



Assessing the Impact of APCNF
(Andhra Pradesh Community Managed Natural Farming)
A Comprehensive Approach Using Crop Cutting Experiments



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Abbreviations

APCNF	: Andhra Pradesh Community Managed Natural Farming
BCs	: Backward Castes
BTFs	: Bottom Ten percent Farmers
CCEs	: Crop Cutting Experiments
CESS	: Centre for Economic and Social Studies
CNF	: Community Managed Natural farming
CRPs	: Community Resource Persons
CSs	: Case Studies
DES	: Directorate of Economics and Statistics
DPMs	: District Project Managers
FGDs	: Focus Group Discussions
FYM	: Farm Yard Manure
GCA	: Gross Cropped Area
GPs	: Gram Panchayats
Ha/ ha	: Hectare/ hectares
HAT Zone	: High-Altitude and Tribal areas Zone
HP	: Horsepower
IASRI	: Indian Agricultural Statistical Research Institute
ICRPs	: Internal Community Resource Persons
IDSAP	: Institute for Development Studies Andhra Pradesh
MSPs	: Minimum Support Prices
NGOs	: Non-Governmental Organizations
NSSO	: National Sample Survey Organization
Non-CNF	: Non-Community Managed Natural Farming
OCs	: Other Castes
PMDS	: Pre-Monsoon Dry Sowing
PNPI	: Plant Nutrients and Protection Inputs
RDT	: Rural Development Trust
RySS	: Rythu Sadhikara Samstha

S2S	:	Seed to Seed
SCs	:	Scheduled Castes
SHG	:	Self-Help Group
SIs	:	Strategic Interviews
STs	:	Scheduled Tribes
SWOT	:	Strengths, Weaknesses, Opportunities and Threats
TTFs	:	Top Ten percent Farmers
ZBNF	:	Zero Budget Natural Farming

Executive summary

0.1. Objectives and methodology

1. Specific objectives of the study are:
 - a. To compare the profile of CNF and non-CNF farmers
 - b. To assess the changes in expenditure on plant nutrients and protection inputs (PNPI), paid-out cost of cultivation, gross and net values of crop output, due to CNF; and impact of those changes.
 - c. To estimate changes in the crop yields due to CNF.
 - d. To understand the CNF farmers' adoption levels of different CNF practices and inputs.
 - e. To analyse the impact of CNF on the quality and usage of agriculture inputs and factors of production.
 - f. To assess the impact of CNF on faming and farmers across agroclimatic zones and farm categories.
 - g. To estimate and analyse the households' income at the state, agroclimatic zones and farm categories.
 - h. To estimate the savings made in the use of agrichemicals and changes in the cost of cultivation, crops output, gross and net values of crop output, at the project and the potential benefits at the state level
 - i. To learn the impact of the CNF on environment and farmers well-being
 - j. To assess the issues and challenges in the implementation of the CNF.
 - k. To provide insights for the improvement of the program.
2. The study has deployed “with and without” method to assess the impact of CNF. In this method the outcomes of CNF farmers, cultivating a particular crop, are compared with the outcomes of the non-CNF farmers cultivating the same crop, using chemical inputs.
3. The study is conducted in all the 13 districts of the State of Andhra Pradesh. The list of Gram Panchayats (GPs) with number of cultivators adopting CNF *as of September 2020*, provided by RySS, was used as the sample frame to draw CNF sample GPs. The total list of GPs in the state, excluding the GPs of CNF, formed the sample frame for non-CNF samples. In both the cases the study followed a stratified, two-stage sampling scheme with Gram Panchayats (GPs) as first stage units and cultivators (households) as second stage units.

4. To estimate the detailed cost and returns, the study planned to collect data for 13 major crops in the state. The crops are: (1) Paddy, (2) Groundnut, (3) Cotton, (4) Bengal Gram, (5) Black Gram, (6) Maize, (7) Red Gram, (8) Chillies, (9) Green Gram, (10) Ragi, (11) Sugarcane, (12) Jowar and (13) Horse gram.
5. However, minimum required data was obtained only for nine crops, viz., : (1) Paddy, (2) Groundnut, (3) Cotton, (4) Black Gram, (5) Maize, (6) Red Gram, (7) Chillies, (8) Green Gram, (9) Ragi. Crop wise costs, yields and output values are estimated for these nine crops. These nine crops are used as the basis to estimate the project level actual benefits and state level potential benefits.
6. The study has covered 1,140 CNF household and 646 non-CNF household. Exactly 100 CNF and 126 non-CNF additional households were included in the sample to get minimum observations for each of sample crops.
7. Further, qualitative information was collected through three methods, viz. focus group discussions (FGDs) (65), strategic interviews (SIs) with the district project managers (DPMs) (13) and the case studies (CSs) of progressive and model farmers and (social) entrepreneurs (65).
8. Each of sample household is visited 4 to 8 times during the survey period/ year to track their agriculture operations and economic activities during the agriculture year 2020-21 and pre monsoon months – March to May of 2020. While CNF farmers were visited during four cropping seasons or cycles, viz. Pre-Kharif, Kharif, Pre-Rabi and Rabi seasons; non-CNF farmers were visited during two major seasons, viz. Kharif and Rabi.
9. 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.
10. Crop Cutting Experiments (CCEs) were conducted scientifically to get an independent estimate of crop yields under CNF and non-CNF. A total of 1,837 CCEs were conducted, including 1,196 CNF and 641 non-CNF.

11. The data was processed using software CS-Pro, SPSS, and Excel. Analytical parameters were estimated using the sample weights. Because of data paucity, analysis is limited to agroclimatic zones, instead of districts.

0.2. Profile of the sample household

12. RySS's positive bias towards poor and vulnerable sections has clearly manifested in the social composition of CNF farmers. The SC farmers, who are the most resource poor, constitutes 13.1 percent in CNF farmers. The same is just 5.4 percent among non-CNF farmers. Though landed, the STs, the most backward farming community, constitutes 21 percent in CNF farmers vis-à-vis 12.7 percent in non-CNF.

13. Surprisingly the percentage of female headed families is less in CNF vis-à-vis non-CNF sample. RySS has been working with women self-help group (SHG) institutions and has a very high positive bias towards women farmers. Female headed households constitute a small percentage of all farming households in the state. There are a number of interesting and inspiring case studies and models by women farmers.

14. Though CNF farmers own smaller holdings compared to non-CNF farmers, they have cultivated relatively higher proportion of land, both in Kharif and Rabi seasons.

15. Marginal farmers and pure tenant farmers are higher in CNF than that of non-CNF by 2.9% and 5.4% percentage points respectively.

16. It is striking to note that more of younger, and middle aged, and less of older farmers are into CNF than those into non-CNF.

17. Relatively fewer illiterate farmers and a greater number of highly educated farmers who have educational qualifications above secondary level, and above graduation are into CNF.

18. CNF is attracting not only informed farmers, who own non-farm enterprises and salaried jobs, but also poor and vulnerable sections, whose major occupation is casual labour.

0.3. Impact of CNF on the farming conditions at the state

19. Two points to be noted while analysing the farming conditions are: (i) This year the crops are adversely affected by the heavy rains. (ii) Almost all CNF crops are obtained from PMDS plots.

20. The combined results of Kharif and Rabi (weighted average of Kharif and Rabi results¹) are focus of this report. Costs and returns are calculated for nine crops.

¹ Weights being the area under each crop in each season in the sample

21. As expected, the farmers are able to save in the expenditure on PNPIs in each and every crop. It varies from 2% in Ragi to 76% in Chilies (Table 0.1). The paid-out cost too is lower under CNF for each and every crop considered in this report. Though in percentage terms the savings in the paid-out costs appeared to be less than the savings in the PNPIs for seven out of nine crops, in absolute terms the savings in paid-out costs are larger in each sample crop. In the previous studies, such a clear trend was not observed. One possible reason is that CNF farmers might have incurred some of paid-out costs, particularly for land preparation, at the time of PMDS sowing, which is not included in the cost of cultivation of the Kharif crops. Such practices enable them to optimize the use of their own labour and assets/ machinery over two crop seasons viz., PMDS and Kharif.
22. Yields of CNF crops are higher than that of non-CNF in eight out of nine sample crops covered. It varies from one percent in Red gram to 51 percent in Ragi. Only CNF yields of Black gram is less than that of non-CNF by two percent.
23. The gross value of CNF crop outputs is higher than that of non-CNF in eight out of nine crops covered. Black gram is the only exception.
24. In all nine crops, the net value of output of CNF crops is higher than that of non-CNF crops. It varies from seven percent in Black gram to whopping 914 percent in Cotton (Table 0.1).

Table 0.1: Difference between CNF and non-CNF crops on major indicators

In percentages

Crop	PNPIs	Paid-out costs	Yields	Gross value of output	Net value of output
Paddy	-60	-21	4	8	61
Groundnut	-49	-13	32	52	125
Cotton	-68	-28	14	0	914
Black gram	-64	-29	-2	-4	7
Maize	-59	-13	32	46	111
Red gram	-32	-43	1	3	79
Chilies	-76	-45	10	5	18
Green gram	-56	-28	23	20	53
Ragi	-2	-35	51	36	420

Sources: IDSAP, Field Survey 2020-21

25. A comparison of the yield differences, between CNF and non-CNF crops during last three Kharif and Rabi seasons, has categorically proved the efficacy of PMDS in enhancing the crop yields and crops' resilience to heavy rains.

