-------------|-------------|-------------|-------------|------------------------------------|
| State | AP | 0.33 | 0.57 | 0.59 | 0.63 | 91 |
| Agroclimatic zones | HAT | 0.38 | 0.47 | 0.65 | 0.65 | 71 |
| | North coastal | 0.23 | 0.58 | 0.49 | 0.33 | 43 |
| | Godavari | 0.29 | 0.49 | 0.56 | 0.54 | 86 |
| | Krishna | 0.33 | 0.42 | 0.58 | 0.47 | 42 |
| | Southern | 0.28 | 0.72 | 0.69 | 0.69 | 146 |
| | Scarce rainfall | 0.46 | 0.69 | 0.52 | 1.05 | 128 |
| Farm size categories | Marginal | 0.30 | 0.43 | 0.48 | 0.45 | 50 |
| | Small | 0.31 | 0.64 | 0.65 | 0.71 | 129 |
| | Others | 0.47 | 0.96 | 0.91 | 1.17 | 149 |
| | Tenants | 0.35 | 0.48 | 0.59 | 0.52 | 49 |

| Agroclimatic Zones & Categories of farmers | | 2018-19 | 2019-20 | 2020-21 | 2021-22 | Change in 2021-22 over 2018-19 (%) |
|--|-------------------|---------|---------|---------|---------|------------------------------------|
| Tenurial categories | Owner-cum-tenants | 0.25 | 0.93 | 0.55 | 0.58 | 132 |
| | Owners | 0.34 | 0.54 | 0.59 | 0.64 | 88 |
| Social categories | SC | 0.26 | 0.38 | 0.42 | 0.44 | 69 |
| | ST | 0.36 | 0.65 | 0.64 | 0.63 | 75 |
| | BC | 0.27 | 0.51 | 0.49 | 0.69 | 156 |
| | OC | 0.43 | 0.68 | 0.79 | 0.65 | 51 |

Source: *IDSAP, Field Survey 2021-22*

The area allocated to CNF is not only increasing in absolute terms, but also in relative terms. Area allocated to CNF as a percentage of operational area of the sample farmers has increased from 46 percent in Rabi 2018-19 to 66 percent in Rabi 2019-20 and 69 percent in Rabi 2020-21, then declined slightly to 67 percent in Rabi 2021-22 (Figure 4.3). It is interesting to note that CNF area as percentage of operational area of sample farmers has reached about two-thirds in 2019-20. It remained at that level during last three years at the state level. Same increasing trend can be observed in almost all agroclimatic zones and farmers categories (Table 4.2).

Figure 4.3: Average area under CNF as a percentage of operational area during Rabi season of 2018-19 to 2021-22



Source: *IDSAP, Field Survey 2021-22*

Table 4.2: Agroclimatic zone wise and farmer category wise average area under CNF as a percentage of operational area during Rabi season of 2018-19 to 2021-22 [in percentages]

| Agroclimatic Zones & Categories of farmers | 2018-19 | 2019-20 | 2020-21 | 2021-22 |
|--|--------------|--------------|--------------|--------------|
| Agroclimatic zones | | | | |
| HAT | 49.07 | 58.04 | 72.58 | 53.39 |
| North coastal | 46.21 | 102.22 | 88.95 | 49.20 |
| Godavari | 41.61 | 66.06 | 72.40 | 69.33 |
| Krishna | 81.33 | 67.24 | 73.52 | 73.55 |
| Southern | 25.53 | 69.22 | 68.38 | 66.08 |
| Scarce rainfall | 40.07 | 42.62 | 40.25 | 84.58 |
| Total | 46.48 | 66.30 | 68.60 | 66.97 |
| Farm size categories | | | | |
| Marginal | 64.70 | 82.18 | 87.51 | 81.36 |
| Small | 23.53 | 51.56 | 48.52 | 49.62 |
| Others | 16.49 | 32.01 | 31.70 | 42.10 |
| Total | 46.48 | 66.30 | 68.60 | 66.97 |
| Tenurial categories | | | | |
| Tenants | 38.43 | 57.60 | 66.77 | 62.25 |
| Owner-cum-tenants | 15.98 | 45.41 | 35.76 | 37.75 |
| Owners | 49.62 | 68.58 | 71.69 | 69.85 |
| Total | 46.48 | 66.30 | 68.60 | 66.97 |
| Social categories | | | | |
| SC | 44.74 | 63.78 | 70.47 | 71.45 |
| ST | 43.22 | 73.00 | 70.04 | 55.48 |
| BC | 33.48 | 52.44 | 57.72 | 74.15 |
| OC | 70.86 | 83.01 | 83.31 | 64.99 |
| Total | 46.48 | 66.30 | 68.60 | 66.97 |

Source: IDSAP, Field Survey 2021-22.

The focus group discussions with farmers and case studies of farmers across the sample villages have also endorsed this trend, especially in recent years. The land use pattern in terms of diversified crops grown is another indicator to assess the environmental sustainability. Focused group discussions with farmers have indicated that a shift from monocropping to multi cropping has been taking place slowly by the farmers due to CNF. The qualitative data also indicate that farmers have started growing gradually mixed crops, inter crops, border crops, and bund crops. They are growing fruits, vegetables and flowers, which provide ecological services also.

Another impact of CNF on land use in agriculture is the increase in cropping intensity. CNF is positively impacting the cropping intensity through PMDS and 365 days green cover strategy.

Compared to non-CNF farmers, the PMDS+CNF enabled CNF farmers to cover their cultivated land with crops for longer periods. As per previous Kharif survey, the CNF fields have 187 days crop cover compared to 152 days crop cover on non-CNF field, i.e., 35 (23 percent) days more crop cover.³³Crop coverage for longer periods implies taking more than one crop on the same piece of land. This has multiple benefits: Firstly, the availability of more biomass consisting of green manure, fodder, foodgrains, vegetables and leafy vegetables. Secondly, the soil would be protected from the sunlight and heat, thus preserving the soil moisture and microbes in the soil. Thirdly, plants prepare their own food through photosynthesis and exudate a part of it into the soil, which nourish the microbes in the soil. Additionally, the longer the crop cover means the microbes would be nourished for longer periods of time. However, there is no difference between CNF fields of CNF farmers and non-CNF fields of non-CNF farmers with respect to crop cover over their fields during Rabi 2021-22. The difference in number of days of crop cover over CNF and non-CNF fields is just one day (0.4 percent). Almost similar (marginal differences) trends can be observed across all agroclimatic zones and farmer categories (Table 4.3). This shows that there is less scope to take Pre-Rabi Dry Sowing (PRDS) between Kharif and Rabi crops. It may be noted that PMDS was the major contributory factor for longer crop cover over the CNF fields during March – November 2021 period, covered in the previous (Kharif) survey. As of now the duration of Kharif and Rabi crops are appeared to be same. They may change, as and when crop diversity and mixed cropping are taken up in a large number under CNF. At the moment, it appears that such expected changes are in the initial stages.

Table 4.3: Agroclimatic zones and farmer category wise crop cover over fields of CNF and non-CNF farmers during Nov 2021 to April 2022 (Days)

| Agroclimatic Zones & Categories of farmers | CNF fields of CNF farmers | Non-CNF fields of non-CNF farmers | Difference between CNF and non-CNF | |
|--|---------------------------|-----------------------------------|------------------------------------|------------|
| | | | Days | percentage |
| Agroclimatic zones | | | | |
| HAT | 150 | 149 | 1 | 0.4 |
| North coastal | 119 | 132 | -13 | -10 |
| Godavari | 123 | 122 | 1 | 0.6 |
| Krishna | 120 | 127 | -7 | -5.8 |
| Southern | 130 | 114 | 17 | 14.5 |
| Scarce rainfall | 128 | 131 | -4 | -2.7 |
| Total | 128 | 129 | -1 | -0.4 |
| Farm size categories | | | | |
| Marginal | 126 | 125 | 1 | 0.6 |
| Small | 131 | 128 | 3 | 2.7 |

³³ Ibid

| Agroclimatic Zones & Categories of farmers | CNF fields of CNF farmers | Non-CNF fields of non-CNF farmers | Difference between CNF and non-CNF | |
|--|---------------------------|-----------------------------------|------------------------------------|-------------|
| | | | Days | percentage |
| Others | 131 | 136 | -5 | -3.7 |
| Total | 128 | 129 | -1 | -0.4 |
| Tenurial categories | | | | |
| Tenants | 125 | 123 | 2 | 1.3 |
| Owner-cum-tenants | 124 | 128 | -3 | -2.6 |
| Owners | 129 | 129 | 0 | -0.2 |
| Total | 128 | 129 | -1 | -0.4 |
| Social categories | | | | |
| SC | 129 | 121 | 8 | 6.8 |
| ST | 143 | 144 | -1 | -0.6 |
| BC | 123 | 125 | -2 | -1.6 |
| OC | 125 | 128 | -3 | -2.6 |
| Total | 128 | 129 | -1 | -0.4 |

Source: IDSAP, Field Survey 2021-22.

4.3. Labour-use and Environmental sustainability

The earlier studies conducted by IDSAP on impact of APCNF has brought out clearly three insights regarding labour use across all the crops: (1) The labour days used per hectare by and large is higher across all the crops for CNF compared to non-CNF; this means that CNF is labour intensive. (2) The hired labour use is also higher for CNF compared to non-CNF for majority of the crops; this means that CNF provides more employment to wage employment seekers. (3) The own labour (family labour) is also higher in almost all crops for CNF over non-CNF; this shows that the engagement of the family labour with CNF is more.

The results of the Rabi survey of 2021-22 endorse these trends. A greater number of own labour days are used in CNF crops vis-à-vis non-CNF in four out of five crops covered here, in the range of 4 days per ha in Groundnut to 14 days per ha in Paddy. Only in Maize, use of own labour is less under CNF by 7 days per hectare. In the case of hired labour, a greater number of labour days are used under CNF in three out of five crops, in the range of 5 days per hectare in Groundnut to 22 days per hectare in Maize. On the other hand, a lesser number of hired labour days are used under CNF, in remaining two crops, in the range of 4 days per hectare in Bengal gram to 7 days in Black gram. In total, a greater number of labour days are used in four crops under CNF; and equal number of days are used in the remaining Black gram for both CNF and non-CNF (Table 4.4). The results, once again confirm the earlier observation that CNF is more labour intensive. The major reasons for higher labour requirement are preparation of biological inputs and stimulants and crop diversity- taking mixed crops, inter crops, bund

crops and border crops. Even more important reason is that CNF is a knowledge intensive, in which farmers have to be vigilant and responsive to the developments in the fields. All these indicate the CNF's employment generation potential. At least it can reduce the disguised³⁴ unemployment in agriculture and increase the labour productivity in the sector.

Table 4.4: Crop wise own, hired and total labour used under CNF and non-CNF during Rabi 2021-22

| Labour categories | Crop | Days/ hectare | | Difference between CNF & non-CNF | |
|-------------------|-------------|---------------|---------|----------------------------------|------------|
| | | CNF | non-CNF | Days | Percentage |
| Own labour | Paddy | 58 | 44 | 14 | 32 |
| | Groundnut | 48 | 44 | 4 | 9 |
| | Bengal gram | 17 | 12 | 5 | 42 |
| | Black gram | 52 | 45 | 7 | 16 |
| | Maize | 47 | 54 | -7 | -13 |
| Hired labour | Paddy | 54 | 38 | 16 | 42 |
| | Groundnut | 46 | 41 | 5 | 12 |
| | Bengal gram | 19 | 23 | -4 | -17 |
| | Black gram | 26 | 33 | -7 | -21 |
| | Maize | 60 | 38 | 22 | 58 |
| Total labour | Paddy | 112 | 82 | 30 | 37 |
| | Groundnut | 94 | 85 | 9 | 11 |
| | Bengal gram | 36 | 35 | 1 | 3 |
| | Black gram | 78 | 78 | 0 | - |
| | Maize | 107 | 92 | 15 | 16 |

Source: *IDSAP, Field Survey 2021-22*

4.4. Water-use and Environmental sustainability

As pointed out in the previous Kharif 2021-22 report, various CNF practices are expected to soften the soil and increase the carbon content in the soil. These changes in turn would increase the water/ rainfall percolation into the soils and increase the water/ moisture holding capacity of the soils. To know the field reality, the CNF farmers were asked about their experiences with respect to changes in water consumption in crop cultivation after the introduction of CNF. Their responses have been recorded in the five-point scale, during Rabi 2021-22 survey. The data is presented in Table 4.5. Among CNF farmers, 81 percent have reported that water-use consumption has been decreased moderately or considerably, due to CNF. With minor exceptions, the trend holds good across almost all agroclimatic zones and all farmers'

³⁴In economics text books, the term disguised unemployment is used to the workers with zero marginal productivity, in agriculture and unorganized sector. It implies their presence or absence does not impact the total production. Because of higher labour requirement in CNF with specific skills, the disguised unemployed can contribute positively to the total production, i.e., shift occurs

categories. The focused group discussions with the farmers and the case studies of farmers across the sample villages has endorsed this. These farmers have also reported that the moisture in the soil has increased and groundwater levels are also increased in some of the sample villages.

Table 4.5: Agroclimatic zones and farmer category wise CNF farmers response about change in water use in crop cultivation due to CNF in Rabi 2021-22(in %)

| Agroclimatic zones & farmers categories | Decreased considerably | Decreased moderately | No change | Increased moderately | Increased considerably |
|---|------------------------|----------------------|-----------|----------------------|------------------------|
| Zone | | | | | |
| HAT | 4 | 39 | 57 | - | - |
| North coastal | 6 | 18 | 75 | 1 | - |
| Godavari | 41 | 59 | - | - | - |
| Krishna | 7 | 68 | - | 9 | 16 |
| Southern | 1 | 87 | 5 | 7 | 1 |
| Scarce rainfall | - | 100 | - | - | - |
| AP | 14 | 67 | 14 | 3 | 2 |
| Farm size categories | | | | | |
| Marginal | 13 | 67 | 14 | 4 | 3 |
| Small | 15 | 66 | 16 | 2 | 1 |
| Others | 15 | 70 | 11 | 2 | 3 |
| All | 14 | 67 | 14 | 3 | 2 |
| Tenurial categories | | | | | |
| Tenants | 40 | 60 | - | - | - |
| Owner-cum-tenants | 27 | 70 | 1 | 1 | - |
| Owners | 10 | 67 | 16 | 3 | 3 |
| All | 14 | 67 | 14 | 3 | 2 |
| Social categories | | | | | |
| SC | 9 | 76 | - | 8 | 8 |
| ST | 22 | 59 | 19 | - | - |
| BC | 10 | 64 | 23 | 2 | 2 |
| OC | 16 | 75 | 2 | 4 | 3 |
| All | 14 | 67 | 14 | 3 | 2 |

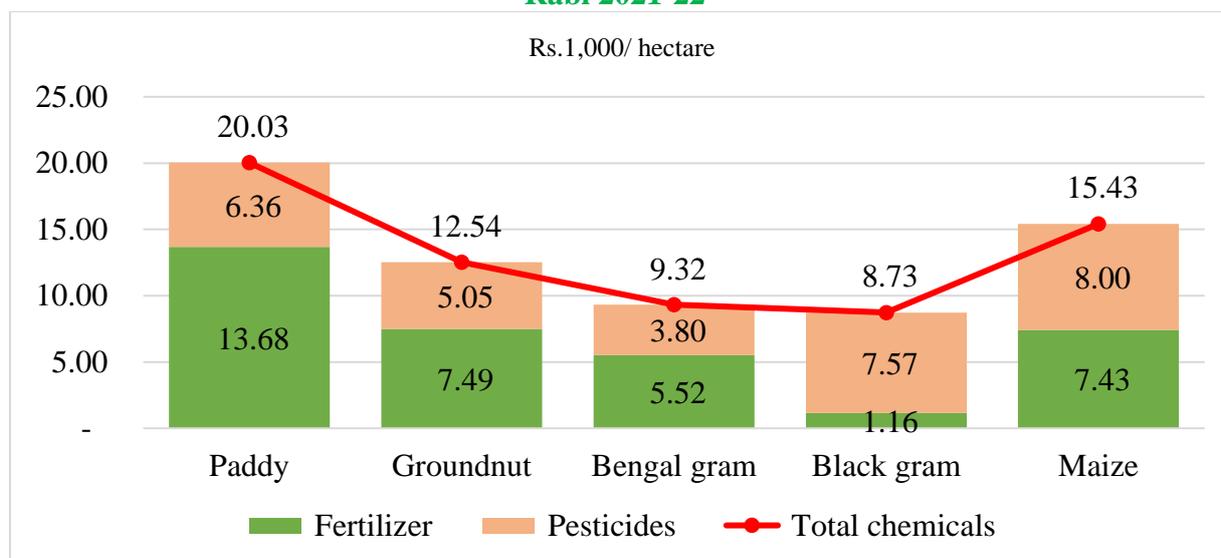
Source: *IDSAP, Field Survey 2021-22.*

4.5. Avoidance of agrochemicals and environmental effect

One of the most dreaded effects of modern agriculture is the pollution effects of agrochemicals, i.e., fertilizers and pesticides. These chemicals pollute the soils, water bodies, and atmosphere. These chemicals have killed the microbes in the soil and made the soil dead (without any life in it). The polluted water bodies and atmosphere have health hazards to the human and other living beings. Even the agrochemical residues in agriculture output, particularly the food, have bigger health risk to the human and other living beings. By avoiding completely these agrochemicals, the CNF farmers have been contributing immensely in halting and reversing the multidimensional pollution of the agrochemicals, including the resource degradations. Crop

wise avoided expenditure on agrochemicals, by CNF farmers, are shown in Figure 4.4. The avoided expenditure on agrochemicals varies from ₹8.73 thousand per hectare in Black gram to ₹20.03 thousand per hectare in Paddy. The avoided expenditure on fertilizers varies from ₹1.16 to ₹13.68 thousand, i.e., ₹1.16 thousand in Black gram to ₹13.68 thousand in Paddy respectively. Various studies have indicated that Government of India’s fertilizer subsidy is equal to actual expenditure of the farmers on fertilizers.³⁵ That is if a farmer spends ₹100 on fertilizers, the GoI would spend ₹100 on subsidy. By avoiding the use of fertilizers, the CNF farmers are saving the fertilizers subsidy of the GoI.

Figure 4.4: Crop wise avoided expenditure on agrochemicals*by CNF farmers during Rabi 2021-22



*This is actual expenditure incurred on agrochemicals by non-CNF farmers. Hence, this is considered as the expenditure avoided on agrochemicals, by CNF farmers

Source: *IDSAP, Field Survey 2021-22.*

4.6. Outcomes of Environmental sustainability

In the earlier sections in this chapter, the potential environmental benefits of CNF are discussed. The benefits include halting and reversing the degradation of the natural resources, pollution of the atmosphere, etc. The study has been collecting the CNF farmers’ experiences and perceptions about improvement in the soil quality, crop quality and related issues, due to CNF. Agroclimatic zones and farmers categories wise CNF farmers responses with respect to improvement in soil quality are presented in Table 4.6. Over three-fourths of farmers, at the state level, said that soil quality has improved moderately due to CNF. Another 12 percent farmers said that the soil quality has improved considerably. On the other hand, 3 percent and 4 percent farmers have alleged that the soil quality has deteriorated considerably and

³⁵ See for example Harish Damodaran (2020): “Explained: How fertiliser subsidy works”, *The Indian Express*, October 20, 2020 <https://indianexpress.com/article/explained/how-fertiliser-subsidy-works-6793395/>

moderately respectively. Though small in number, these responses are unexpected. Most of these responses came from the HAT zone and tribal farmers. It is well known that this zone and these farmers have peculiar resource base and farm practices. However, the reasons for their responses need further investigation. The variations in the farmers' responses with respect to soil quality improvement are relatively higher across the agroclimatic zones compared to farmer categories.

Table 4.6: CNF farmers response about the improvement in the soil quality during Rabi 2021-22 (in %)

| Agroclimatic Zones & Categories of farmers | Decreased considerably | Decreased moderately | No change | Increased moderately | Increased considerably |
|--|------------------------|----------------------|-----------|----------------------|------------------------|
| Zone | | | | | |
| HAT | 11 | 24 | 5 | 60 | |
| North coastal | 7 | 2 | 20 | 71 | |
| Godavari | 1 | - | 1 | 76 | 23 |
| Krishna | - | - | - | 65 | 35 |
| Southern | 3 | - | 6 | 83 | 9 |
| Scarce rainfall | 1 | - | 1 | 99 | |
| AP | 3 | 4 | 5 | 76 | 12 |
| Farm size categories | | | | | |
| Marginal | 5 | 5 | 5 | 72 | 13 |
| Small | 0 | 2 | 5 | 84 | 9 |
| Others | 3 | 1 | 2 | 81 | 13 |
| All | 3 | 4 | 5 | 76 | 12 |
| Tenurial categories | | | | | |
| Tenants | - | - | 4 | 78 | 18 |
| Owner-cum-tenants | - | - | 6 | 70 | 24 |
| Owners | 4 | 4 | 5 | 77 | 11 |
| All | 3 | 4 | 5 | 76 | 12 |
| Social categories | | | | | |
| SC | 2 | 1 | 4 | 69 | 24 |
| ST | 7 | 15 | 3 | 69 | 6 |
| BC | 3 | 0 | 8 | 78 | 11 |
| OC | 1 | - | 1 | 83 | 14 |
| All | 3 | 4 | 5 | 76 | 12 |

Source: *IDSAP, Field Survey 2021-22.*

From the past surveys, four indicators, viz., (1) soil softness, (2) presence of earthworms in the soil, (3) green cover in the fields and (4) moisture levels in the soil, have been identified to reflect the soil quality. CNF farmers' responses about each of these four indicators are presented in Table 4.7. Nearly 90 percent farmers have reported that soil softness increased moderately or considerably. Similarly, nearly 79 percent and 78 percent farmers have reported an increase in earthworms and green cover respectively in their fields. Over three-fourths have

informed an increased soil moisture levels (moisture hold capacity of the soil) in their fields. Needless to say, the list of indicators is not comprehensive. The list can be enlarged.

Table 4.7: CNF farmers’ response with respect to changes in soil quality related indicators during Rabi 2021-22 (in %)

| Indicators of soil quality | Decreased considerably | Decreased moderately | No change | Increased moderately | Increased considerably |
|-----------------------------|------------------------|----------------------|-----------|----------------------|------------------------|
| Soil softness | 0.18 | 0.37 | 11.43 | 75.87 | 12.16 |
| Earthworms | - | 0.64 | 20.53 | 54.33 | 24.49 |
| Green cover in the fields | - | 0.28 | 21.58 | 59.41 | 18.73 |
| Moisture levels in the soil | - | 0.37 | 24.07 | 63.66 | 11.9 |

Source: *IDSAP, Field Survey 2021-22.*

Similarly, crop quality has been assessed through grain weight, stem’s strength, crop tolerance to dry spells, crop tolerance to heavy rains and crop tolerance to strong winds. These data have been collected through farmer’s household survey. Similarly, 86 percent of farmers reported that grain weight of crops has increased, 79 per cent reported that strength of stems of crops has increased. Further, 74, 66 and 70 per cent of farmers respectively have reported that crop tolerance to dry spells, heavy rains and strong winds have increased respectively (Table 4.8).

Table 4.8: CNF farmers’ responses with respect to crop quality improvement indicators during Rabi 2021-22 (in %)

| Indicators of crop quality | Decreased considerably | Decreased moderately | No change | Increased moderately | Increased considerably |
|--------------------------------|------------------------|----------------------|-----------|----------------------|------------------------|
| Grain weight | 0.27 | 0.27 | 13.5 | 70.89 | 15.05 |
| Stem strength | - | 0.36 | 20.44 | 66.42 | 12.77 |
| Crop tolerance to dry spells | - | 0.91 | 24.75 | 57.17 | 17.17 |
| Crop tolerance to heavy rains | - | 0.83 | 33.33 | 49.68 | 16.16 |
| Crop tolerance to strong winds | 0.28 | 0.75 | 28.97 | 57.67 | 12.32 |

Source: *IDSAP, Field Survey 2021-22.*

4.7. Conclusions

The above analysis indicates that resources are efficiently used by the CNF farmers. This is a pointer to the environmental sustainability. By avoiding the use of fertilizers and pesticides completely, the CNF has the potential to halt and reverse the degradation of the natural resources and deterioration of the environment in the state and country. The environmental sustainability has resulted in the improvement of soil health and crop health. The totality of the analysis is pointer to the contribution of CNF to the environmental sustainability.

Chapter 5: Wellbeing of CNF farmers

5.1. Introduction

In chapter 1, it was pointed out that the chemical-based agriculture has adversely affected the farmers' wellbeing in the country in general, in the state in particular. Further, the environmental consequences of the chemical-based farming are well known. In chapter 2 to chapter 5, the issues of social, economic and environmental sustainability of CNF have been discussed. The analyses in those three chapters, have established that CNF has positive contributions in each of the three dimensions of sustainable development. In this chapter, the impact of CNF on the wellbeing of farmers is deliberated. It is well known that wellbeing is multidimensional phenomenon. For easy understanding and illustration, the wellbeing indicators covered, in this chapter are grouped in three-dimension framework, viz., (1) Development, (2) Freedom and (3) Dignity. Primary data collected through CNF farmer household survey and the qualitative data collected through focused group discussions and case studies of farmers, across the sample villages, have been used in this chapter. The analysis has been conducted through the integration of quantitative and qualitative data.

The three dimensions of development, proposed to be discussed in this chapter, are (1) Development, (2) Freedom, and (3) Dignity. This is an exploratory exercise. First time, an attempt is made to make ranking analysis to understand easily, the reach of the programme across the state and farmers' categories. In the first part of the chapter, the concepts and indicators are discussed individually. In the latter part the actual ranks are discussed at the level of agroclimatic zones and farmers categories.

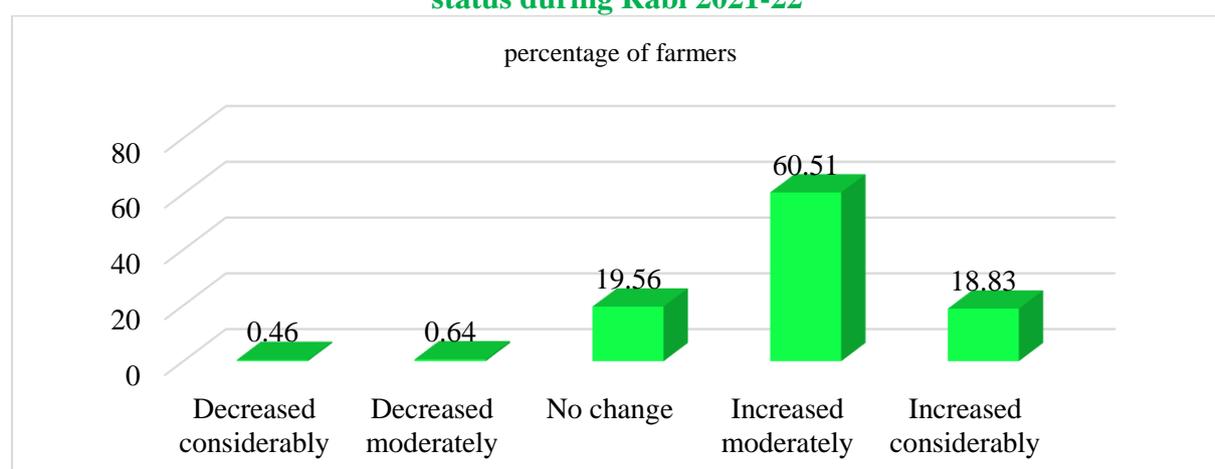
5.2. Development

This dimension is similar to the human development index (HDI), which include health, education and standard of living. In this section, the data and information available with respect to CNF households' health, education and economic improvements are discussed.

5.2.1. Health

Information about two health indicators, viz., (1) Impact of CNF on the health status of CNF farmers households, and (2) Impact of CNF on the household health expenditure, was collected in the household survey during Rabi 2021-22. As farmers and family members have reduced, if not stopped, the application of agrochemicals, particularly the pesticides, their illness rate might have come down. Further, their consumption of CNF food, which is chemical free, might have improved their health condition. Farmers responses about the health status of the family members have been enquired, in the survey. Health status implies the incidence of sickness among the family members, i.e., the number of sick person days³⁶, a family experienced in a year. The changes, if any, in the incidence of sickness in the family, due to CNF, are enquired and summarized in Figure 5.1 and Table 5.1. Over 60 percent of farmers have reported a moderate improvement in the health status of the family members, due to CNF. In addition, 19 percent CNF farmers have testified a considerable improvement in their health status due to CNF. Among agroclimatic zones, 100 percent in Krishna zone and 94 percent farmers in Godavari zone have reported either moderate or considerable improvement in health status of their family members (Table 5.1).

Figure 5.1: CNF farmers responses about impact of CNF on family members health status during Rabi 2021-22



Source: *IDSAP, Field Survey 2021-22.*

³⁶That include the number of persons fell sick in a year and the number of days a family member fell sick in a year.