26. The proportion of operational area allocated to CNF out of the total operated area has increased from 26.48 percent in Kharif 2017-18 to 62.81 percent in Kharif 2020-21. Similarly, the share of CNF area in the average operational holdings has increased from 29.88 percent in Rabi 2017-18 to 66.91 percent in Rabi 2020-21.
27. Apart from allocating higher percentages operational holdings over the years, the CNF farmers are using the land intensively and more productively. The CNF farmers have a greater number (242) days of crop cover on their fields, vis-à-vis 228 days by non-CNF farmers. About 16% and 7% CNF farmers have cultivated mixed crops during Kharif and Rabi seasons. The same is 9% and 1% for non-CNF farmers.
28. This year data also confirms that CNF is a labor-intensive method of cultivation. In each of nine crops of Kharif season 2020-21, a greater number of person days are used in CNF farming vis-à-vis non-CNF farming. As expected, a greater number of own labour days are used in CNF crops compared non-CNF crops, in all but one crop, i.e., chilies. In Rabi season also, a higher labour input is used in CNF vis-à-vis non-CNF, in each crop. On average 25 additional labour days are used in CNF. The reasons for higher labour use in CNF include (i) preparation of biological inputs, (ii) improved farming practices- line transplantation, (iii) improved cropping practices such as mixed crops, bund crops, border crops, etc., and (iv) higher yields.
29. Over 39 percent farmers reported a moderate decline in water consumption in CNF crops vis-à-vis non-CNF crops, 6.6 percent reported a considerable decrease.
30. Similar trend was observed in the consumption of power in CNF farming.
31. CNF farmers dependence on the market for agrichemicals has declined at the rate ₹.11,250 per ha. ***But such change is not clearly visible in seed purchases. RySS may focus on promotion of local seed-banks on a scale.***
32. According to latest NSSO's indebted survey, AP is one of most indebted states in the country. CNF proved to be a wonderful solution to this frightening problem. CNF farmers' dependence on external sources is less vis-à-vis non-CNF farmers in Government subsidies, banks and institutional credits and others. A greater percentage of CNF farmers have met their funds needs from own savings and from friends and relatives. It was observed in the field that the CNF farmers in many villages are getting advances for CNF food items to be supplied after the harvesting. This practice is quite different from the traditional practice of output pledging or mortgaging to the traders and money lenders.

33. The percentage share of funds obtained from different sources clearly indicates the CNF farmers' reduced dependency on the borrowed funds vis-à-vis non-CNF farmers. It also indicates a lesser funds' need for CNF farmers.
34. Over 30 percent CNF farmers said the need for working capital for farming has declined considerably due to CNF. Further, over 44 percent farmers experienced a moderate decline in the working capital needs. Over 14 percent have stated no change. Over two-thirds of CNF farmers have indicated moderate to considerable decline in borrowing for agriculture and about one-fourth experienced no change in the borrowing status.
35. There is a consistent increase in the number of CNF practices adopted by the participants over the years. During the Kharif seasons, the average number of adopted CNF practices has increased from 2.3 in 2017-18 to 5.5 in 2020-21. The number of adopted CNF practices has increased from 2.1 in Rabi 2017-18 to 4.2 in Rabi 2020-21.
36. CNF crop output are being sold in a greater number of market channels in both Kharif and Rabi seasons. Compared to non-CNF, relatively lesser percentages of CNF output were sold in the Market-yards. Relatively a greater percentages of CNF output are sold to the Traders within the villages. It indicates a growing local interest for CNF crops' output. It also indicates that CNF output is attracting a number of Traders to those villages.
37. More than 80% farmers are experiencing increased respect in the market and over 88% of farmers are witnessing an increased preference for CNF output. But only about 45% of CNF farmers reported that they are getting higher prices for CNF output. While 23.6% farmers realized a moderately higher prices, 18.6 percent of total CNF farmers got considerably higher prices for their CNF output.

0.4. Impact of CNF on Farming Conditions in Agroclimatic Zones

38. The CNF farmers in rainfall dependent zones such as High altitude, North coastal, Southern and Scarce rainfall, compared to highly irrigation assured Krishna and Godavari zones, have allocated higher proportion of area towards CNF in the total cultivated area in Kharif as well as in Rabi seasons. The cropping intensity is also higher in rainfall dependent zones over assured irrigation zones. This is due to the utilization of land in pre-Kharif, Kharif, pre-Rabi and Rabi seasons. Thus, land is intensively used in rainfall dependent zones over assured irrigation zones. The coverage of land throughout the agricultural year with crops reduces water evaporation and enhances the moisture in the soils. This enables crops to withstand dry spells and results in higher yields in rainfall dependent zones.

39. The total labour days employed per hectare for growing crops is found to be higher for the CNF farmers over non-CNF farmers across all the zones. This clearly indicates that farmers are more engaged with CNF over non-CNF because of its labour-intensive nature. The hired labour use is also higher for CNF farmers over non-CNF farmers across all the zones. This also reinforces the labour-intensive nature of CNF. This indicates the demand for hired labour is higher under CNF. Family labour use is also higher for CNF farmers over non-CNF farmers, except north coastal zone. This means the engagement of family labour with CNF agriculture is more across all the zones
40. The CNF farmers, compared to non-CNF farmers, have higher percentage of area under cultivation in Rabi season across all the agroclimatic zones except Godavari zone. Moreover, the larger proportion of area is under borewell irrigation for CNF farmers over non-CNF farmers across all the zones. This implies that large proportion of cultivated area is under controlled irrigation for the CNF farmers. The controlled irrigation is very conducive to CNF. Thus, the CNF farmers over non-CNF farmers might have obtained higher yields for the crops grown under borewell irrigation.
41. The sources of funds mobilized for meeting the expenditure towards raising crops and meeting household needs across the zones has revealed that there is no systematic pattern found to be in existence across the zones. This means that the local credit market conditions specific to agroclimatic zones have determined the pattern of sources of funds mobilized.
42. The number of CNF practices adopted has been increasing over years from 2017-18 to 2020-21 in all the zones in Kharif as well as Rabi seasons. It is the highest in High altitude zone among the zones across all the agricultural years considered. The number of CNF practices adopted is found to be more or less the same in the agricultural years 2000-21 across the zones. The adoption of a greater number of practices leads to the higher reduction in the costs of growing crops on one hand and higher increase in crop yields on the other.
43. The use of biological inputs under CNF has reduced costs of plant nutrition and protection inputs of CNF over non-CNF. The paid-out costs also reduced for growing paddy crop. The reduction in costs is higher in Krishna and Godavari zones compared to other zones. This is due to application of higher level of chemical input use in assured irrigation zones of Krishna and Godavari zones. This is true in Kharif as well as Rabi seasons. The net returns were higher for CNF for all zones except southern zone for Paddy in the kharif season. The net returns for Paddy were higher for CNF for all zones except Godavari zone in the rabi season.

0.5. Impact of CNF on Farming Conditions of Small Landholders

44. Small landholders, compared to large landholders, have allocated larger proportion of cultivated area under CNF in the total cultivated area in Kharif and Rabi seasons of the agricultural year 2020-21. This has reflected in cropping intensity. Further, the pre-Kharif and pre-Rabi areas under PMDS has also enhanced further the cropping intensity. This is the reason why the cropping intensity of small landholders is higher than the large landholders. Thus, small landholders have used land intensively. The coverage of crop land throughout the agricultural year reduces the water evaporation and increases the soil moisture. This might have impacted crop yields also.
45. The small as well as large landholders of CNF farmers engaged higher number of days of human labour per hectare of land than their counterparts of non-CNF for growing crops. This clearly indicates the labour-intensive nature of CNF. The family labour use is higher for the small and large land holder under CNF over non-CNF farmers. This reflects the higher engagement of family labour with the CNF.
46. The area under rainfed conditions for raising crops is lower for small as well as large landholders under CNF over non-CNF in Rabi season. However, higher cultivated area is under borewell irrigation for small landholders of CNF over non-CNF. This reflects that the small landholders of CNF growing crops under more controlled irrigation than their counterparts under non-CNF. Controlled irrigation creates congenial conditions for CNF and it may lead to higher yields.
47. Small landholders of CNF have lower dependency on informal credit sources as compared to their counterparts under non-CNF for raising crops. Moreover, their access to credit from formal institutional sources such as banks is higher. This indicates the enhancement in the credit worthiness of small landholders of CNF. This also indicates lower cost of credit for the small landholders of CNF compared to their counterparts under non-CNF.
48. The adoption of number of CNF is higher for the small landholders over large landholder. The CNF practices have implications for cost of cultivation on one hand and yield of crops on the other. The adoption of more CNF practices leads to more reduction in the cost of raising crops and more enhancement in the yields of crops. Moreover, the adoption of mixed cropping is also pronounced among CNF farmers over non-CNF farmers belonging to small landholders.

49. Thus, intensive use of land, more engagement with CNF agriculture, controlled use of water for irrigation, accessing credit from sources that give lower cost of credit and adoption of more CNF practices by small landholders clearly indicates that their costs of raising crops may be lower and returns may be higher, compared to their counterparts under non-CNF.
50. The analysis shows that the CNF leads to a substantial reduction on plant nutrients and protection inputs (PNPIs) costs for farmers of all sizes. The net value of Paddy output is higher for CNF compared to non-CNF, for all size class of farmers for Kharif Paddy cultivation. In the Rabi season the net value of output per hectare of Paddy was higher for CNF cultivators compared to non-CNF for marginal and small farmers; but lower than non-CNF for medium and large farmers.
51. The biological input use has led to reduction in plant nutrient and protection inputs under CNF over non-CNF. The paid-out costs also has become lower under CNF over non-CNF. Thus, the costs of production of Paddy crop in Kharif and Rabi for the small farmers of CNF are lower compared to their counterparts under non-CNF. The Paddy yields are higher for the small land holders of CNF over non-CNF. The gross and net value of output is also higher for the small land holders of CNF over their counterparts under non-CNF for Rabi Paddy.

0.6. Household Incomes of CNF and non-CNF Farmers

52. The estimated annual household income from all sources of economic activities during the agricultural year 2020-21 is found to be higher for CNF farmer over non-CNF farmers in the state of Andhra Pradesh. In High Altitude Zone, the income for CNF was higher from allied activities compared to non-CNF farmers. Furthermore, increase in the household income of the CNF farmers is predominantly due to raise in the agricultural income and increase income is solely attributable to diversified CNF agriculture only. The higher income from livestock for the CNF farmers shows the strong linkages between agriculture and livestock for the CNF farmers over non-CNF farmers. Moreover, the CNF has enabled farmers to depend more on agriculture duly adjusting the dependency on wage employment.
53. A comparison across different agroclimatic zones has revealed that the annual income is higher for CNF farmers over non-CNF farmers across all the agroclimatic zones except high altitude zones. The agricultural income is higher for CNF farmers over non-CNF

farmers across all the zones. The higher household income for CNF farmers is only due to increased income from CNF. Interestingly, the income from animal husbandry is higher for CNF farmers over non- CNF farmers in high altitude and Godavari zones. Moreover, income from forestry is higher for CNF farmers over non-CNF only in high-altitude zone. This clearly indicates that the CNF has enabled tribals to make use of their livestock and forest resources more optimally to derive higher incomes. It is interesting to note that the contribution of CNF to the livelihood strategies of CNF farmers has varied across zones. The CNF farmers have reduced dependency on wage employment compared to non-CNF to increase dependency on agriculture for obtaining higher incomes in all zones except in South zone and Scarce rainfall zones.

54. The annual household income of small as well as large landholders of CNF farmers is higher than their counterparts under non-CNF. Similarly, the income from animal husbandry and fisheries is higher for the CNF farmers over non-CNF farmers. The increase in household income of CNF farmers over non-CNF farmers is due to CNF agricultural income across all the category of farmers. The small landholders of CNF have reduced dependency on wage employment and increased dependency on agriculture for obtaining higher incomes, while large landholders of CNF increased dependency on wage employment (mostly salaried employment) as well dependency on agriculture to derive higher household incomes.

0.7. Actual and potential impact of CNF in AP

55. It is estimated that each of CNF/ S2S farmers has saved ₹.11,944 in agrichemicals and ₹.12,177 in the paid-out costs. Each CNF farmer got additional gross value of output of ₹.15,493 and additional net values of output of ₹.27,670 due to their participation in CNF. It is assumed that each of the partial CNF farmers would get 50% of each of these benefits.
56. In 2020-21, total 4,78,844 farmers adopted CNF. These include 1,28,304 CNF farmers and 3,50,540 partial farmers.
57. It is estimated that in 2020-21, the state has experienced an actual reduction in the consumption of fertilizers and pesticides worth of ₹.362.59 crores; a savings of ₹.369.65 crores in the paid-out costs; ₹.470.32 crores additional gross value of crop output and ₹.839.98 crores of additional net value of crop output due to CNF project.
58. Had the entire cropped area in the state put under CNF, the state would have saved ₹.8,423.54 crore by not using agrichemicals.

59. Even without applying any agrichemicals, the state would have got higher crop output in eight out of nine selected crops. Only exception is Black gram, which might have declined by 0.09 lakh tons. In the remaining eight crops the increase vary from 0.02 lakh tons in Red gram to 5.62 lakh tons in Groundnut. Paddy output would have been increased by 4.86 lakh tons, followed by Maize output by 4.78 lakh tons. Cotton output would have been larger by 0.96 lakh tons and Chilies output would have been higher by 0.76 lakh tons.
60. It is reasonable to assume that CNF crop outputs would have been larger in 85% to 90% of remaining crops, if the entire cropped area were put under CNF in the state.
61. If the entire cropped area put under CNF, the farmers would have saved ₹.8,587.83 crores in the paid-out costs; would have obtained ₹.10,927 crores additional gross values of crop output and ₹.19,515 crores higher net values of crop output.

0.8. Impact of CNF on environment and well-being of farmer

62. CNF has improved soil health, crop health and well-being of farmer households at the state level.
63. But there are variations across the zones with regard to performance of these parameters. The high altitude and north coastal zones compared to the other rainfall dependent zones namely southern and scarce rainfall zones have performed better.
64. Thus, farmers gain in environmental sustainability parameters and wellbeing depends more on their location, the seasons and probably the financial gains and comfortable food intake.

0.9. Issues, Challenges and Suggestions

65. From the three streams of analyses, the study has identified four major challenges, viz., (1) slow progress of the CNF project, (2) marketing, (3) productivity enhancement, and (4) institutional issues.
66. Slow progress is an aggregation of many issues such as inadequate extension services, inadequate supply of the biological inputs, knowledge gap for the CNF farmers, lack of remunerative marketing avenues, shortage of livestock, raw material shortage, etc. It is perplexing, while the benefits of CNF are clearly visible, still very small number of farmers, say less than 5% farmers, are adopting the CNF in many villages. Perhaps the expectation of subsidies in each and every activity may be one of the reasons.

67. The data indicates that there is no marked difference between CNF and non-CNF farmers in the use of own and local seeds. It appears that the village seed banks program is not yet taken off at the desired scale.
68. Massive publicity should be given to the CNF, using all kinds of publicity channels ranging from TV to wall writings. Booklets and pamphlets about the benefits, success stories, self-learning, etc., may be printed in a large number and distributed frequently. Once the farmers are convinced about the benefits of CNF, they themselves will resolve many of the issues and challenges.
69. RySS may think of involving institutions, who can implement, expand, replicate and own the programs. The possible institutions are Sarpanches, NGOs, and CSR institutions. At the moment, there are about 30 thousand Sarpanches, overwhelming majority of them are women and from SC and ST communities. The Sarpanches have real and larger stakes in the development of their villages and welfare of their people.
70. The issues of landless tenant farmers need to be resolved. Awareness generation could be one of the important solutions.
71. Further, as per the available anecdotal evidence, CNF, including PMDS, is capturing the carbon-dioxide from the atmosphere and storing in the soil. RySS may get confirmed this; and facilitate Carbon Credits to the CNF farmers.
72. With respect to marketing, the farmers, themselves, have suggested and demanded, in the FGDs, the following policy initiatives:
 - a. The Government should announce the minimum support prices (MSPs) for CNF crops.
 - b. The Government should procure the CNF food items instead of non-CNF food items.
 - c. A dedicated place should be allocated to CNF crops in all market yards such as Rythu Bazars, Market Yards, Shandies, Exhibitions, etc.
 - d. CNF farmers should be given identity cards.
73. Apart from above, RySS may think about introducing the forest species or promotion of agro-forestry, to save the CNF farmers from the wider fluctuations in seasonal and horticulture crops' production and prices.
74. Regarding productivity enhancement, this year data clearly indicate that the PMDS is an effective tool in enhancing the crop yields and resistance to weather anomalies.
75. Further, RySS may develop and propagate the region specific, irrigation status specific and crop specific packages of farm practices.
76. With respect to institutional issues, a couple of contradictory trends are observed in the field and mentioned in the FGDs are:

- a. While RySS is promoting CNF zealously, its parent organization the Agriculture Department, is promoting the non-CNF with same level of zeal.
- b. While Community Resource Persons (CRPs) were appointed from the poorer communities, the well-off farmers were appointed as the internal community resources persons (ICRPs) in many places. Instead of supporting the CRPs, some of these ICRPs are commanding the CRPs.

Chapter 1: Context, Objectives and Methodology

1.1. Introduction

The farmers in the state and also in the country are stressed. The major and generic reasons, across the country, include rising costs of cultivation, stagnant yields, escalating losses from the cultivation, swelling debts, alarming health issues, declining land quality, depleting groundwater resources, degrading natural resources, deteriorating environment, etc.² Further, the woes associated with the climate change cause the farmers' distress. To relieve the farmers, in the state, from the chemical-based agriculture associated distress, the Government of Andhra Pradesh has introduced the Zero Budget Natural Farming (ZBNF) in 2016 as an alternative to chemical-based agriculture. Later, the name was changed to Andhra Pradesh Community Managed Natural Farming (APCNF)³. CNF is an agri.-ecological farming approach. It believes that the soil already has all the nutrients necessary for plant growth, and there is no need for adding any external inputs to supply nutrients. Instead, the existing nutrients have to be released and made available for the plants. CNF facilitates this process. Thus, the philosophy of CNF is quite opposite to the conventional chemical-based agriculture. Beejamurutham (treating of seeds with microbial substance), Jeevamrutham (incorporation of microorganism into soils), Achadana (mulching), and Waaphasa (aeration) are the four core CNF farming practices. In order to protect crops from pests and insects, CNF prescribes a number of natural fungicides and pesticides, known as Kashayams and Ashtrams, made from locally available ingredients like neem leaves, chillies, garlic, tobacco, sour buttermilk, etc.

Diversification of cropping pattern is another key feature of CNF. Under CNF, different crops are intensively grown in a variety of ways. These include crop rotation, mixed cropping, inter cropping, border cropping and bund cropping, pre-monsoon dry sowing (PMDS) cropping, etc. One of the great innovations under this intervention is the introduction of multitier cropping models, known as 5-layer model and 7-layer model. Under these models, different varieties of

² All these factors have been reemphasised by 1000s of farmers in the interactions with the present research team, especially in the hundreds of the focussed group discussions (FGDs). More details can be seen IDSAP, 2020 and 2021.

³ The words APCNF and CNF are used interchangeably in this report. Pre-Monsoon Dry Sowing (PMDS) cultivation and Pre Kharif and Pre Rabi cultivation are also used interchangeably.

fruit trees, vegetables and seasonal crops are grown on the same plot. These models have several advantages. They optimize the horizontal, vertical, and temporal use of the land. Different layers of crops access the soil moisture and nutrients at different times and from different layers (depths) in the soil. The need for human labour is staggered; and it optimizes the family labour use. Farmers get higher and stable net incomes, throughout the year. More details about CNF can be seen in the Reports of CESS, 2020 and IDSAP, 2021⁴.

In a true sense, CNF is a paradigm shift in agricultural development in the state and, perhaps, in the country. The findings of earlier studies and the current survey indicate that CNF is able to resolve most of the pressing problems of the farmers and agriculture in the state.⁵ CNF is able to reduce the cost of cultivation and enhance the profitability of the farming, considerably. It is enhancing the quality of the soil and local environment, including the revival of the environmental services. It is resulting in the positive health and cordial outcomes at the individual, family and community levels. It is pleasing to note that CNF is making the agriculture climate change resilient, to some extent. Evidence from different parts of the state suggest that CNF crops can withstand prolonged dry periods, heavy rains, and strong winds compared to non-CNF crops⁶.