Table 5.1: Agroclimatic zones and farmers' categories wise CNF farmers response about changes in the health status of their families due to CNF, in Rabi 2021-22 (in %)

| Agroclimatic zones & farmers' Categories | Decreased considerably | Decreased moderately | No change | Increased moderately | Increased considerably |
|--|------------------------|----------------------|-----------|----------------------|------------------------|
| <u>Agroclimatic zones</u> | | | | | |
| HAT | 1 | 1 | 35 | 36 | 27 |
| North coastal | 2 | 1 | 37 | 46 | 13 |
| Godavari | - | 3 | 3 | 65 | 29 |
| Krishna | - | - | - | 75 | 25 |
| Southern | 0 | - | 21 | 63 | 16 |
| Scarce rainfall | - | - | 30 | 70 | 1 |
| <u>AP</u> | 0 | 1 | 20 | 61 | 19 |
| <u>Farm size categories</u> | | | | | |
| Marginal | 1 | 0 | 18 | 59 | 22 |
| Small | 0 | 2 | 23 | 61 | 13 |
| Others | - | - | 20 | 64 | 16 |
| All | 0 | 1 | 20 | 61 | 19 |
| <u>Tenurial categories</u> | | | | | |
| Tenants | - | 4 | 10 | 67 | 19 |
| Owner cum tenants | - | 2 | 11 | 68 | 19 |
| Owners | 1 | 0 | 21 | 60 | 19 |
| All | 0 | 1 | 20 | 61 | 19 |
| <u>Social categories</u> | | | | | |
| SC | 1 | - | 19 | 61 | 19 |
| ST | 0 | 2 | 24 | 46 | 28 |
| BC | 1 | 0 | 23 | 63 | 13 |
| OC | - | 0 | 11 | 69 | 19 |
| All | 0 | 1 | 20 | 61 | 19 |

Source: *IDSAP, Field Survey 2021-22.*

These days, the health concerns are on the rise. Because of evolving of new diseases, viruses, increasing pollutions, etc., the incidence of illness and expenditure on health-care are on the rise. Because of inflation and other reasons, the expenditure on health care, in general, is increasing year after year. However, majority of CNF farmers reported a reduction in the out-of-pocket expenditure on health care. While eight percent farmers reported a considerable decline in the health expenditure, another 45 percent have experienced a moderate reduction (Figure 5.2). Among six agroclimatic zones, 36 percent and 60 percent farmers in Godavari zone reported a decrease in health expenditure considerably and moderately, respectively.

Among different farmer categories, higher percentage of tenant and owner-cum-tenant farmers have reported a decrease in health expenditure (Table 5.2).

Figure 5.2: CNF farmers response about the changes in their health expenditures after CNF, during Rabi 2021-22

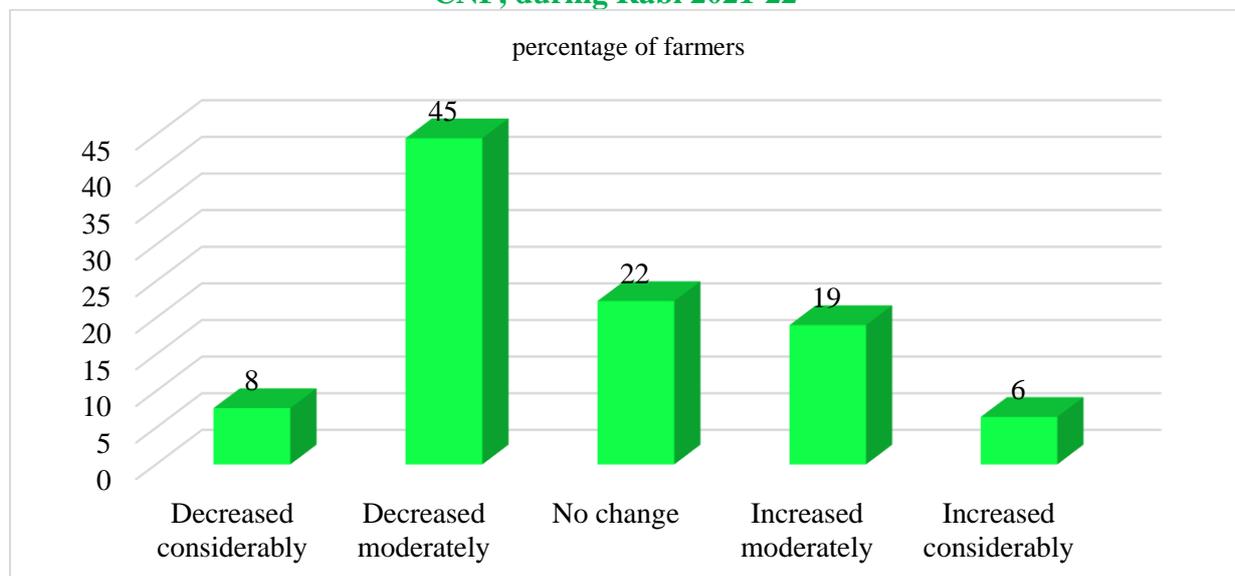


Table 5.2: Agroclimatic zones and farmer categories wise CNF farmers response about the changes in their health expenditures after CNF, during Rabi 2021-22 (in %)

| Agroclimatic zones & farmers' categories | Decreased considerably | Decreased moderately | No change | Increased moderately | Increased considerably |
|--|------------------------|----------------------|-----------|----------------------|------------------------|
| Agroclimatic zones | | | | | |
| HAT | 2 | 42 | 45 | 7 | 4 |
| North coastal | 4 | 26 | 57 | 13 | |
| Godavari | 36 | 60 | 4 | - | |
| Krishna | 2 | 55 | 5 | 23 | 15 |
| Southern | 1 | 41 | 20 | 24 | 14 |
| Scarce rainfall | - | 37 | 18 | 45 | |
| AP | 8 | 45 | 22 | 19 | 6 |
| Farm size categories | | | | | |
| Marginal | 7 | 48 | 20 | 19 | 7 |
| Small | 9 | 41 | 28 | 16 | 7 |
| Others | 9 | 39 | 24 | 25 | 3 |
| All | 8 | 45 | 22 | 19 | 6 |
| Tenurial categories | | | | | |
| Tenants | 27 | 56 | 10 | 4 | 2 |
| Owner cum tenants | 15 | 61 | 15 | 6 | 2 |
| Owners | 6 | 43 | 23 | 21 | 7 |
| All | 8 | 45 | 22 | 19 | 6 |
| Social categories | | | | | |
| SC | 4 | 55 | 7 | 23 | 12 |
| ST | 14 | 48 | 28 | 8 | 3 |

| Agroclimatic zones & farmers' categories | Decreased considerably | Decreased moderately | No change | Increased moderately | Increased considerably |
|--|------------------------|----------------------|-----------|----------------------|------------------------|
| BC | 5 | 41 | 27 | 22 | 6 |
| OC | 9 | 42 | 19 | 23 | 8 |
| All | 8 | 45 | 22 | 19 | 6 |

Source: *IDSAP, Field Survey 2021-22.*

5.2.2. Education

In the international human development index, education is an important dimension, consists of two indicators. But there were no questions about education in the household questionnaire, to assess the impact of CNF on children's education. However, the impact of CNF on education has come out prominently in the FGDs. Some those points are given below.

- a. As the incidence of diseases reduced, due to CNF, children's attendance in the schools has increased.³⁷
- b. As the tensions related to chemical-based agriculture reduced, due to CNF, families are able to focus on children's education.
- c. Because of improvements in the financial position, some CNF farmers are able to admit their children in the private schools for 'quality education'.
- d. Due to improvement in health and other positive developments, children's learning skills have improved.

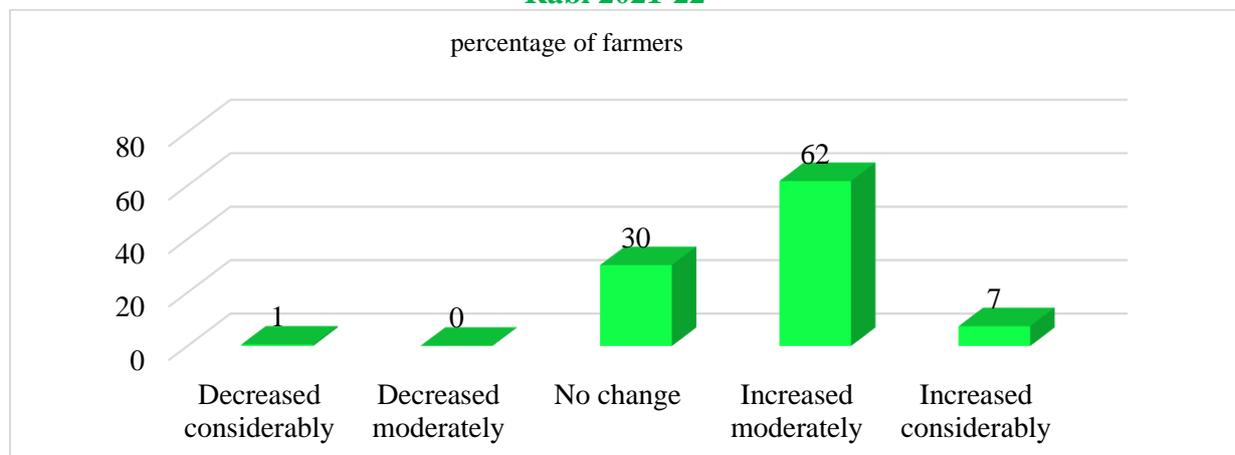
5.2.3. Financial conditions

Living standard represented by the per-capita income, is third dimension in the international human development index. In all previous surveys and also in the present survey, it was established, that CNF gives higher net value of output than non-CNF, in almost all crops. In the previous two consolidated/ final reports, it was seen that the household incomes of the CNF farmers are higher than that of non-CNF. In the present survey also more than three-fourths of CNF farmers confirmed an improvement in their financial position, due to CNF (Figure 5.3). In Krishna zone over 78 percent of farmers have reported a moderate increase in their financial situation and another 18 percent have reported a considerable increase in their financial condition. A higher proportion of farmers in Southern zone reported an increase in their financial conditions, due to CNF. Among the farm size categories, a higher percentage of marginal farmers reported an increase in their financial position. Similarly, a higher proportion

³⁷Even if the school going child is healthy, he/ she may not go to school, if he has to take care of other sick person in the family or no healthy person is available in the family to send him/ her to the school.

of tenant farmers among the tenurial categories and OC farmers among social categories reported an increase in their financial conditions (Table 5.3).

Figure 5.3: CNF farmers response about the changes in their financial position during Rabi 2021-22



Source: IDSAP, Field Survey 2021-22.

Table 5.3: Agroclimatic zones and farmers categories wise CNF farmers response about the changes in their financial position during Rabi 2021-22 (in %)

| Agroclimatic zones & farmers categories | Decreased considerably | Decreased moderately | No change | Increased moderately | Increased considerably |
|---|------------------------|----------------------|-----------|----------------------|------------------------|
| Agroclimatic zones | | | | | |
| HAT | 3.11 | - | 37.27 | 57.14 | 2.48 |
| North coastal | - | - | 52.38 | 47.62 | |
| Godavari | - | - | 32.99 | 56.19 | 10.82 |
| Krishna | - | - | 3.31 | 78.45 | 18.23 |
| Southern | 0.38 | 0.38 | 24.44 | 66.17 | 8.65 |
| Scarce rainfall | - | - | 42.17 | 57.83 | |
| AP | 0.55 | 0.09 | 30.26 | 61.7 | 7.4 |
| Farm size categories | | | | | |
| Marginal | 0.47 | - | 27.99 | 63.14 | 8.4 |
| Small | 0.72 | 0.36 | 35.38 | 57.4 | 6.14 |
| Others | 0.57 | - | 30.46 | 63.22 | 5.75 |
| All | 0.55 | 0.09 | 30.26 | 61.7 | 7.4 |
| Tenurial categories | | | | | |
| Tenants | - | - | 18.75 | 72.92 | 8.33 |
| Owner cum tenants | - | - | 33.33 | 54.76 | 11.9 |
| Owners | 0.62 | 0.1 | 30.56 | 61.75 | 6.96 |
| All | 0.55 | 0.09 | 30.26 | 61.7 | 7.4 |
| Social categories | | | | | |
| SC | 0.72 | - | 28.78 | 57.55 | 12.95 |
| ST | 1.97 | - | 28.35 | 65.35 | 4.33 |
| BC | - | - | 39.57 | 54.44 | 6 |
| OC | - | 0.35 | 19.01 | 71.13 | 9.51 |
| All | 0.55 | 0.09 | 30.26 | 61.7 | 7.4 |

Source: IDSAP, Field Survey 2021-22.

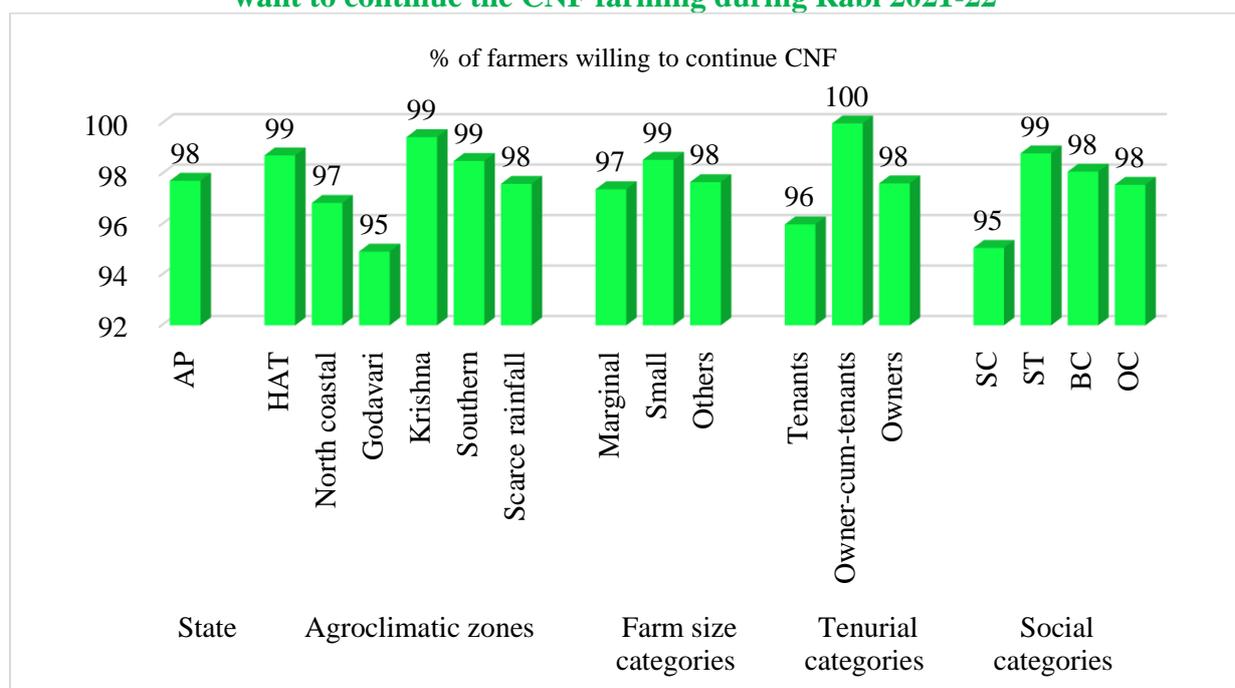
5.3. Freedom

The CNF has given or is giving the freedom to the participating farmers, in a number of ways. CNF farmers and households got freedom from chemical-based agriculture, which is a health hazard, apart from many other risks. They also got freedom from unhealthy food. They also got freedom from input, credit and output markets. These issues are discussed, briefly, in this section.