The state Government planned to cover all 60 lakh farmers and entire 80 lakh hectares of crop land, in the state, with the CNF. An independent organization, known as Rythu Sadhikara Samstha (RySS), a not-for-profit company, was established to implement the programme effectively. So far CNF has reached about 10% of farmers and Gram Panchayats in the state. As per the latest available information from RySS 2,37,125 farmers stopped completely the use of chemical inputs, viz. fertilisers and pesticides, and they are able to cultivate at least a part of their holdings, completely with CNF. Further, 3,54,964 farmers, in the state, have used CNF inputs and practices, along with agrichemicals and chemical based agriculture practices, during the year. These farmers are known as partial CNF farmers.

⁴ Needless to say, RySS is the repository of the resources on APCNF. See <https://apcnf.in/> for more details including the links to the two studies cited above.

⁵ Participants in many Focused Group Discussions (FGDs) stated that APCNF is providing solutions to many of their problems. They, further, said that APCNF should be promoted with appropriate incentives and facilitation.

⁶ In 2020-21, the survey period, the state received heavy rains. On the whole, APCNF crops fared better vis-à-vis non-CNF crops. After seeing the resilience of APCNF Paddy to heavy rains, during Kharif 2020-21, the farmers, of Mantenavari Palem, of P V Palem Mandal in Guntur district, have converted their entire crop land into APCNF method during the Rabi season 2020-21.

Recently, RySS has made a major breakthrough in CNF in the form of the *Pre-Monsoon Dry Sowing (PMDS)*. PMDS is a global breakthrough. The exact science of PMDS is yet to be determined. The enhancement of soil biology through CNF practices and raising of 8 to 15 diverse crops, as a mixed crops, creates some special conditions for the seed germination and plant survival during the dry seasons. The mulching material, which was spread across the field, as a part of PMDS, acts as the catalyst to harness the water vapour from the atmosphere that drops to the land surface in the form of early morning dew. The mulching material facilitates the percolation of the dew into the soil and prevents its evaporation again. Therefore, farmers grow PMDS during March-June, followed by Kharif crops, Pre-Rabi Dry Sowing (PRDS) followed by Rabi crops, under the CNF scheme. The crops grown in PMDS are used, ultimately, as green manure, after obtaining intermittently some cash income and food items to the farmers and green fodder to animals. Thus, PMDS contributes to cropping intensity, agricultural incomes and continuous green cover for 365 days in a year.

Institute for Development Studies Andhra Pradesh (IDSAP), Visakhapatnam has been assigned, the task of assessing the impact of CNF on farming and farmers for the year 2020-21, by RySS, the Government of Andhra Pradesh. The current study is in continuation of the impact studies undertaken for 2018-19 and 2019-20 by the same Institute/ Team. In the context of innovation of PMDS by RySS, the impact assessment of CNF in 2020-21 has focused on the impact assessment of PMDS plus CNF. The study has selected sample from the CNF farmers who are also raising PMDS during March -May/ June. The study surveyed the CNF farmers during PMDS in pre-Kharif season, CNF⁷ in Kharif, PRDS in pre-Rabi season and CNF in Rabi seasons. The impact assessment reports on PMDS of pre-Kharif season, CNF of Kharif season and CNF of Rabi season have been submitted, as the first, the second and third interim reports respectively to RySS. The present report is the final report of 2020-21 study covering all the seasons of 2020-21, including the pre-monsoon period of 2020.

1.2. Objectives

In the above backdrop, the present study of 2020-21 has assesses the impact of CNF on farming and farmers of Andhra Pradesh with the following specific objectives:

⁷ The word PMDS+APCNF implies a cropping pattern followed on a plot, in which PMDS (8-15) crops were grown during March-June and normal crops are grown during the monsoon month under CNF method. The words “PMDS+APCNF”, “CNF” and “CNF” are used interchangeably in this report. Similarly, the words “non-APCNF CNF” and “non-CNF” are used interchangeably in this report.

- a. To compare profile of the CNF and non-CNF farmers
- b. To assess the changes in expenditure on plant nutrients and protection inputs (PNPI), paid-out-cost of cultivation and gross and net returns of crop cultivation, due to CNF; and impact of these changes.
- c. To estimate the changes in the crop yields due to CNF.
- d. To understand the CNF farmers' adoption levels of different CNF practices and inputs.
- e. To analyse the impact of CNF on the quality and usage of agriculture inputs and factors of production.
- f. To assess the impact of CNF on farming and farmers across the agroclimatic zones and farm categories.
- g. To estimate and analyse the household's income at the state, agroclimatic zones and farm categories.
- h. To estimate the savings made in the use of agrichemicals and changes in the cost of cultivation, crops output, gross and net values of crop output, at the project level and the potential benefits at the state level
- i. To learn the impact of the CNF on environment and farmers well-being
- j. To assess the issues and challenges in the implementation of the CNF.
- k. To provide insights for the improvement of the program.

1.3. Methodology

1.3.1. The Basic Approach

The study has deployed “with and without” method to assess the impact of CNF. In this method the outcomes of CNF farmers, cultivating a particular crop, are compared with the outcomes of the non-CNF farmers cultivating the same crop, using chemical inputs. Costs and returns for the crops considered for the analysis have been obtained from the farmers through farmer household surveys. Crop Cutting Experiments (CCEs) have been conducted to assess the yields of the crops independently and scientifically. Community Managed Natural farming (CNF) is used interchangeably to mean PMDS+APCNF as well as PMDS+CNF and CNF. Similarly non-APCNF or non-CNF are used interchangeably.

1.3.2. Sample Design and coverage

The CNF and non-CNF sample have been drawn from two separate sample frames. In both the cases the study followed a stratified, two-stage sampling scheme with Gram Panchayats (GPs) as first stage units and cultivators (households) as second stage units. The study is conducted in all the 13 districts of the State of Andhra Pradesh. For CNF the coverage of the study is the entire area where CNF is practiced. Rest of Andhra Pradesh is covered under non-CNF. All the GPs, where CNF practices are followed, constitutes the sample frame for drawing CNF samples. The list with number of cultivators following CNF *as of September 2020* was provided by RySS. According to the data provided by RySS, the universe for CNF consists of 3,135 GPs with 63,812 cultivators. The district wise distribution of CNF and PMDS+CNF farmers is given in Table 1.1.

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

<i>In number</i>				
S no	District	Total Gram Panchayats (GPs)	Total PMDS cultivators	Total PMDS+CNF cultivators
1	Anantapuramu	250	2,258	2,150
2	Chittoor	283	6,940	4,358
3	East Godavari	237	7,997	4,639
4	Guntur	219	6,951	1,653
5	YSR Kadapa	455	10,059	9,266
6	Krishna	266	5,154	3,360
7	Kurnool	270	5,481	5,178
8	PSR Nellore	246	5,587	3,180
9	Prakasam	152	4,364	1,138
10	Srikakulam	80	6,048	6,048
11	Visakhapatnam	260	4,647	4,139
12	Vizianagaram	213	18,849	14,457
13	West Godavari	204	5,337	4,246
	Total	3,135	89,672	63,812

Source: RySS, 2020: List of PMDS practicing GPs.

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

As the study planned to estimate crop wise costs and returns, a minimum number of sample observations are needed for each crop. Given the sample size, it is not feasible to cover many

crops. Therefore, survey was limited to 13 major crops that are identified based on the cropped area in the state. These crops together account for more than 90% of the gross cropped area in the state. The crops include: (1) Paddy, (2) Groundnut, (3) Cotton, (4) Bengal Gram, (5) Black Gram, (6) Maize, (7) Red Gram, (8) Chillies, (9) Green Gram, (10) Ragi, (11) Sugarcane, (12) Jowar and (13) Horse gram. Some of these crops are one season crops (e.g., Bengal gram is predominantly Rabi crop) and some Kharif crops are long duration crops (e.g., Sugarcane and Chillies), whose harvesting continues into Rabi season.

1.3.3. Selection of Gram Panchayats (GPs)

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

1.3.4. Selection of CNF sample households

The sampling frame for selecting the cultivators is derived from a household listing carried in each GP covering all the CNF cultivators. At the time of listing information on whether the cultivator is practicing CNF was collected to *eliminate non-CNF cultivators in sample selection*. This formed the universe for the selection of sample CNF farmers. From this, a sample of 10 cultivators was selected randomly from each sample GP, totalling 1,040 cultivators. Wherever 10 cultivators were not available in a GP, the deficit is compensated from another nearby sample GP, preferably from the same Mandal. While drawing samples, care has been taken to make sure that each of the 13 crops would be covered in at least 50 samples. This was achieved by increasing sample size of GPs by three and cultivators by 100. As a result, the survey covered a total sample size of 1,140 cultivators from 107 GPs (See Table 1.2).

Table 1.2: District wise sample GPs and allocated sample farmers

<i>In number</i>			
Sl. No	District	Sample GPs for survey	Sample CNF cultivators
1	Anantapuramu	5	32
2	Chittoor	8	84

3	East Godavari	11	111
4	Guntur	7	65
5	YSR Kadapa	8	80
6	Krishna	7	72
7	Kurnool	7	70
8	PSR Nellore	7	75
9	Prakasam	7	77
10	Srikakulam	10	101
11	Visakhapatnam	7	69
12	Vizianagaram	16	234
13	West Godavari	7	70
	Total	107	1,140

Source: IDSAP Field Survey, 2020-21

1.3.5. Selection of non-CNF sample

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

Further, qualitative information was collected through three methods, viz. focus group discussions (FGDs) (65), strategic interviews (SIs) with the district project managers (DPMs) (13) and case studies (CSs) of progressive and model farmers and (social) entrepreneurs (65).

1.4. Data Collection and Management Process

Each of the sample households was visited 4 to 8 times during the survey period/ year to track their agriculture operations and economic activities during the agriculture year 2020-21 and pre monsoon months – March to May of 2020. While CNF farmers were visited during four cropping seasons or cycles, viz. Pre-Kharif, Kharif, Pre-Rabi and Rabi seasons; non-CNF farmers were visited during two major seasons, viz. Kharif and Rabi. Needless to say, that each sample farmer was visited more than one time during each of two major seasons to collect the cost and returns data and information about other economic activities and to conduct the CCEs.