6.3.1. Freedom from chemical-based agriculture

In chapter 1, it is shown that farmers are becoming relatively, if not absolutely, poorer year after year. Two decades back, the NSSO in “The Situation Assessment of India” reported that more than 40 percent of farmers would like to quit agriculture if alternative opportunities were available. Since then, farmers are leaving cultivation. The youth are going to even for low paying jobs, instead of continuing in agriculture. In this background, 98 percent CNF farmers want to continue CNF farming. The same vary between 95 to 100 percent across the agroclimatic zones and farmers categories (Figure 5.4).

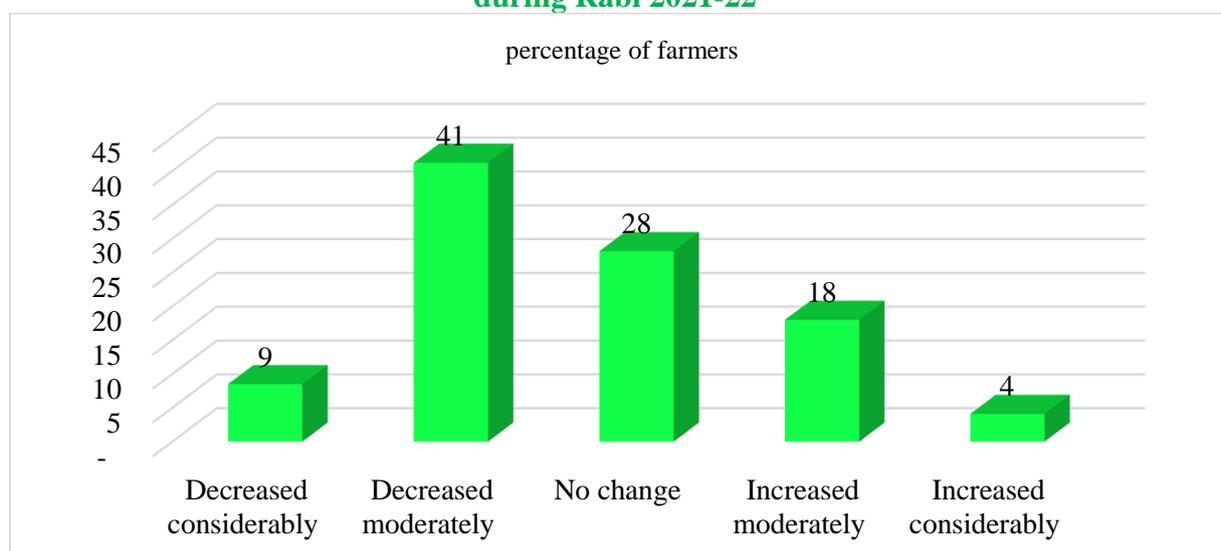
Figure 5.4: Agroclimatic zone and farmers’ categories wise percentage of CNF farmers want to continue the CNF farming during Rabi 2021-22



Source: *IDSAP, Field Survey 2021-22.*

Liking of CNF, by the farmers is not just for environmental reasons, but for economic and personal reasons. Apart from health hazards, chemical-based farming involves larger investments and mobilization of larger funds, from various sources, often with adverse, if not exploitative, terms and condition. All these lead to personal and domestic tensions. About 50 percent of CNF farmers have experienced or perceived that CNF has reduced their agriculture related tensions (Figure 5.5). The same is as high as 84 percent in Godavari zone and 71 percent in Krishna zone. The same is 77 percent for tenant farmers and 68 percent for owner-cum-tenant farmers, among tenurial categories (Table 5.4).

Figure 5.5: CNF farmers response about changes in farming related stress after CNF during Rabi 2021-22



Source: *IDSAP, Field Survey 2021-22.*

Table 5.4: Agroclimatic zones and farmers categories wise CNF farmers response about changes in farming related stress after CNF, during Rabi 2021-22 (in %)

| Agroclimatic Zones & farmers categories | Decreased considerably | Decreased moderately | No change | Increased moderately | Increased considerably |
|---|------------------------|----------------------|-----------|----------------------|------------------------|
| <u>Agroclimatic zones</u> | | | | | |
| HAT | 1 | 33 | 58 | 8 | 1 |
| North coastal | 8 | 11 | 76 | 5 | |
| Godavari | 29 | 54 | 13 | 3 | |
| Krishna | 13 | 58 | 2 | 18 | 9 |
| Southern | 0 | 33 | 30 | 27 | 10 |
| Scarce rainfall | - | 52 | 7 | 41 | |
| <u>AP</u> | 9 | 41 | 28 | 18 | 4 |
| <u>Farm size categories</u> | | | | | |
| Marginal | 9 | 43 | 25 | 18 | 5 |

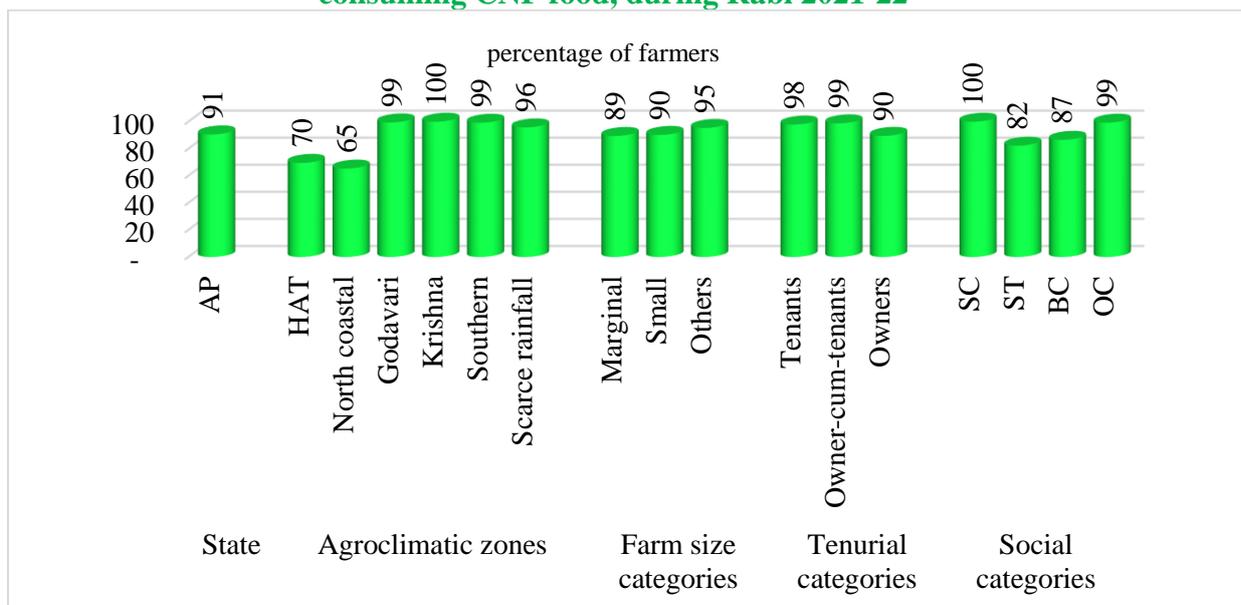
| Agroclimatic Zones & farmers categories | Decreased considerably | Decreased moderately | No change | Increased moderately | Increased considerably |
|---|------------------------|----------------------|-----------|----------------------|------------------------|
| Small | 9 | 36 | 36 | 16 | 3 |
| Others | 8 | 43 | 25 | 20 | 3 |
| All | 9 | 41 | 28 | 18 | 4 |
| Tenurial categories | | | | | |
| Tenants | 17 | 60 | 13 | 10 | |
| Owner-cum-tenants | 18 | 50 | 24 | 4 | 5 |
| Owners | 7 | 40 | 29 | 20 | 4 |
| All | 9 | 41 | 28 | 18 | 4 |
| Social categories | | | | | |
| SC | 6 | 50 | 13 | 24 | 6 |
| ST | 11 | 43 | 38 | 8 | 0 |
| BC | 5 | 35 | 36 | 20 | 4 |
| OC | 12 | 45 | 15 | 21 | 6 |
| All | 9 | 41 | 28 | 18 | 4 |

Source: *IDSAP, Field Survey 2021-22.*

6.3.2. Freedom from toxic food

Another chemical-based agriculture related factor, which has been affecting adversely the farmers and their families, is the contaminated food with fertilizers and pesticides' residues. Nowadays, the health hazards of food, produced in chemical-based farming, are well known. But the consumers, including farmers, have no choice but to consume the toxic food. CNF has provided them a choice, in the form of chemical free food, which is cultivated under CNF. At the aggregate level, 91 percent CNF farmers have reported that they are consuming CNF food. The same is 100 percent in Krishna zone and 99 percent in Godavari and Southern zone. Over 90 to 100 percent farmers among most of the farmer categories, have been consuming CNF food. But only 65 and 70 percent farmers of North coastal and HAT zones, respectively, are consuming CNF food. Similarly, relatively fewer number of ST (82 percent) and BC (87 percent) farmers reported about consuming the CNF food (Figure 5.6). A couple of possible reasons, for relatively a smaller number of farmers in these two zones and two social categories could be: (1) they might not be raising food crops or foodgrains of their choice, and (2) they might be selling CNF output at higher prices and consuming non-CNF food.

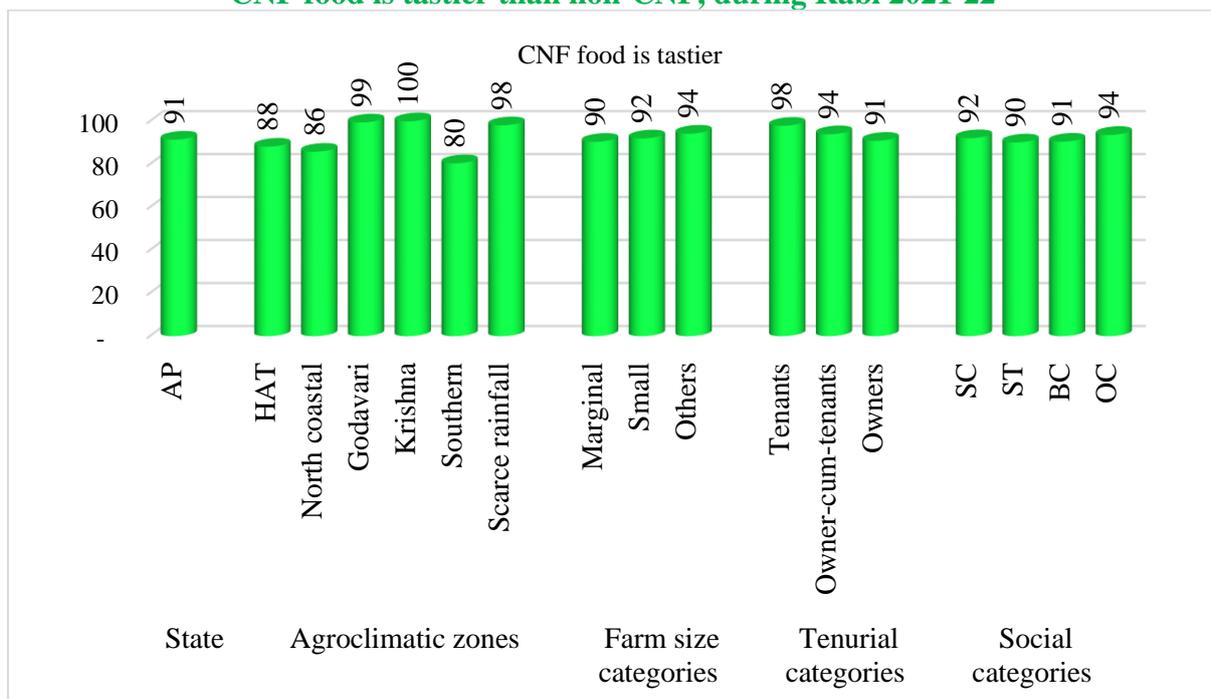
Figure 5.6: Agroclimatic zones and farmers categories wise percentage of farmers consuming CNF food, during Rabi 2021-22



Source: *IDSAP, Field Survey 2021-22.*

CNF food is not only healthy, but also tasty. Over 91 percent of CNF farmers, at the state level, have reported that CNF food is tastier than non-CNF food. Across all farmer categories, 90 to 94 percent farmers stated that CNF food is tasty. Further, 98 to 100 percent farmers in three agroclimatic zones have experienced that CNF food is tasty. However, this percentage is a little less in remaining three zones (Figure 5.7).

Figure 5.7: Agroclimatic zones and farmers categories wise percentage of farmers stated CNF food is tastier than non-CNF, during Rabi 2021-22



Source: *IDSAP, Field Survey 2021-22.*

5.3.1. Freedom from exploitations of the input markets

As shown in the chapter 3 and 5, under the chemical-based farming, farmers spend a lot of money on fertilizers, pesticides and seeds. These inputs are often costly; which compel farmers to mobilize funds from different sources, including the input suppliers, with unfavorable terms and conditions, on continuous basis. Spurious inputs are another common problem faced by farmers in the chemical-based farming. Under CNF, farmers would stop completely the application of fertilizers and pesticides. They would start using their own seeds. All these would reduce, if not remove, CNF farmers' dependency on the input markets and related exploitations. As CNF sample is drawn from the list S2S farmers, who stopped completely, at least in a part of their operational holding, 100 percent farmers in each zone and category reported a reduction in their dependence on input markets.

5.3.2. Freedom from the credit markets

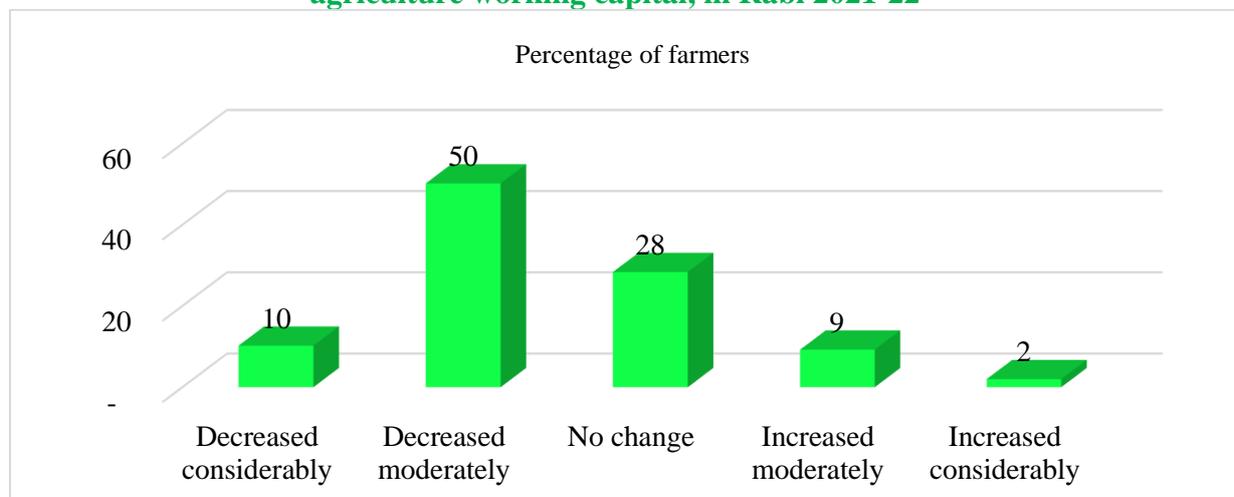
In all previous studies, and also in the present study, it is established that the cost of cultivation is low under CNF vis-à-vis non-CNF (chemical-based farming). It naturally led to lesser borrowing for agriculture. For example, in the Kharif 2021-22 report, it was found that the average loan amount for each CNF farmer was ₹71,964, and for each non-CNF farmer was ₹1,03,136, i.e., each non-CNF farmer has 30 percent higher loan amount vis-à-vis a CNF farmer. The average loan outstanding was ₹36,606 per CNF farmers compared to ₹52,335 per non-CNF farmer³⁸. Normally, farmers take agriculture/ crop loans once in a year. Therefore, the loan data was not collected in the Rabi survey. However, the qualitative data about the impact of CNF on the cost of cultivation and borrowings for agriculture purpose were collected in the present survey.

At the aggregate level, 50 percent of CNF farmers experienced a moderate reduction in the fund's requirement for agriculture. In addition, 10 percent of CNF farmers felt a considerable reduction in funds requirement for cultivation (Figure 5.8). As many as 36 percent of CNF farmers in Godavari zone and 14 percent in Krishna zone stated a considerable decline in funds requirement for CNF cultivation. About 31 percent of tenant farmers and 20 percent of owner-

³⁸See details in IDSAP (2022): *Assessing the Impact of APCNF [Andhra Pradesh Community Managed Natural Farming]: A comprehensive Approach Using Crop Cutting Experiments: Second Interim Report of 2021-22: Kharif Season*, Institute for Development Studies Andhra Pradesh (IDSAP), Visakhapatnam. https://apcnf.in/wp-content/uploads/2023/02/Final-APCNF-Kharif-Season-Report-2021-22_17012022.pdf or <https://www.idsap.in/assets/reports/13%20APCNF%20Kharif%20Season%20Report%202021%2022%2031%20Dec%202022.pdf>

cum-tenant farmers also indicated a considerable decline in funds requirements for agriculture (Table 5.5).

Figure 5.8: CNF farmers response about the impact of CNF on funds requirement for agriculture working capital, in Rabi 2021-22



Source: *IDSAP, Field Survey 2021-22.*

Table 5.5: Agroclimatic zones and farmers' categories wise CNF farmers response about impact of CNF on funds requirement for agriculture in Rabi (in %)

| Agroclimatic zones & farmers' categories | Decreased considerably | Decreased moderately | No change | Increased moderately | Increased considerably |
|--|------------------------|----------------------|-----------|----------------------|------------------------|
| <u>Zone</u> | | | | | |
| HAT | 1 | 16 | 79 | 5 | - |
| North coastal | - | 35 | 60 | 6 | - |
| Godavari | 36 | 55 | 9 | 1 | - |
| Krishna | 14 | 47 | 19 | 12 | 8 |
| Southern | 8 | 49 | 25 | 17 | 1 |
| Scarce rainfall | - | 82 | 10 | 8 | - |
| <u>AP</u> | 10 | 50 | 28 | 9 | 2 |
| <u>Farm size categories</u> | | | | | |
| Marginal | 7 | 52 | 29 | 9 | 3 |
| Small | 11 | 47 | 31 | 10 | 1 |
| Others | 17 | 44 | 25 | 12 | 1 |
| All | 10 | 50 | 28 | 9 | 2 |
| <u>Tenurial categories</u> | | | | | |
| Tenants | 31 | 58 | 8 | 4 | - |
| Owner-cum-tenants | 20 | 53 | 16 | 9 | 2 |
| Owners | 8 | 49 | 31 | 10 | 2 |
| All | 10 | 50 | 28 | 9 | 2 |
| <u>Social categories</u> | | | | | |
| SC | 5 | 57 | 17 | 14 | 7 |
| ST | 15 | 29 | 51 | 5 | - |

| Agroclimatic zones & farmers' categories | Decreased considerably | Decreased moderately | No change | Increased moderately | Increased considerably |
|--|------------------------|----------------------|-----------|----------------------|------------------------|
| BC | 6 | 56 | 29 | 8 | 1 |
| OC | 16 | 55 | 16 | 12 | 2 |
| All | 10 | 50 | 28 | 9 | 2 |

Source: IDSAP, Field Survey 2021-22.

A reduction in the fund's requirement for CNF vis-à-vis non-CNF, would logically lead to a reduction in the borrowings for agriculture. As many as 53 percent of farmers, at the state level, confirmed a moderate decline in borrowings for agriculture, due to CNF, during Rabi 2021-22. Further, 11 percent of CNF farmers sensed a considerable reduction in borrowings for agriculture, due to CNF (Figure 5.9). As many as 88 percent of CNF farmers in Scarce rainfall zone and 72 percent of farmers in Godavari zone perceived a moderate decline in borrowings for agriculture due to CNF. Further, 25 percent and 20 percent of farmers in Krishna and Godavari zones, respectively, said a considerable reduction in the borrowings for agriculture, because of CNF (Table 5.6).

Figure 5.9: CNF farmers response about the impact of CNF on borrowings for agriculture, during Rabi 2021-22

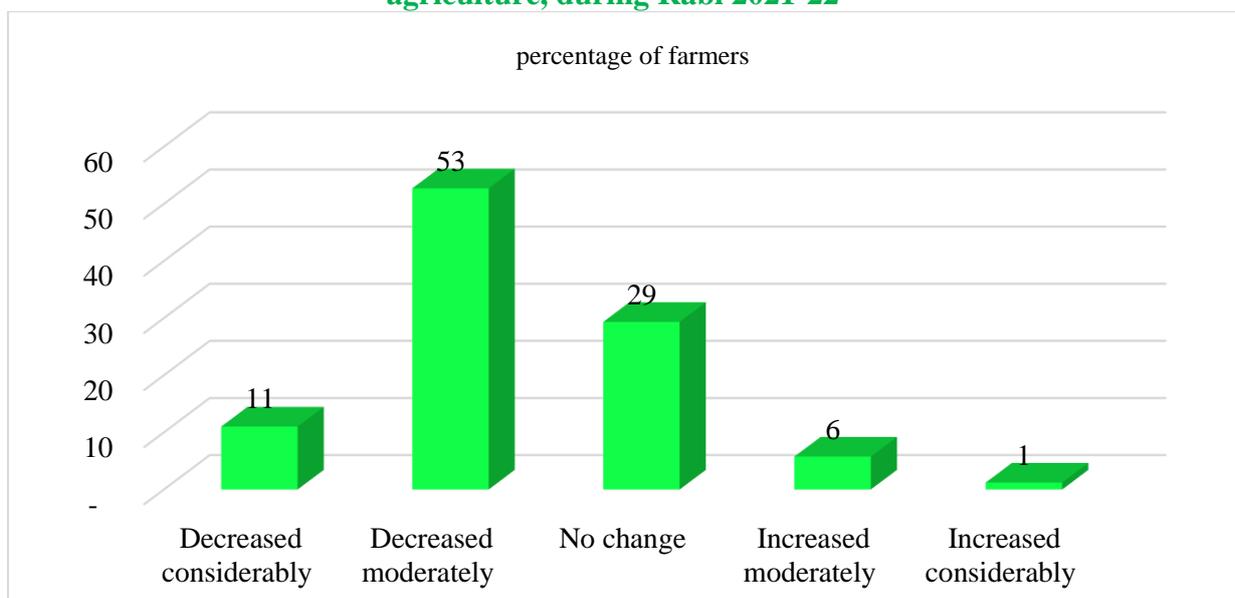


Table 5.6: Agroclimatic zones and farmers' categories wise CNF farmers responses about the impact of CNF on borrowings for agriculture, during Rabi 2021-22 (in %)

| Agroclimatic Zones & Categories of farmers | Decreased considerably | Decreased moderately | No change | Increased moderately | Increased considerably |
|--|------------------------|----------------------|-----------|----------------------|------------------------|
| <u>Agroclimatic zones</u> | | | | | |
| HAT | 1 | 15 | 79 | 4 | - |
| North coastal | 2 | 22 | 74 | 2 | - |

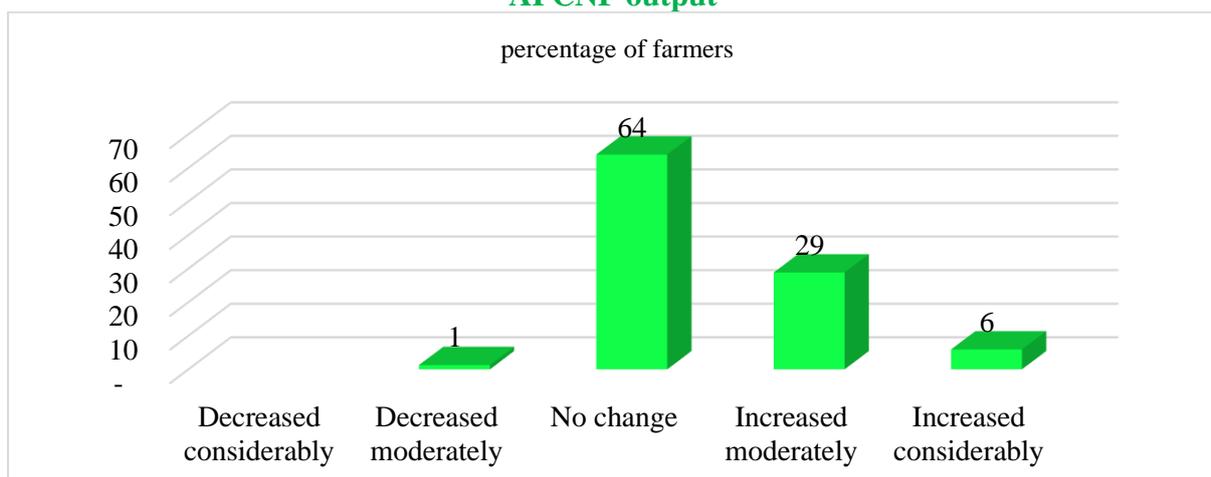
| Agroclimatic Zones & Categories of farmers | Decreased considerably | Decreased moderately | No change | Increased moderately | Increased considerably |
|--|------------------------|----------------------|-----------|----------------------|------------------------|
| Godavari | 20 | 72 | 8 | - | - |
| Krishna | 25 | 51 | 15 | 6 | 3 |
| Southern | 10 | 46 | 27 | 15 | 2 |
| Scarce rainfall | - | 88 | 11 | 0 | - |
| AP | 11 | 53 | 29 | 6 | 1 |
| <u>Farm size categories</u> | | | | | |
| Marginal | 12 | 50 | 31 | 6 | 1 |
| Small | 7 | 53 | 33 | 6 | 1 |
| Others | 13 | 56 | 23 | 7 | 1 |
| All | 11 | 53 | 29 | 6 | 1 |
| <u>Tenurial categories</u> | | | | | |
| Tenants | 17 | 75 | 4 | 4 | - |
| Owner-cum-tenants | 12 | 70 | 17 | - | 1 |
| Owners | 10 | 49 | 32 | 7 | 1 |
| All | 11 | 53 | 29 | 6 | 1 |
| <u>Social categories</u> | | | | | |
| SC | 8 | 59 | 22 | 9 | 3 |
| ST | 8 | 36 | 52 | 4 | - |
| BC | 11 | 57 | 27 | 5 | 1 |
| OC | 15 | 55 | 20 | 7 | 2 |
| All | 11 | 53 | 29 | 6 | 1 |

Source: IDSAP, Field Survey 2021-22

5.3.3. Relief in agriculture output marketing

Agriculture output marketing is one of the big challenges, in general, in India and also in the state. Various studies on the subject indicate that farmers get mostly a raw deal in the output marketing. The literature also indicates that almost all existing marketing channels are exploitative of farmers. Fortunately, CNF farmers, albeit in small number, are getting new opportunities and new marketing channels to market their output. At the state level, 29 percent of CNF farmers witnessed a moderate increase in new output marketing channels such as opportunities to sell in *Shandis*, exhibitions, door delivery, online; selling directly to friends and relatives, local shops, etc. Further, 6 percent of CNF farmers have seen a considerable increase in new output marketing channels (Figure 5.10). Among four out of six agroclimatic zones, viz., HAT, Godavari, Krishna and Southern, have experienced emergence of more new marketing channels. On the other hand, the farmers of Scarce rainfall zones did not see advent of any new output marketing channels and relatively a smaller percentage of CNF farmers in North coastal zone see the new marketing channels (Table 5.7).