As both CNF and non-CNF sample farmers were selected based on their PMDS cultivation and crops cultivated during Kharif season, all 1,420 CNF sample farmers, by default, have cultivated crops during Pre-Kharif and Kharif seasons. Similarly, all 646 non-CNF sample farmers have cultivated one or other sample crops during the Kharif season. As anticipated, some of the sample farmers did not cultivate any crop during Rabi season. Out of 1,420 sample CNF farmers, 10.1 percent have cultivated Pre-Rabi Dry Sowing (PRDS) crops and also Rabi crops. Further, 62.8 percent CNF farmers have cultivated only Rabi crops. Contrary to the intuition, a higher percentage of non-CNF farmers have cultivated during the Rabi season; the difference was 3.6 percentage points. Though, the difference was marginal at the state level, there are marked differences at the farm category levels and agro-climatic zones level (Table 1.3). The differences were the results of variations in the resource endowments of each farmer and region. Given the positive bias of RySS towards resource poor farmers and regions, there are some notable variations in the socio-economic and geographical profiles of the CNF (project/ treatment) and non-CNF (control) sample farmers. For example, the incidence of canal irrigation is significantly high among the control farmers (8 percentage points during Rabi season). In Godavari zone, the gap between CNF and non-CNF farmers is highest (40 percentage points). It implies that the non-CNF farmers have been concentrated more in the canal irrigated areas in the Godavari zone. These issues will be elaborated further in the next chapter.

Table 1.3: Number and percentage of farmers growing crops during, pre-Kharif, Kharif, pre-Rabi and Rabi seasons

In number

Farm category/ Zone	CNF farmers				Non-CNF farmers	
	Grown PMDS & Kharif crops (number)	Grown crops during Pre-Rabi and Rabi seasons (in %)	Grown crops during Rabi season only (in %)	Grown crops during Pre-Rabi and/ or Rabi seasons (in %)	Grown Kharif crops (number)	Grown crops during Rabi seasons (in %)
Farm category						
Pure Tenant	96	2.8	74.8	77.6	20	100.0
Marginal	677	13.0	65.1	78.1	385	78.4
Small	292	7.1	51.6	58.7	180	72.8
Medium & Large	75	0.4	67.9	68.3	61	67.2
Total	1,140	10.1	62.8	72.9	646	76.5
Agroclimatic zone-						
High Altitude Zone	42	-	71.9	71.9	98	54.1
North Coastal Zone	362	3.2	83.0	86.2	109	80.7
Godavari Zone	150	14.7	45.7	60.4	70	100.0
Krishna Zone	219	1.5	77.4	78.9	140	87.1
Southern Zone	270	20.4	58.2	78.6	124	89.5

Scarce Rainfall Zone	97	-	21.4	21.4	105	47.6
Total	1,140	10.1	62.8	72.9	646	76.5

Sources: IDSAP, Field Survey, 2020-21

In all, eleven research tools, viz. (1) Household listing schedule in the CNF GPs, (2) Household listing schedule in the non-CNF GPs, (3) Village survey schedule for CNF GPs, (4) Village survey schedule for non-CNF GPs (5) PMDS schedule to collect the data from CNF household about PMDS details, (6) Questionnaire for CNF households, (7) Questionnaire for non-CNF households, (8) Checklist for Case Studies, and (9) Checklist for Strategic Interviews, (10) Checklist for Focused Group Discussions, (11) Schedule to record the CCE related details, were used. Further, the Kharif CNF and non-CNF households' schedules were revised for the Rabi survey. The quantitative filed-based instruments have in-built checks with appropriate skip patterns 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 the last week of September 2020. The field staff is placed continuously in the field/ districts to track the farming and related activities of sample farmers throughout the year. Each sample CNF farmer was visited about eight times and each non-CNF farmer is visited about six times by the field staff to collect the data throughout the year. Senior team members have visited the field and cross-checked the information filled and participated in data collection processes; conducted SIs with DPMs and a few field staff of RySS, participated in the FGDs, visited fields, especially the model farmers and their farm practices and social entrepreneurs.

Out of total 13 crops, proposed to be covered during the present yearlong study, the study could not get enough observations for certain crops. Bengal gram is one important crop missed.⁸ These issues were discussed in the second and third interim reports. All the crops with less than minimum required number of observations are dropped from the crop wise analysis in those reports. In this report, nine crops are covered in the crop wise analysis, viz., Paddy, Groundnut, Cotton, Black gram, Maize, Red gram, Chillies, Green gram and Ragi. Out of these nine crops, eight crops have minimum planned 30 sample observations for the cost and returns estimates.

⁸ Despite increasing the sample size, the study could not get adequate observations, for all planned crops. One of the reasons is that PMDS is scarcely cultivated at the moment. Finding sample crops grown on such PMDS plots is very difficult. Another challenge is that sample farmers were selected at the beginning of Kharif season data. Therefore, certain predominantly Rabi crops such as Bengal gram were missed out in the sample.

Ragi is the only exception. However, it is included as a special case (Table 1.4). All the nine crops are analysed with respect to cost of cultivation and marketing parameters. Other four crops' details were included in the household income estimates.

Table 1.4: Crop wise sample for cost and returns estimates in 2020-21 Report

In number

Crop	Kharif		Rabi		Kharif+Rabi	
	CNF	non-CNF	CNF	non-CNF	CNF	non-CNF
Paddy	819	501	291	266	1110	767
Groundnut	46	58	44	18	90	76
Cotton	54	57	0	0	54	57
Black gram	13	50	175	126	188	176
Maize	29	55	90	58	119	113
Red gram	45	66			45	66
Chilies	15	41	15	26	30	67
Green gram			67	41	67	41
Ragi	9	48			9	48

Source: APCNF Field Survey 2020-21

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 major crop, is identified. From this parcel of land, a plot of *size as required by the procedure* has been selected at random for estimating yield through CCEs. It is to be noted that the study has adopted standard methodology of Indian Agricultural Statistical Research Institute (IASRI), which is followed by NSSO and Directorate of Economics and Statistics (DES) of all states, including Andhra Pradesh, for conducting CCEs. It was planned to conduct at least one CCE for each sample farmer to get adequate sample for each crop. Crop wise number of CCEs conducted at district level is shown in Table 1.5. But 30 plus CCEs were obtained only for six crops from CNF farmers. In all 840 CCEs from CNF plots of project sample and 407 CCEs from non-CNF plots of control sample were conducted during Kharif season. During Rabi season, only 356 CNF and 234 non-CNF CCE were conducted. CCEs were affected by Covid 19 restrictions. Some villagers, on their own, prevented the entry of outsiders into their villages. In total, 1,837 CCEs, including 1,196 CNF and 641 non-CNF, were conducted during the year.

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

Crop	Kharif			Rabi			Kharif+ Rabi		
	PMDS+ CNF	Non- CNF	Total	PMDS+ CNF	Non- CNF	Total	PMDS+ CNF	Non- CNF	Total
Paddy	507	129	636	131	102	233	638	231	869
Groundnut	33	32	65	38	36	74	71	68	139
Cotton	82	45	127	16	10	26	98	55	153
Black Gram	36	31	67	57	26	83	93	57	150
Red Gram	48	62	110				48	62	110
Chilies				8	17	25	8	17	25
Green gram				23	16	39	23	16	39
Maize				65	13	78	65	13	78
Jowar				5	6	11	5	6	11
Ragi	32	20	52				32	20	52
Bengal gram				13	3	16	13	3	16
Total (Including other crops)	840	407	1,247	356	234	590	1,196	641	1,837

Source: APCNF Field Survey 2020-21

1.5. Data entry, processing and analysis

The data entry Program was written in CS-Pro software and used for data entry and processing. Data is processed using the SPSS and Excel software. A separate mobile-based app is developed/ generated to enter the CCEs' information; and training is given to all the field staff, after duly installing the app on their mobiles.

Descriptive statistics, frequency distributions and cross tabulation are generated at state level, agro-climatic zone wise, farm category wise and district wise. In the previous report, it was felt that district level tables could not be prepared for all, but one, crop, viz. Paddy, owing to inadequate number of sample observations at the district level. Therefore, this year, it was planned to analyze the data at the agro-climatic zones, instead of districts. The list of agro-climatic zones is shown in the appendix 1, at the end of this chapter.

1.5.1. Sample Weights for Cross Section Survey

All the analysis is carried with weighted descriptive statistics. For any estimate of the aggregate for the state, Y_s is derived as the sum of estimates of aggregates of the strata (districts) i.e.

$$Y_s = \sum Y_j$$

where Y_j is estimate of aggregate for the j^{th} Strata (district).

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

1.5.2. In case of CNF

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

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

n = number of Gram Panchayats in the district,

z_i = number of CNF cultivators in GP,

H_i = number of households listed,

h_i = number of households selected,

y = any characteristic of household.

‘i’ stands for the GP and ‘k’ stands for the farmer

1.5.3. In case of non-CNF,

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

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

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

W_i = number of Wards in the village,

w_i = number of wards selected for listing,

H_i = number of households listed,

h_i = number of households selected, and

y = any characteristic of household.

1.6. Structure of the Report

The report has nine chapters and an executive summary. The context, objectives and methodology of the study have been presented in Chapter 1. Chapter 2 describes the socio-economic profile of the sample CNF and non-CNF households. The parameters used include socio-economic group composition, literacy levels, occupation, and age of the head of the households, farm categories, etc. Chapter 3 focused on the state level analysis. It has covered the comparative analyses between the CNF and non-CNF farmers with regards to the changes in expenditure on Plant Nutrient and Plant protection inputs (PNPIs), paid-out costs, crop

yields, gross and net values of output. The chapter also assessed the impact of the CNF on resources use such as land, labour, purchased inputs, credit mobilization, water, and technologies at the state level. It also elaborated the changes in the marketing of CNF output at the state level. Chapter 4 and 5 have discussed the same issues covered in chapter 3, at the agro-climatic zone level and farm category level, respectively. Chapter 6 has discussed the impact of the CNF on the household income. The actual benefits that accrued to the state due to CNF project and the potential benefits of CNF are discussed in chapter 7. The environmental and well-being benefits of CNF are discussed in chapter 8. In chapter 9, the issues, challenges and suggestions are deliberated.