Figure 5.10: CNF farmers responses with respects to changes in market channels for APCNF output



Source: *IDSAP, Field Survey 2021-22.*

Table 5.7: Agroclimatic zones and farmer categories wise CNF farmers responses with respect to changes in market channels for APCNF output, during Rabi 2021-22 (in %)

| Agroclimatic Zones & farmers categories | Decreased considerably | Decreased moderately | No change | Increased moderately | Increased considerably |
|---|------------------------|----------------------|-----------|----------------------|------------------------|
| <u>Agroclimatic zones</u> | | | | | |
| HAT | - | - | 53 | 45 | 2 |
| North coastal | - | - | 84 | 16 | - |
| Godavari | 1 | 58 | 28 | 13 | |
| Krishna | 3 | 54 | 32 | 11 | |
| Southern | 3 | 52 | 39 | 6 | |
| Scarce rainfall | - | 100 | - | - | - |
| <u>AP</u> | 1 | 64 | 29 | 6 | |
| <u>Farm size categories</u> | | | | | |
| Marginal | 2 | 61 | 32 | 5 | |
| Small | 1 | 68 | 24 | 7 | |
| Others | 1 | 66 | 26 | 7 | |
| All | 1 | 64 | 29 | 6 | |
| <u>Tenurial categories</u> | | | | | |
| Tenants | - | 66 | 28 | 6 | |
| Owner-cum-tenants | - | 56 | 30 | 14 | |
| Owners | 1 | 64 | 29 | 5 | |
| All | 1 | 64 | 29 | 6 | |
| <u>Social categories</u> | | | | | |
| SC | 1 | 62 | 29 | 8 | |
| ST | - | 51 | 43 | 6 | |
| BC | 1 | 74 | 22 | 4 | |
| OC | 4 | 63 | 25 | 8 | |
| All | 1 | 64 | 29 | 6 | |

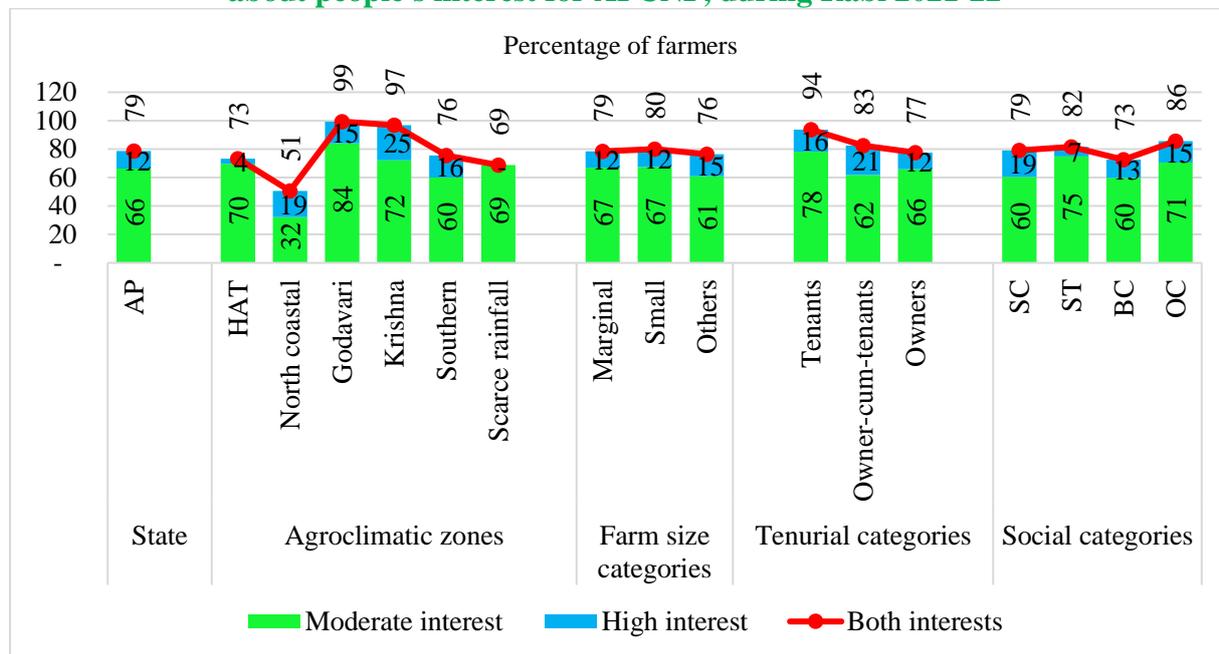
Source: *IDSAP, Field Survey 2021-22.*

5.4. Impact of CNF on farmers' dignity

Farmers dignity is defined, here, as the respect they get, as CNF farmers, from relatives and friends, and in the market. Apart from responses in the household survey, the CNF farmers in FGDs have revealed that they are getting respect and priority in the market yards, Rythu Bazars, and other marketing places in unloading their output, allocation of slots, shops, display places, storing places, etc. The respect, the CNF farmers command, is reflecting the people's (including consumers, relatives and friends and officials in the markets) interest in CNF food and CNF itself, which is environmentally benign.

At the state level, 66 percent and 12 percent of CNF farmers experienced and witnessed a moderate interest and high interest, respectively, in the people, including consumers, relatives and friends and officials, in CNF and CNF food. The percentage of farmers, who felt an interest in CNF varies widely, from 51 percent in North coastal zone to 99 percent in Godavari zone, across the agroclimatic zones. Such variations are least across the farm size categories, little higher among tenurial categories and social categories (Figure 5.11).

Figure 5.11: Agroclimatic zones and farmer category wise CNF farmers responses about people's interest for APCNF, during Rabi 2021-22

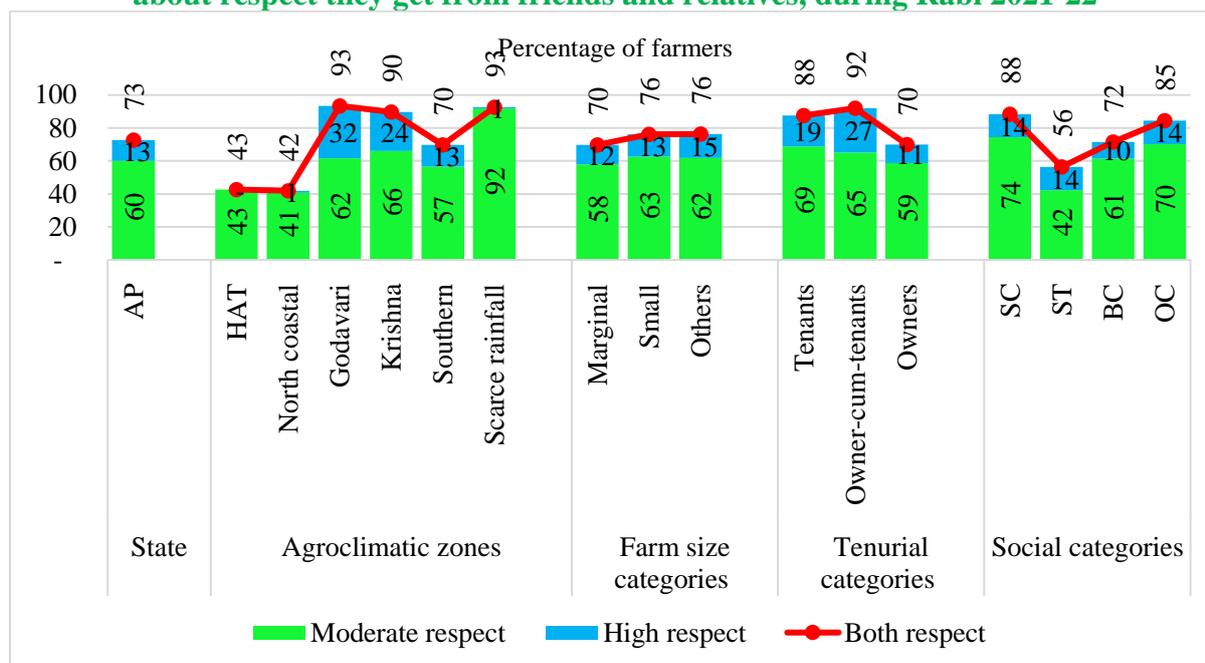


Source: IDSAP, Field Survey 2021-22.

As per the information obtained in FGDs, the relatives and friends of CNF farmers are purchasing/ getting CNF food in large numbers and larger quantities from CNF farmers. As mentioned above, this kind of interest in CNF food, obviously, turns into the respect for the

CNF farmers. At the state level, 73 per cent of CNF farmers have enjoyed the respect from friends and relatives, during the study period. The same varies from 42 percent in North coastal zone to 93 percent in Godavari zone (Figure 5.12). Such variations are least among the farm-size categories, and moderately wider among tenurial categories and social categories. It may be noted that most of disaggregated results are similar for HAT zone and tribal farmers. The reasons are obvious, i.e., coterminous existence of HAT zone and tribal farmers.

Figure 5.12: Agroclimatic zones and farmer category wise CNF farmers responses about respect they get from friends and relatives, during Rabi 2021-22



Source: *IDSAP, Field Survey 2021-22.*

Compared to 73 percent of CNF farmers, who command respect of their friends and relatives, only 50 per cent of farmers said that they got respect in markets or from general public/consumers, during the study period.³⁹ The same varies widely from 14 percent in HAT zone to 92 percent in Godavari zone. Such variations are relatively less across different farmer categories (Figure 5.13).

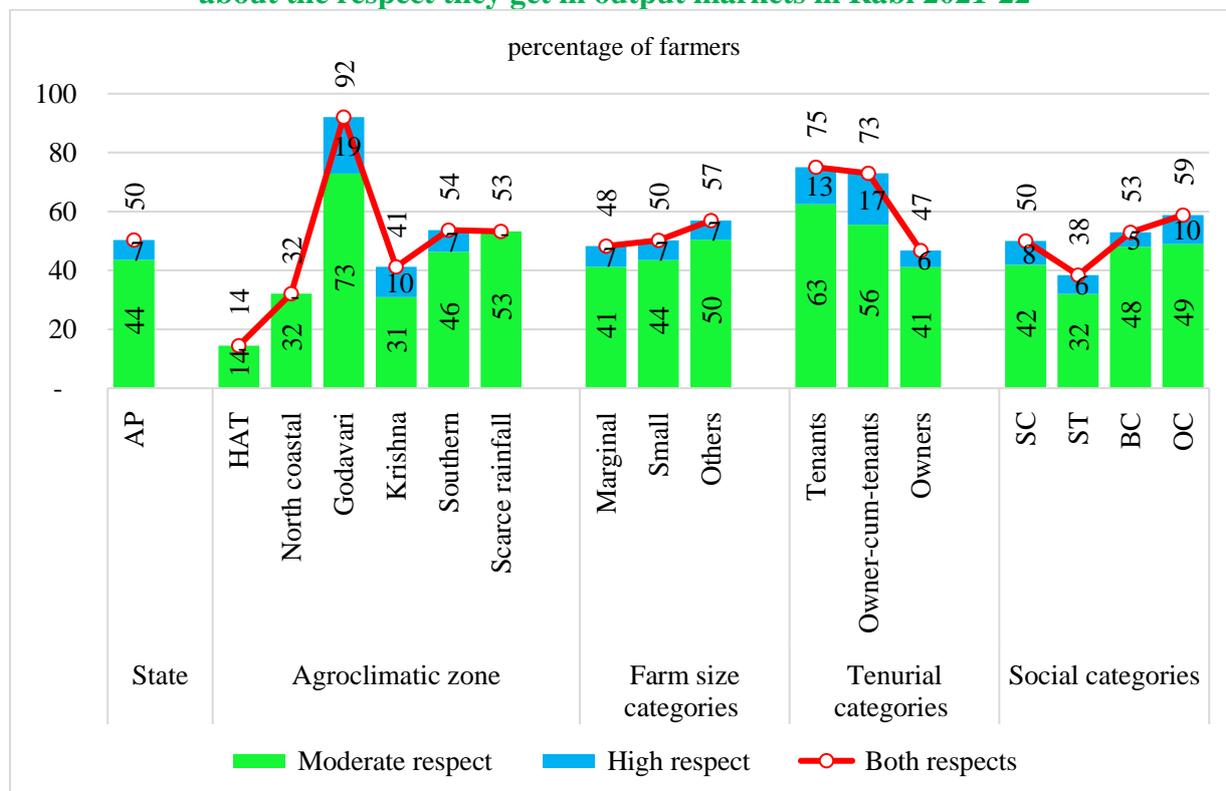
The FGDs also revealed that CNF output, especially the fruits and vegetables, including the leafy vegetables, have longer shelf life. Despite being chemical free and having longer shelf life, CNF output get less recognition⁴⁰ in markets and a smaller number of CNF farmers get

³⁹ Respect in the market implies getting priority in unloading the CNF output, over non-CNF output and getting priority in allocation of display spots or points or shops, etc.

⁴⁰ Less recognition implies that consumers are not willing to pay higher prices

respect in the market. It indicates an inadequate awareness about CNF food in the general public and consumers.

Figure 5.13: Agroclimatic zones and farmer category wise CNF farmers responses about the respect they get in output markets in Rabi 2021-22



5.5. Impact of CNF across the agroclimatic zones and farmers categories

In the above analysis, each zone and each farmer category has performed differently in different indicators. To get a holistic picture, a ranking exercise is done in this section.

1. Each zone and each category are given a rank based on percentage of “positive responses” obtained in that zone and category. For example, a zone, in which highest percentage of farmers got respect in the market, is given ‘rank 1’ (1st rank), and so on. A farmer’s category, in which highest percentage of farmers reported a reduction in the “borrowings for agriculture”, is given ‘rank 1’ (1st rank), and so on.
2. From individual indicators’ ranks, the dimensional ranks are obtained. A simple average of the individual ranks. The three dimensions and indicators included under each dimension, are shown in the Table 5.8.

Table 5.8: Development dimensions and indicators used in ranking of agroclimatic zones and farmers categories

| S. No. | Dimension | S. No. | Indicator |
|--------|-----------------------------|--------|--|
| 1 | Farmers (human) development | 1 | Percentage of farmers reported an improvement in health status of family members |
| | | 2 | Percentage of farmers reported a decline in health expenditure |
| | | 3 | Percentage of farmers reported an increase in financial position |
| 2 | Farmers' freedom | 1 | Percentage of farmers wanted to continue CNF |
| | | 2 | Percentage of farmers reported a reduction in the farming related stress |
| | | 3 | Percentage of farmers consuming CNF food |
| | | 4 | Percentage of farmers stated CNF food is tasty |
| | | 5 | Percentage of farmers stated a reduction in funds requirement for agriculture |
| | | 6 | Percentage of farmers reported a reduction in borrowings for agriculture |
| | | 7 | Percentage of farmers reported emergence of new output market channels |
| 3 | Farmers dignity | 1 | Percentage of farmers seen public interest for CNF and CNF food |
| | | 2 | Percentage of farmers, who got respect from relatives and friends |
| | | 3 | Percentage of farmers, who got respect in markets |

From the dimensional ranks, the overall ranks have been obtained through simple average of dimensional ranks. The results are given in Table 5.9. It may be noted that these are just ranks, gives the relative position of each zone and each category farmers compared to their counterparts. It does not give the absolute differences between the zones and farmers categories. The ranks are result of two factors, viz. (1) condition of non-CNF⁴¹ in each zone and each farmers category, and (2) effectiveness of the implementation of APCNF across the zones and farmer categories.

Interestingly, there are many common ranks among the agroclimatic zones and farmers categories. For example, two zones viz., Godavari and Krishna got 'rank 2' in overall ranking.

⁴¹It was mentioned in Chapter 3 and earlier reports that the potentials for savings in PNPIs and paid-out costs is high in input intensive crops. Similarly, the potential benefits could be high in higher investing zones and categories.

Similarly, HAT and Scarce rainfall zones got ‘rank 4’. All three farm size categories got ‘rank 2’. While SC and OC categories got common ‘rank 2’, ST and BC got common ‘rank 3’ (Table 5.9). The results suggest that CNF is reaching evenly each zone and each farmer category. Another inference from the results is that the zones and categories, which, normally, make higher investments, either capital or labour, in agriculture get relatively higher benefits from CNF, because potential savings in the cost of cultivation under CNF.

Table 5.9: Ranks of agroclimatic zones and farmer categories on three dimensions and overall, during Rabi 2022

| Agroclimatic zones & farmers categories | | Rank of Development | Rank of Freedom | Rank of Dignity | Overall rank |
|---|-------------------|---------------------|-----------------|-----------------|--------------|
| Agroclimatic zones | HAT | 4 | 4 | 5 | 4 |
| | North coastal | 6 | 5 | 6 | 6 |
| | Godavari | 2 | 2 | 1 | 2 |
| | Krishna | 1 | 2 | 3 | 2 |
| | Southern | 3 | 4 | 3 | 3 |
| | Scarce rainfall | 5 | 3 | 3 | 4 |
| | | | | | |
| Farm size categories | Marginal | 1 | 2 | 3 | 2 |
| | Small | 3 | 2 | 2 | 2 |
| | Others | 2 | 1 | 2 | 2 |
| | | | | | |
| Tenurial categories | Tenants | 1 | 2 | 1 | 1 |
| | Owner-cum-tenants | 2 | 2 | 2 | 2 |
| | Owners | 3 | 3 | 3 | 3 |
| | | | | | |
| Social categories | SC | 2 | 2 | 2 | 2 |
| | ST | 3 | 3 | 3 | 3 |
| | BC | 4 | 3 | 3 | 3 |
| | OC | 2 | 2 | 1 | 2 |

Source: *IDSAP, Field Survey 2021-22.*

5.6. Conclusions

The detailed analysis in this chapter clearly indicates that CNF has substantial positive impact on the farmers’ wellbeing. This is the need of hour. Apart from improving household income, it is positively impacting the health and education of the CNF households. CNF is freeing farmers from many compulsions and dependencies. The disaggregate analysis suggests that the project impact is evenly spread across all agroclimatic zones and farmer categories.

Chapter 6: Implementation of APCNF: Issues, challenges and way forward

6.1. Introduction

The chapter 2, 3 and 4 have clearly demonstrated the potentials of CNF in attaining social, economic and environmental sustainability. The previous chapter clearly proved that the farmers' wellbeing would increase substantially under CNF. The increase in farmers enrolment in APCNF project and area allocation to CNF by participating farmers, validate that the benefits from the CNF are real and realizable. As per the data provided by the RySS, the number of S2S⁴² farmers have increased from 0.33 lakh in 2018 to 2.59 lakh in 2021-22. Though the growth rates were impressive in relative (percentage) terms, the growth in absolute numbers is not so impressive during last three years (Table 6.1), in the larger context of the programme.

Table 6.1: Number of APCNF participating farmers and change over last three years

| Category | 2018-19 | 2019-20 | 2020-21 | 2021-22 |
|-----------------|--|----------|----------|----------|
| | <u>Number participating farmers</u> | | | |
| S2S farmers | 33,124 | 88,390 | 1,28,304 | 2,59,125 |
| Partial farmers | 1,43,380 | 3,53,563 | 3,50,540 | 3,54,964 |
| All farmers | 1,76,504 | 4,41,953 | 4,78,844 | 6,14,089 |
| | <u>Change over previous year in numbers</u> | | | |
| S2S farmers | | 55,266 | 39,914 | 1,30,821 |
| Partial farmers | | 2,10,183 | -3,023 | 4,424 |
| All farmers | | 2,65,449 | 36,891 | 1,35,245 |
| | <u>Change over previous year in percentages</u> | | | |
| S2S farmers | | 167 | 45 | 102 |
| Partial farmers | | 147 | -1 | 1 |
| All farmers | | 150 | 8 | 28 |

Source: RySS

In the larger context of covering the entire 80 lakh hectares of cropped lands and all 60 lakh farmers in the medium term of 8-10 years, present position and growth rates need to be increased substantially. In this context, the constraints encountered by RySS in the

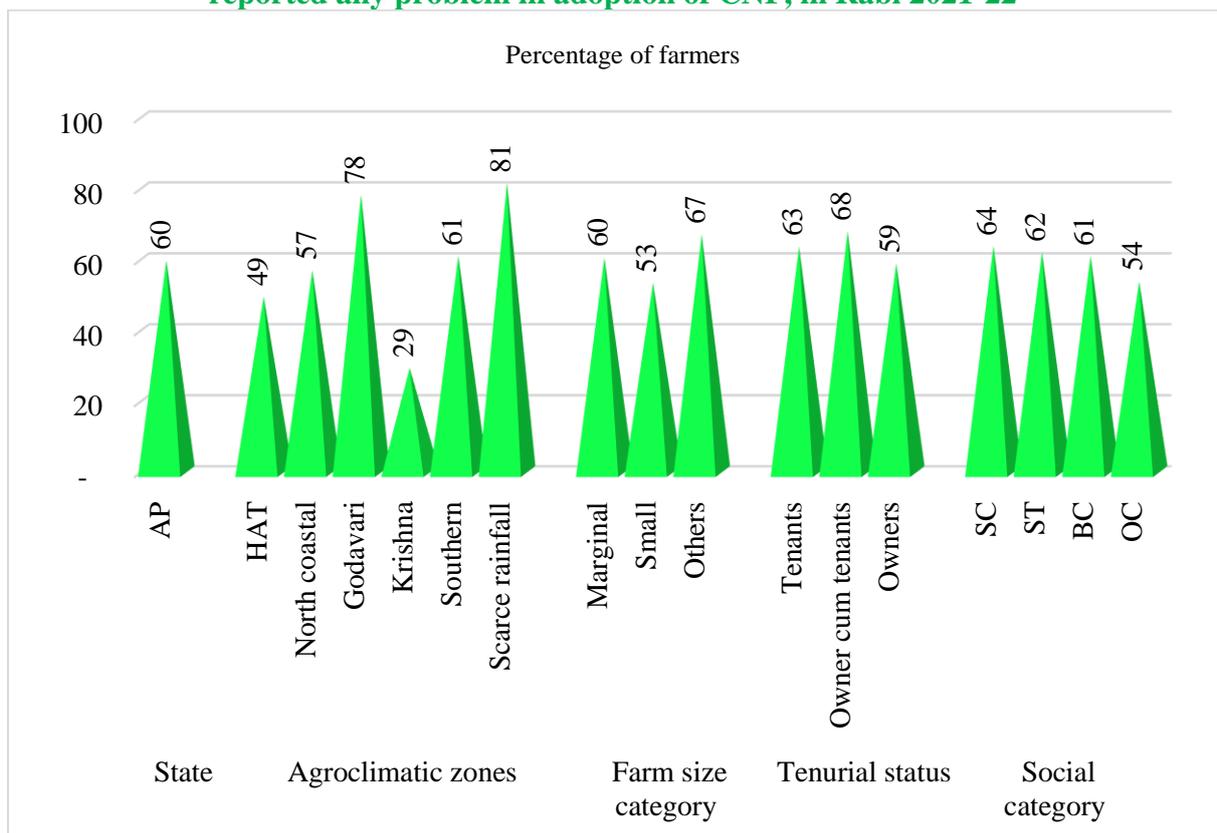
⁴² S2S farmer is a farmer who cultivate crops under CNF, without using 'chemical inputs', at least in one of the plots of his/ her operational area.

implementation of APCNF, and the farmers in adoption of CNF, need to be addressed on priority. It may be noted that RySS has been implementing CNF without any incentives and subsidies to the farmers in the policy environment of incentivized and subsidized chemical-based farming. This is a major challenge and also non-negotiable. At the same time, there are issues and challenges in adoption and expansion of CNF. The challenges faced by the farmers need to be identified and resolve them quickly. It may be noted that the chemical-based farming is mostly homogeneous farming with mono-cropping on a scale. The problems are common and solutions are standardized. But CNF is a heterogeneous model with diversified and intensive cropping. Each farmer faces a different set of issues and challenges. Further, CNF is evolving and challenges are also evolving. In this backdrop, this chapter addresses the issues and challenges encountered in the adoption and expansion of CNF. It provides some insights as the way forward.

6.2. Extent of problems

It is useful to know how many farmers are facing problems in adopting the CNF. Who are they? Where are they? As per the survey results, nearly 60 percent of CNF farmers in the state have reported that they are facing one problem or other in adopting CNF in Rabi season. Given the nature of CNF, which is evolving; it is expected that large number of participants would encounter some issue or other. The number of farmers facing one difficulty or other, varies from 29 percent in Krishna zone to 81 percent in Scarce rainfall zone. As many as 78 percent of farmers in Godavari zone, which is considered most endowed also have one challenge or other in adopting CNF. Compared to variations across the zones, the variations across the farmers categories are small, about 10-15 percentage points. The number of farmers reported that he/ she is facing a problem in adopting the CNF, varies from 53 percent for small farmers to 67 percent for other farmers (medium and large), in the farm size categories. The same, in tenurial categories, varies from 59 percent for owner farmers to 68 percent for owner-cum-tenant farmers; and in social categories, it varies from 54 percent for OC farmers to 64 percent for SC farmers (Figure 6.1).

Figure 6.1: Agroclimatic zones and farmers' categories wise percentage of farmers reported any problem in adoption of CNF, in Rabi 2021-22



Source: *IDSAP, Field Survey 2021-22.*

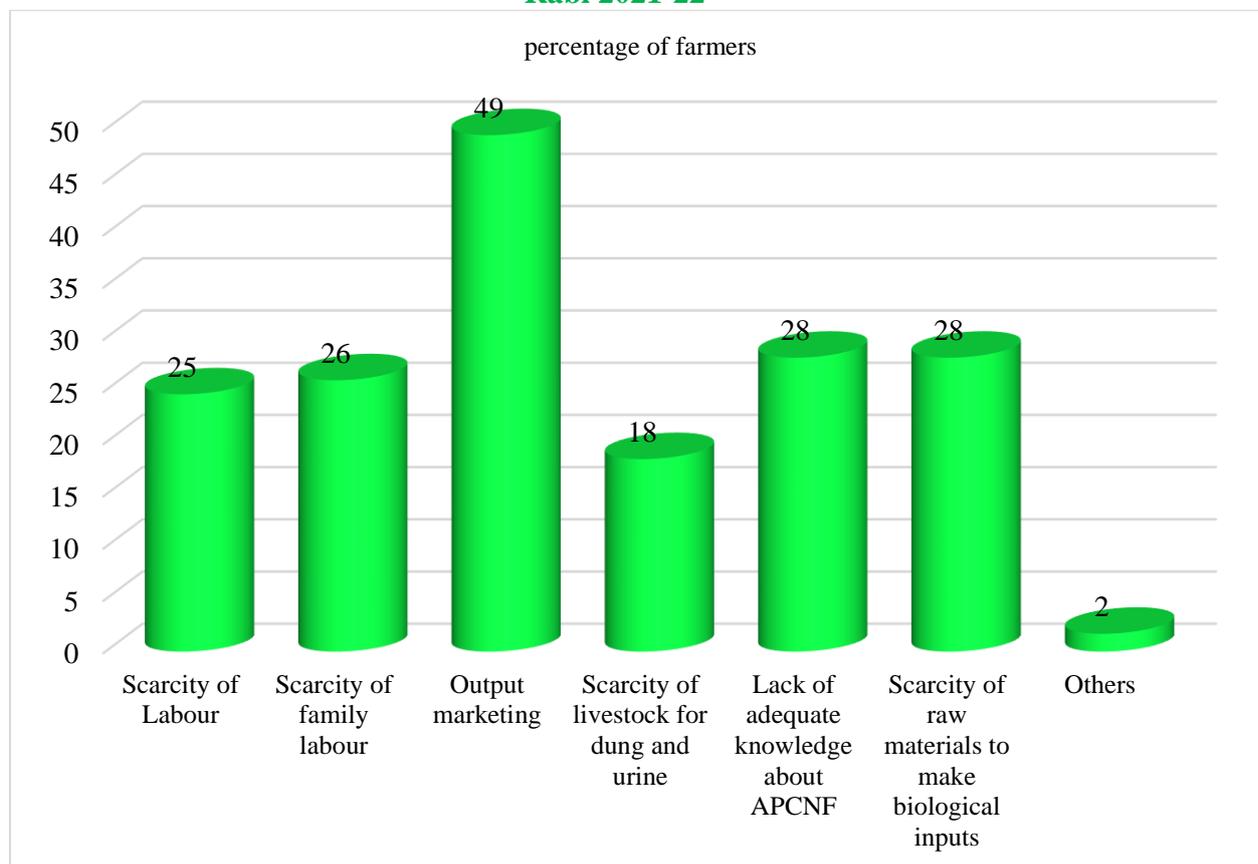
6.3. Major challenges encountered by farmers

The major challenges faced by farmers and number of farmers reported each of those challenges are present in the Figure 6.2. Output marketing is a generic problem in Indian agriculture. Apart from the generic problem of selling the output, CNF farmers' expectation for higher prices for CNF output is another issue. Among all the problems cited in the Figure 6.2, output marketing is number one challenge, reported by 49 percent of CNF farmers. As mentioned above, in the case of CNF output, selling is not a problem, but getting a higher than non-CNF output price, is the real issue for the CNF farmers. This is also evident from the focus group discussions with the farmers. Scarcity of raw materials to make biological inputs and inadequate knowledge to prepare the biological inputs are second highest widely felt challenges; 28 percent farmers reported each of these two issues. Scarcity of labour and scarcity of family labour have been encountered by one fourth of the farmers.⁴³ Scarcity of livestock for dung and urine has been reported by 18 percent of CNF farmers. It may be noted that in the initial stages, APCNF has prescribed the use of Desi (local) cow's cow-dung in the preparation

⁴³Whether the labour scarcity is due to CNF or due to local labour market conditions needs to be examined thoroughly.

of Ghanajeevamrutham and Dravajeevamrutham. Now, RySS has changed the recommendation. Any cattle cow-dung could be used. Therefore, relatively a small number (18 percent) of farmers have scarcity of livestock for dung and urine as a constraint in adoption of CNF.