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

S No	Name of the Zone	Districts and Mandals
I	High-altitude and Tribal areas (HAT) Zone	This zone consists of 37 High altitude and Tribal areas mandals. These include eight mandals, viz., (1) Hiramandalam, (2) Seethampeta, (3) Kothuru, (4) Bhamini, (5) Meliaputti, (6) Saravakota, (7) Pathapatnam, and (8) Mandasa of Srikakulam district; seven mandals, viz., (9) Gummalakshmipuram, (10) Komarada; (11) Kurupam, (12) Makuva, (13) Pachipenta, (14) Parvathipuram, and (15) Saluru of Vizianagaram district; and eleven mandals, viz., (16) Ananthagiri, (17) Arakuvalley, (18) Hukumpeta, (19) Koyyuru, (20) Chintapalle, (21) G. madugula, (22) Gudem Kotha Veedhi, (23) Dumbriguda, (24) Munchingiputtu, (25) Paderu, and (26) Pedabayalu of Visakhapatnam; and eleven mandals, viz. (27) Addatheegala, (28) Chinthuru, (29) Devipatnam, (30) Gangavaram, (31) Kunavaram, (32) Maredumilli, (33) Rajavommangi, (34) Rampachodavaram, (35) V.R. Puram, (36) Y. Ramavaram, and (37) Yetapaka of East Godavari districts. ⁹
II	North Coastal Zone	All mandals of Srikakulam, Vizianagaram, and Visakhapatnam districts, excluding first 26 mandals (i.e., 1 to 26) of HAT zone, mentioned above.
III	Godavari Zone	All mandals of East Godavari, excluding last 11 mandals (i.e., 27 to 37) of HAT zone, mention above and all mandals of West Godavari district
IV	Krishna Zone	All mandals of Krishna, Guntur and Prakasam districts
V	Southern Zone	All mandals of Nellore, Chittoor and Kadapa districts
VI	Scarce Rainfall Zone	All mandals of Kurnool and Anantapur districts

⁹ Information was provided by Associate Director of Research (ADR), Chintapalle.

Chapter 2: Social Inclusion: Profiles of CNF and Non-CNF Farmers

2.1. Introduction

This chapter compares the socio-economic profiles of the farmers of CNF with those of non-CNF to assess whether they differ in their composition of profiles. It is very pertinent to note here that the CNF sample of farmers are drawn from the CNF universe of the Grama Panchayats (GPs) and the sample of non-CNF farmers are from the non-CNF farmers of the Grama Panchayats. As mentioned in the previous chapter, RySS has positive bias towards poor and vulnerable sections and has been focusing on those sections. Hence the profile of CNF farmers is expected to reflect this positive bias. Further, this year, the study is focusing on PMDS farmers. As PMDS is a new initiative, the participants, by default, would be the core constituency of RySS, i.e., the poorest of the poor. On the other hand, the profile of non-CNF farmers is expected to reflect the average profile of the entire farming community in the state. The profiles of CNF and non-CNF farmers are analyzed with respect to select economic, social and demographic indicators. Differences in social group, gender, age, education, land ownership and operation categories among CNF and non-CNF farmers have been highlighted in this chapter.

2.2. Social Inclusiveness

Under this section, two indicators, viz., social categories and Gender categories are analyzed.

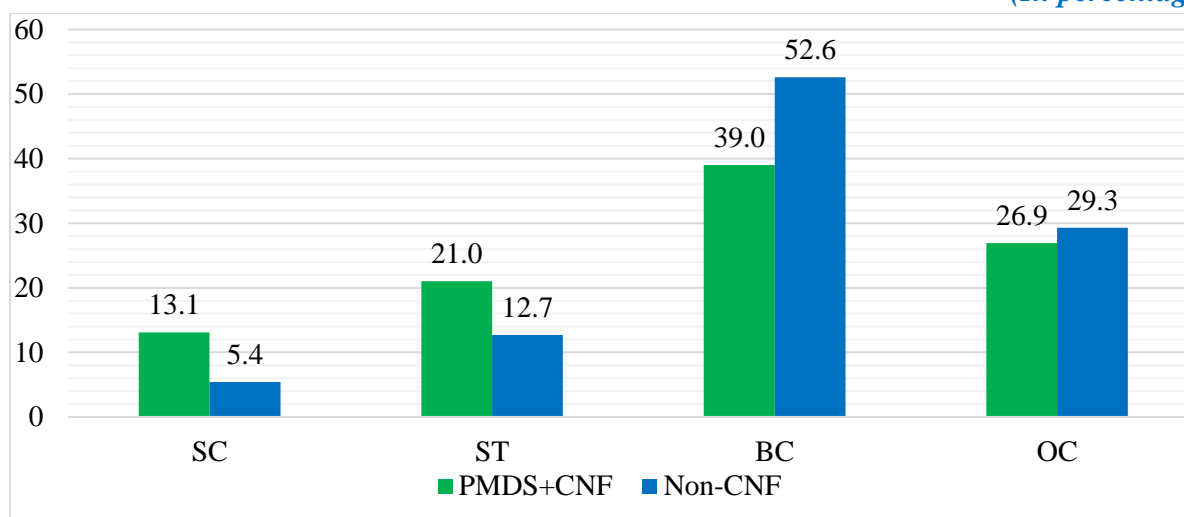
2.2.1. Social Categories

RySS's positive bias towards poor and vulnerable sections has clearly manifested in the social composition of CNF farmers. The Scheduled Caste (SC) farmers, who are the most resource poor, constitutes 13.1 percent in CNF farmers. The same is just 5.4 percent among non-CNF farmers. Though landed, the Scheduled Tribes (ST), the most backward farming community, constitutes 21 percent in CNF farmers vis-à-vis 12.7 percent in non-CNF. Consequently, the share of Backward Castes (BCs) and Other Castes (OCs), who are relatively better off vis-a-vis SCs and STs in terms of resource base, access to infrastructure, market information, technologies, etc., are less represented by 13.6 percentage points and 2.6 percentage points, respectively, in CNF farmers compared to non-CNF farmers (Figure 2.1). Representation of SCs is more among CNF compared to non-CNF in all the agroclimatic zones except in the

high-altitude zone where predominantly tribal population resides. Similarly, tribal farmers are present in higher proportion among CNF in all the zones except in the Scarce Rainfall Zone. It is important to note that almost all the tribal farmers have adopted CNF in the CNF gram panchayats of High-Altitude Zone. As a matter of fact, the participation of tribal farmers in CNF is higher by 30 percentage points over non-CNF. The conversion into CNF from non-CNF of these communities is faster due to the benefits from CNF that alleviate their distress conditions. Moreover, natural farming is close to their hearts down the centuries. Presence of SCs and STs across all the categories of farmers in CNF compared to non-CNF indicates the fact that relatively larger percentage of marginalised sections of farmers are shifting to CNF from non-CNF (Figure 2.1)¹⁰.

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

(In percentage)



Source: IDSAP Field Survey, 2020-21

2.2.2. Gender Composition

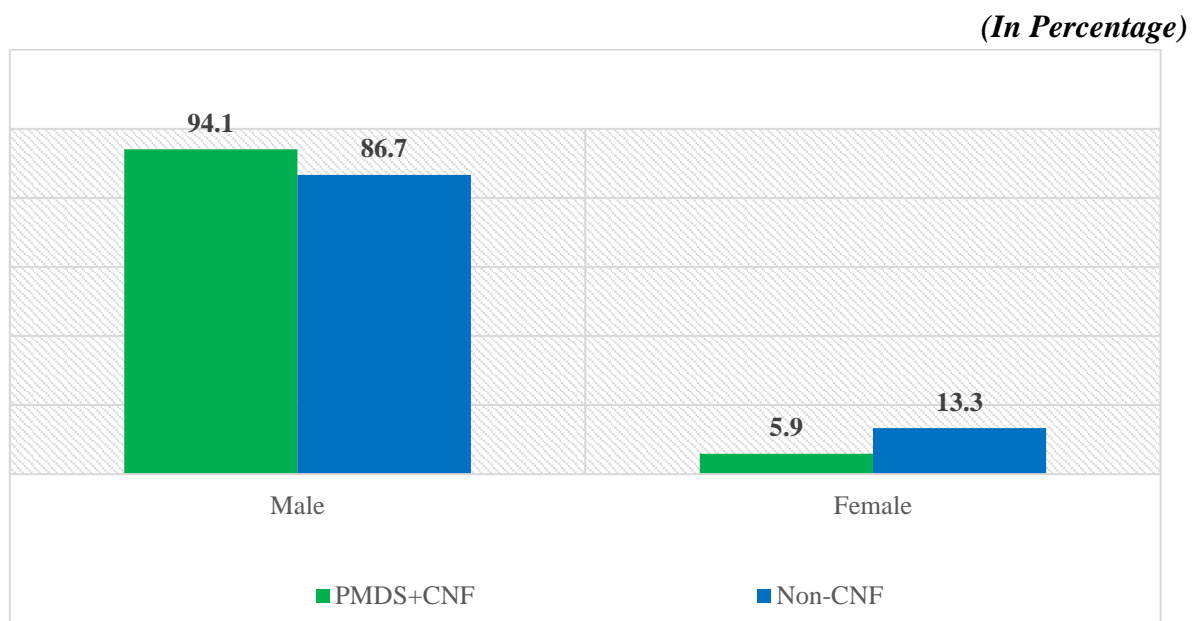
It may be noted that the poor and vulnerable sections also have less occupational diversity, especially in the non-farm sectors and outside their villages. As they do not find employment in non-farm sectors and outside their villages, they remain poor. As the share of poor and susceptible is high among CNF farmers, the share of male farmers is high in CNF sample compared to the sample of non-CNF farmers. (Figure 2.2). It appears that the social and economic variations are influencing factor in low proportion of women farmers among CNF sample vis-à-vis non-CNF sample. RySS has been working with women self-help group (SHG) institutions and has a very high positive bias towards women farmers. There are a number of

¹⁰ Almost all tables hereafter in the report are given at the end of each chapter

interesting and inspiring case studies and models by women farmers. For example, Ms Usha from Guntur district, a female headed farmers, apart from cultivating CNF crops on her seven acres, is running a successful biological input shop with ₹.40 lakh annual turnover. Ms. Jartha Malliswari, from East Godavari district, claims that her family came out of indebtedness because of CNF.