Figure 6.2: Major problems identified by the CNF farmers in adoption of CNF, during Rabi 2021-22



Source: *IDSAP, Field Survey 2021-22.*

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 survey. For example, in 2020-21 survey, 78 percent of farmers reported output marketing problem, 66 percent reported scarcity of Desi cow as the problem, 63 percent reported lack of adequate knowledge in preparation of CNF inputs, 60 percent reported scarcity of labour, 55 percent reported a scarcity of raw material to prepare CNF inputs and 52 percent reported scarcity of family labour.⁴⁴Such drastic reduction in the number of farmers reporting different challenges

⁴⁴IDSAP, 2022: *Assessing the Impact of APCNF(Andhra Pradesh Community Managed Natural Farming): [A Comprehensive Approach Using Crop Cutting Experiments]Final Report 2020-21*, Mimeograph, Institute for Development Studies Andhra Pradesh, Visakhapatnam. https://apcnf.in/wp-coFinal_Report_2020-21Intent/uploads/2022/05/IDS-2020-2021-APCNF-Consolidated-Report.pdf

reflects the farmers' ability to master the new techniques and practices. It also reflects beneficial potentials of CNF, which might have enthused the farmers to master the art and science of CNF. It also reflects a considerable improvement in the RySS's extension and support services.

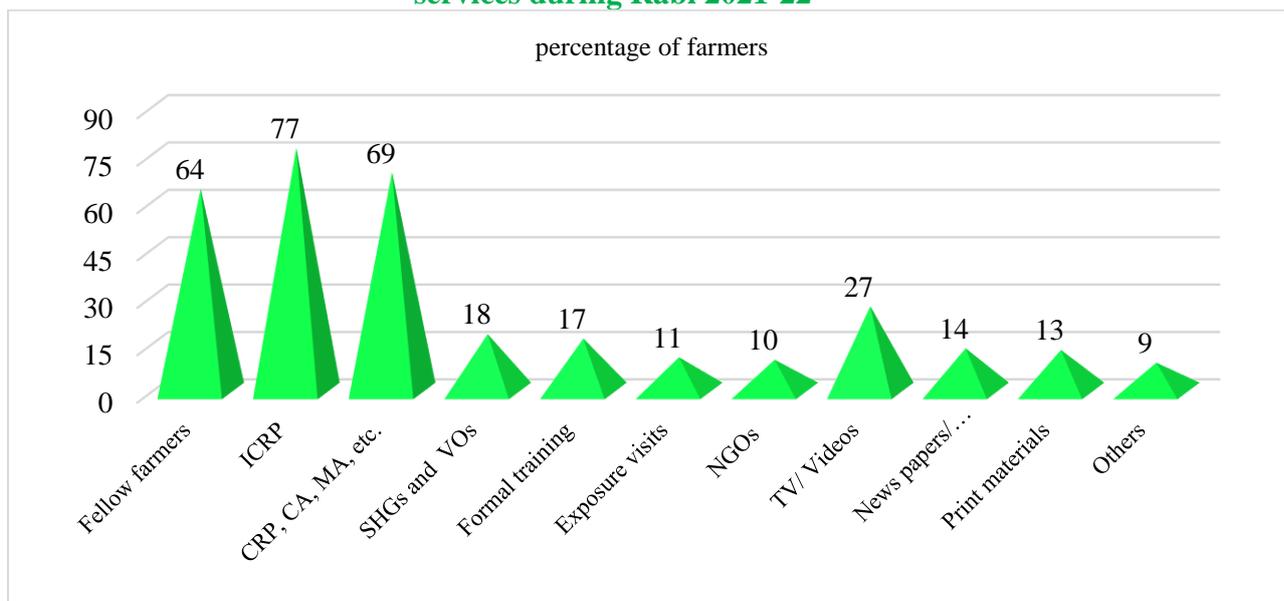
6.4. Extension services

As mentioned above, that CNF is evolving. As it focuses on diversified and intensive cropping pattern, the issues and challenges in adopting CNF are also heterogeneous and also evolving. In this context, extension services are crucial. First time, this year the study has collected information about extension services in terms of sources of extension services, number of interactions the farmers have with different extension service providing agencies and persons and satisfactory levels the farmers have from their interaction with those agencies and persons.

RySS provides awareness, extensions services, and technology transfers, through variety of institutions/ individuals and methods. These include placing a number of extension services providing staff in the field at different levels, on the field training and exposures, self-help group (SHG) institutions, exhibiting the subject specific videos, organizing training camps and programmes at different levels, arranging exposure visits at different levels, distributing printed material, etc. Apart from RySS, some non-government organizations (NGOs) also provide the extension and replication services.

Internal community resource persons (ICRPs) also known as master farmers, who are farmers that live in the villages, can be most popular source of advice and support. As many as 77 percent of CNF farmers have interactions with ICRPs during the study period. Next level field persons of RySS such as community resource persons (CRPs), cluster assistants (CA), mandal anchors (MA), master trainers (MT), etc., are next common sources of advice and support according to 69 percent of farmers. Fellow farmers are another widely accessed source of support, as reported by 64 percent of farmers. Televisions (TVs) and videos are fourth widely used source of knowledge, as reported by 27 percent of farmers. Other sources are used or accessed by 9 to 18 percent of farmers (Figure 6.3).

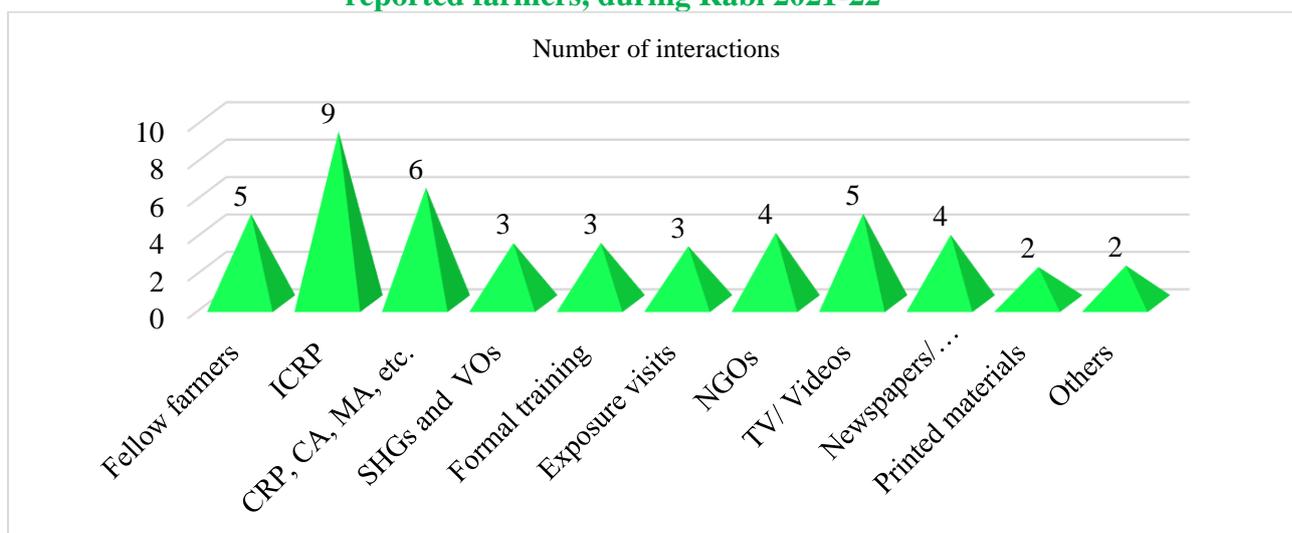
Figure 6.3: Percentage of CNF farmers' interaction with difference sources of extension services during Rabi 2021-22



Source: *IDSAP, Field Survey 2021-22.*

Number of interactions, the farmers have with different extension service providing agencies and events, during Rabi 2021-22, are shown in the Figure 6.4. It may be noted that all the interactions need not be individual interactions. Some might be group interactions. The average number of interactions with each source of information and support, broadly follow the same above pattern. On average each reported farmer interacted 9 times with ICRPs, 6 times with CRPs, CAs, MAs, MTs, etc., 5 times each of fellow farmers and TVs/ videos. Interactions with other sources vary from 2 to 4 times during the study period (Figure 6.4).

Figure 6.4: Number of interactions* with each source information and support by reported farmers, during Rabi 2021-22

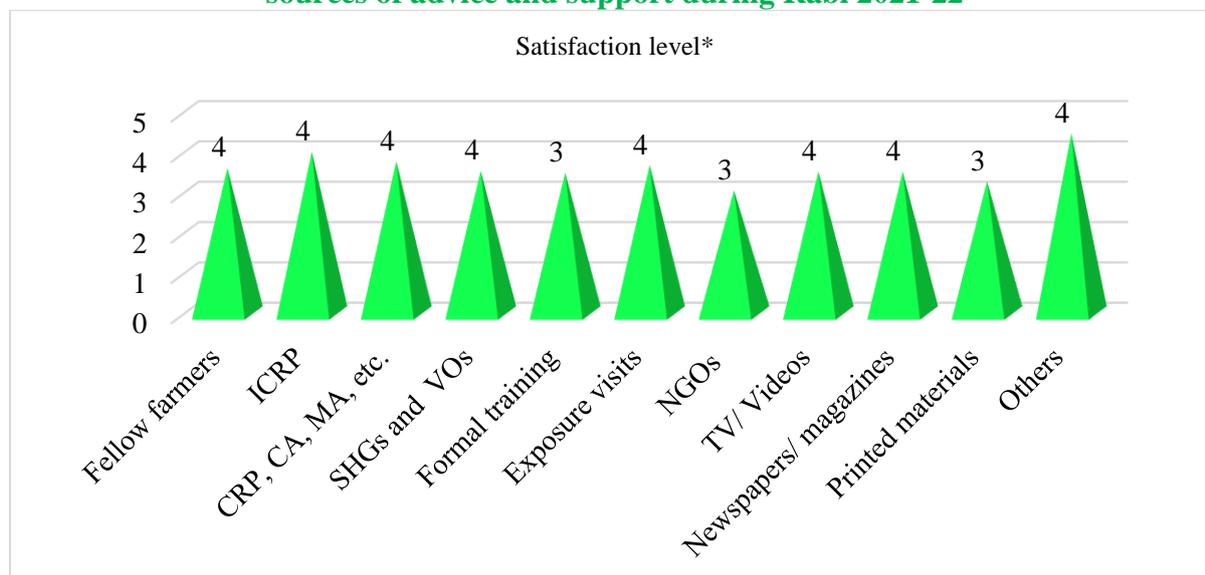


* Note: All the interactions need not be individual interactions. Some might be group interactions

Source: *IDSAP, Field Survey 2021-22.*

Overall, the reported farmers are ‘more satisfied’ with their interactions with eight out of 11 sources of advice and support and ‘satisfied’ with their interactions with remaining three sources (Figure 6.5).

Figure 6.5: Reporting farmers level of satisfaction* in their interactions with different sources of advice and support during Rabi 2021-22



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

Source: IDSAP, Field Survey 2021-22.

The above discussion indicates that RySS’s field people and other training and exposure programmes are major sources of extension and support service to the farmers in adopting CNF. It seems the field people are playing a critical role extensively and more satisfactorily. At the same time, some field staff pointed out about heavy workloads and vacancies in their teams.

It indicates that RySS may strengthen its field personnel to expand the programme. At least, it may fill the vacancies. In some of strategic interviews, the field staff pointed out about the vacancies in their ranks, and consequent work pressure. Apart from filling the vacancies and strengthening the cadre, RySS may consider to provide flexible and focused working conditions so that the staff can optimally use their time, resources and energy balancing their professional and personal responsibilities.

6.5. Way forward

In the above context, the following suggestions are made to implement the programme more effectively and expand it at the accelerated pace.

1. Given criticality of the field staff in 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 to provide flexible and focussed working conditions so that the staff can optimally use their time, resources and energy balancing their professional and personal responsibilities.
2. The plight of Tomato farmers in the Arikela village indicate that higher yields at times may lead to misery. RySS may think of facilitating appropriate marketing support, food processing, storage, etc.
3. The efforts to bring in the TTD for the procurement of CNF foodgrains has given good results. More such efforts are needed.
4. RySS may take up the evidence-based advocacy to convince the farmers to take up the CNF on a large scale; and other stakeholders to support the CNF expansion and replication. Needless to say such evidence would come from more impact assessment studies.
5. RySS may also think about other methods to expand the programme. Involvement of Panchayat Raj institutions, which have larger and direct stake in agriculture development and farmers wellbeing in their villages, is one possible option.
6. Another potential option is involving the corporate sector, with their Corporate Social Responsibility (CSR) funds in implementation of the programme in some villages.
7. RySS may explore a thorough integration with the State Agriculture Department. Utilizing the infrastructure and personnel of Agriculture Department is one possible option. This would be an expected process, as the CNF is going to replace the non-CNF in the state in coming years.

6.6. Conclusions

As the CNF is evolving, the issues and challenges are also evolving. Therefore, majority of farmers reported that they have one problem or other in adopting CNF. The major problems such as output marketing at higher prices, non-availability of raw materials to prepare the biological inputs, inadequate knowhow to prepare the biological inputs, scarcity of labour, etc., remained same over the years. Though the problems remained common in all previous surveys, the number of persons reporting each of these problems has declined significantly in this survey. Such a drastic reduction in the number of farmers reporting different challenges, reflects the farmers ability to master the new techniques and practices. It also reflects beneficial potentials of CNF, which enthused the farmers to master the art and science of CNF. It also reflects a considerable improvement in the RySS's extension and support services. In terms of

number of farmers interacted, average number of interactions with the farmers and satisfaction levels stated by the famers, the field staff is doing a good work. At the same time, some field staff pointed out about heavy workloads and vacancies in their teams. All these indicate that RySS need to strengthen its field staff. But such increase may not be possible as the programme expands to the entire 80 lakh hectares cropped area and total 60 lakh farmers in the state. RySS may explore other methods and options to expand the programme. Utilizing the infrastructure and personnel of Agriculture Department is one possible option. This would be a natural process, as the CNF is going to replace the non-CNF in the state in coming years. Involvement of Panchayat Raj institutions, which have larger and direct stake in agriculture development and farmers wellbeing in their villages, is the other possible option.

About IDSAP

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, 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.



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