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

Figure 2.2: Distribution of CNF and non-CNF according to the gender of the household head



Source: IDSAP Field Survey, 2020-21

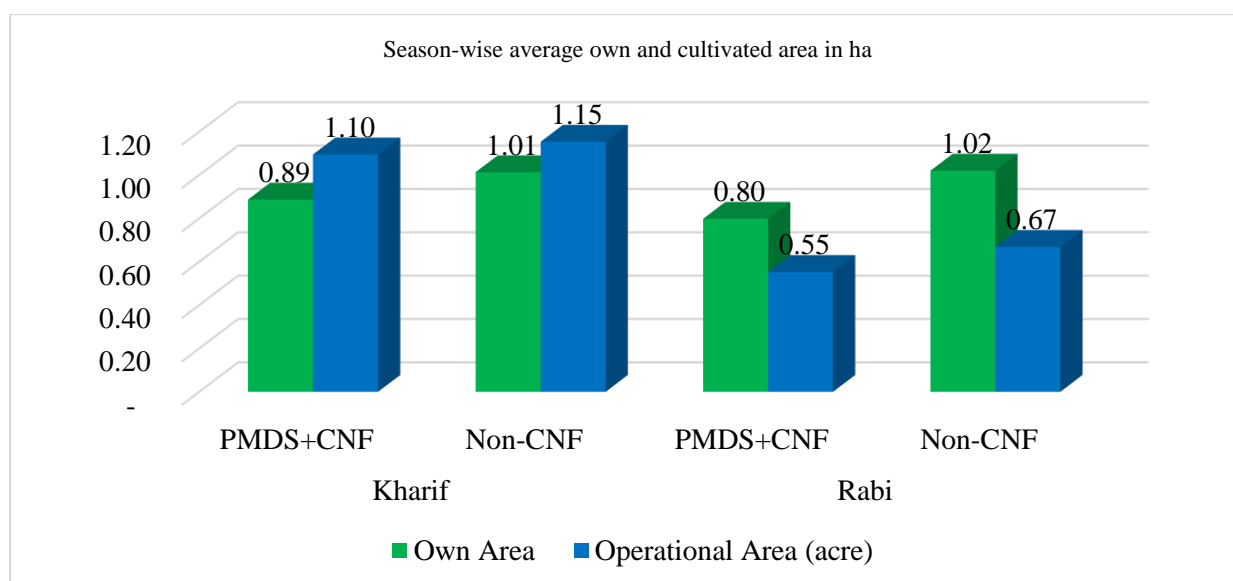
2.3. Economic Inclusiveness

This section, gives the average holding sizes and the composition farm categories.

2.3.1. Average own and operational area

On average, the CNF farmers own 0.89 hectare per household, compare to 1.01 hectare per household, owned by the non-CNF farmers, i.e., 14.2 percent less area. It again confirms that CNF sample farmers are poor vis-à-vis non-CNF farmers. But CNF farmers have cultivated on average 1.10 hectare during the Kharif season. It is 23.45 percentage higher than the average owned land-size. On the other hand, non-CNF farmers have cultivated on the average 1.15 hectare during Kharif, which is 13.87 percent higher than their average own holding size. The CNF farmers', who have cultivated land during Rabi season, on the average owned area of 0.80 ha, but they have cultivated on the average 0.55 hectare during Rabi season, i.e., 30.72 percent less area. At the same time, the non-CNF farmers, who cultivated during Rabi season, have average owned area of 1.02 ha. However, they have cultivated on average 0.67 ha, which is 34.44 percent less area during Rabi season (Figure 2.3).

Figure 2.3: Season wise average own and cultivated area by CNF and non-CNF farmers



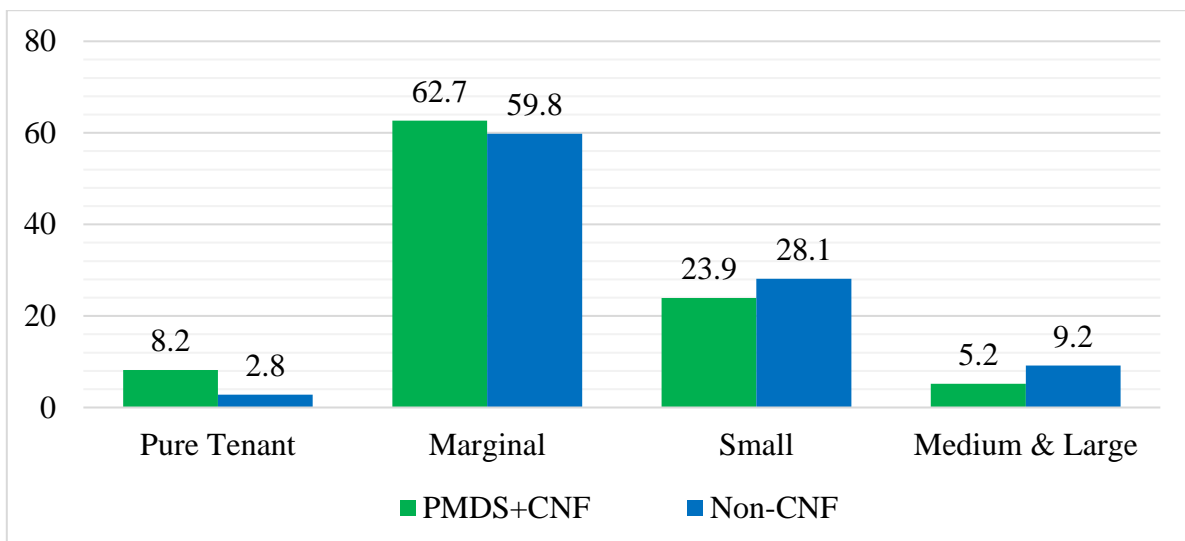
Source: IDSAP Field Survey, 2020-21

2.3.2. Composition of Category of Farmers

Marginal farmers and pure tenant farmers are higher in CNF than that of non-CNF by 2.9% and 5.4% percentage points respectively in the state (Figure 2.4). This again establishes the fact that CNF farmers are relatively poorer compared to non-CNF. Across all the agroclimatic zones except in the High-Altitude Zone, the presence of pure tenant farmers in CNF is higher

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

Figure 2.4: Farm-category wise Distribution of CNF and non-CNF farmers (in %)



Source: IDSAP Field Survey, 2020-21

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

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

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

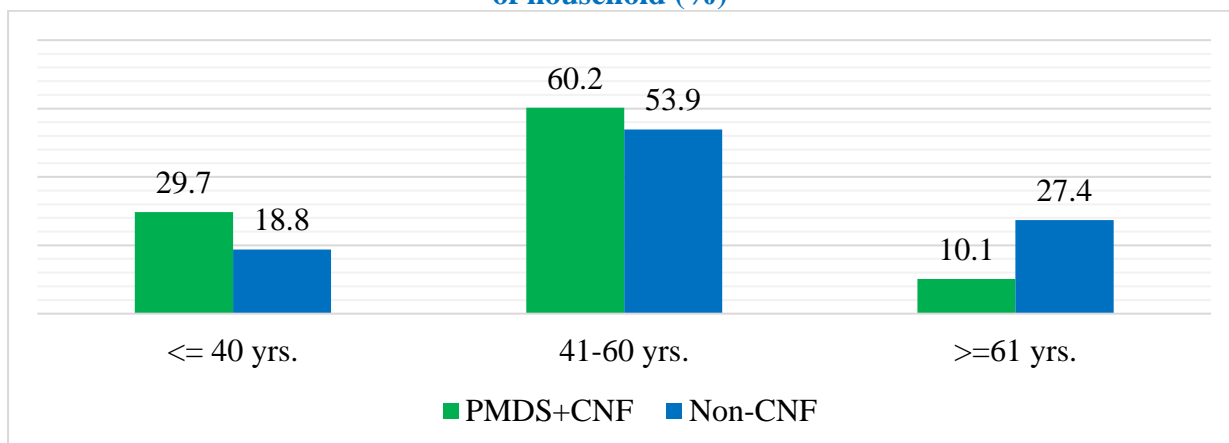
2.4. Select demographic features of CNF and non-CNF farmers

In this section, the age, education and occupations of CNF and non-CNF farmers are discussed.

2.4.1. Age of Farmers

The age composition of the farmers in CNF and non-CNF is given in the Figure 2.5. It is striking to note that more of younger, and middle aged, and less of older farmers are into CNF than those into non-CNF. The younger and middle-aged farmers are more into CNF by 11 percentage points and 6 percentage points respectively and the old-aged farmers lower by 17.3 percentage points. This clearly provides compelling evidence that CNF has attracted the young and middle-aged farmers. All the zones experienced this pattern. But this is pronounced among the High Altitude, Godavari, Krishna, and Scarce Rainfall zones among the zones in case of young farmers. Similarly, North Coastal Zone and Southern Zone in case of middle-aged farmers. The same is true across districts except in West Godavari district where old age farmers have participated in CNF. This is also true across all the categories of farmers.

Figure 2.5: Composition of CNF and non-CNF farmers according to the age of the head of household (%)

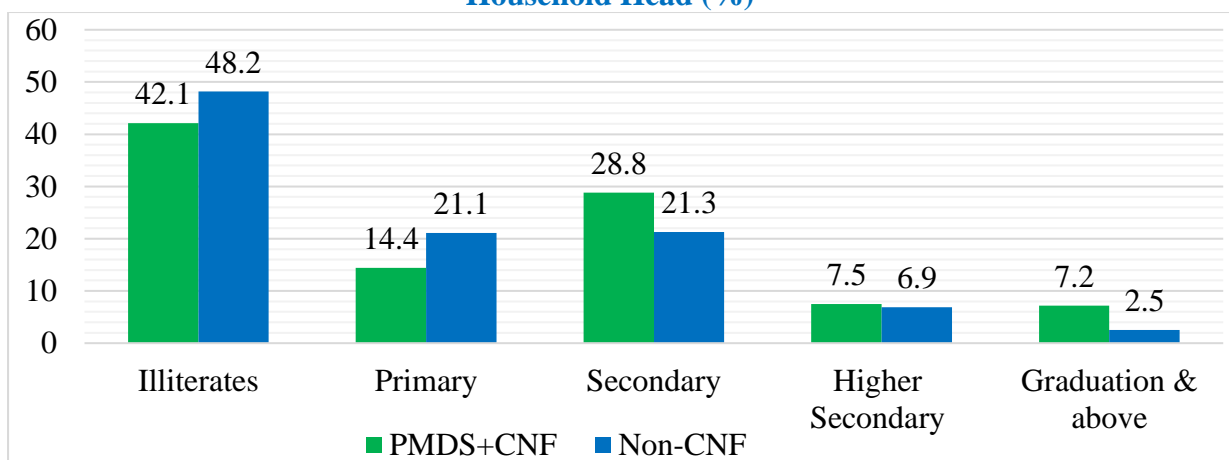


Source: IDSAP Field Survey, 2020-21

2.4.2. Literacy levels of Farmers

Relatively fewer illiterate farmers and fewer with primary education are among CNF farmers compared to non-CNF farmers. A greater number of highly educated farmers who have educational qualifications above secondary level, and above graduation are into CNF. The illiterate farmers are lower by 6.1 percentage points, farmers with secondary education, higher secondary/Diploma, and graduation and above are more by 7.5; 0.6; 4.7 per centage points in CNF over non-CNF in the state (Figure 2.6).

Figure 2.6: Composition of CNF and non-CNF farmers according to Education Level of Household Head (%)



Source: IDSAP Field Survey, 2020-21

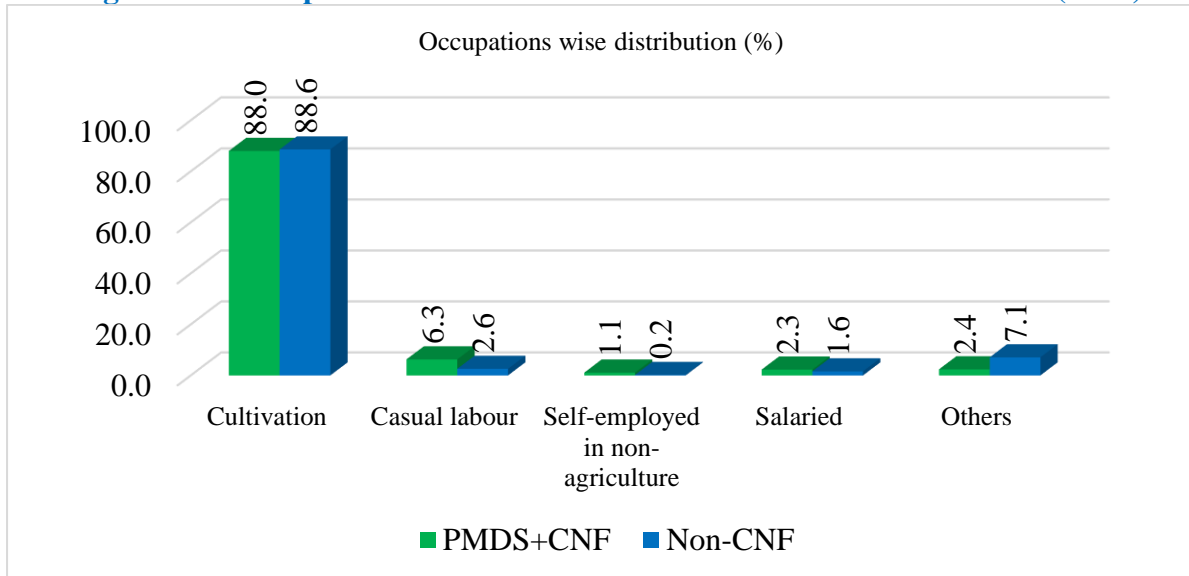
This is clearly a pointer to the fact that the educated are slowly moving into CNF. All the agroclimatic zones have undergone by and large though this process of educated getting into CNF slowly. Visakhapatnam compared to Srikakulam and Vizianagaram is ahead in this. East Godavari district is relatively better off compared to West Godavari in Godavari Zone. Guntur district compared to Krishna and Prakasam had more educated CNF framers from Krishna Zone. Chittoor in comparison with YSR Kadapa and Nellore has a greater number of CNF farmers from Southern Zone. Anantapuramu district has higher percentage of educate farmers than Kurnool in the Scarce rainfall zone.

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

2.4.3. Occupations of CNF and non-CNF farmers

This section analysis the major occupation (as per time criterion) of the head of the family. The data in Figure 2.7 clearly indicates that CNF is attracting not only informed farmers, who have own non-farm enterprises and salaried employment, but also poor and vulnerable farmers, whose major occupation is casual labour. Among the CNF farmers 88 percent reported cultivation as their main occupation, while 88.6% of the non-CNF farmers reported cultivation as their main occupation. Casual labour (6.3%), self-employment in non-farm activities (1.1%) and salaried employment (2.3%), and other occupations (2.4%) have been reported as the main occupation of the other CNF farmers. Some of the non-CNF farmers also reported these occupations as being their main occupations. Precisely 6.3% of the CNF farmers reported casual labour as their main occupation as against only 2.6 % of the non-CNF farmers(Figure 2.7).

Figure 2.7: Occupation wise distribution of CNF and non-CNF farmers (in %)



Source: IDSAP Field Survey, 2020-21

2.5. Conclusion

The profile of CNF and non-CNF farmers clearly indicate that RySS is fulfilling one of its core objectives of social inclusion. Compared to non-CNF farmers, higher shares of CNF farmers can be found in SC and ST social categories. Higher percentage of tenants and marginal farmers have opted for CNF. The average holding sizes of CNF farmers is smaller than that of non-CNF farmers. CNF is, not only, attracting the young, educated, informed (salaried and self-employed in non-farm sectors), but also resource poor (casual labour).

Tables of Chapter 2

Table 2.1: Agroclimatic zone wise, Farm size wise and district wise distribution of CNF and non-CNF farmers across the social categories

In percentages

Zone/ Farm category/ District	SC	ST	BC	OC	Total
I. Agroclimatic Zone					
<u>CNF Farmers</u>					
High Altitude Zone	0.0	99.0	0.0	1.0	100.0
North Coastal Zone	5.5	25.3	63.8	5.4	100.0
Godavari Zone	4.0	38.7	25.0	32.2	100.0
Krishna Zone	23.5	1.6	48.0	27.0	100.0
Southern Zone	18.4	3.1	31.6	47.0	100.0
Scarce Rainfall Zone	17.1	1.8	78.2	2.9	100.0
Total	13.1	21.0	39.0	26.9	100.0
<u>Non-CNF Farmers</u>					
High Altitude Zone	1.5	69.2	27.1	2.2	100.0
North Coastal Zone	3.6	4.7	87.3	4.4	100.0
Godavari Zone	2.9	0.0	34.0	63.1	100.0
Krishna Zone	0.9	0.8	63.8	34.5	100.0
Southern Zone	9.7	1.6	29.6	59.2	100.0
Scarce Rainfall Zone	11.8	6.0	60.3	22.0	100.0
Total	5.4	12.7	52.6	29.3	100.0
II. Farm-Size Composition					
<u>CNF Farmers</u>					
Pure Tenant	30.9	4.6	47.0	17.5	100.0
Marginal	13.5	21.1	42.3	23.0	100.0
Small	6.6	27.0	30.1	36.4	100.0
Medium & Large	9.4	18.2	28.1	44.3	100.0
Total	13.1	21.0	39.0	26.9	100.0
<u>Non-CNF Farmers</u>					
Pure Tenant	8.7	0.0	62.9	28.4	100.0
Marginal	5.6	10.7	58.1	25.6	100.0
Small	4.6	17.7	42.2	35.4	100.0
Medium & Large	5.6	14.4	45.4	34.7	100.0
Total	5.4	12.7	52.6	29.3	100.0
III. District wise Distribution					
<u>CNF Farmers</u>					
Srikakulam	1.9	1.7	88.6	7.7	100.0
Vizianagaram	0.8	41.5	57.7	0.0	100.0

Visakhapatnam	6.1	72.2	16.0	5.8	100.0
East Godavari	1.7	29.7	43.7	24.9	100.0
West Godavari	5.7	45.3	11.4	37.5	100.0
Krishna	20.8	0.0	60.4	18.8	100.0
Guntur	37.8	4.1	27.2	30.9	100.0
Prakasam	17.5	3.3	34.6	44.5	100.0
SPS Nellore	22.4	15.1	47.2	15.3	100.0
YSR Kadapa	16.1	0.0	30.0	53.9	100.0
Kurnool	6.1	0.0	91.8	2.0	100.0
Anantapuramu	42.0	5.9	47.3	4.8	100.0
Chittoor	20.3	1.5	25.2	53.1	100.0
Total	13.1	21.0	39.0	26.9	100.0
<u>Non-CNF Households</u>					
Srikakulam	6.3	1.8	91.9	0.0	100.0
Vizianagaram	4.6	24.2	71.2	0.0	100.0
Visakhapatnam	0.0	43.1	50.8	6.1	100.0
East Godavari	0.0	47.6	13.8	38.6	100.0
West Godavari	4.5	0.0	36.6	58.9	100.0
Krishna	0.0	0.0	90.3	9.7	100.0
Guntur	0.0	3.3	60.5	36.1	100.0
Prakasam	2.2	0.0	44.3	53.5	100.0
SPS Nellore	32.4	0.0	11.0	56.7	100.0
YSR Kadapa	2.1	5.2	41.1	51.6	100.0
Kurnool	11.6	0.0	79.7	8.7	100.0
Anantapuramu	12.1	15.2	30.4	42.3	100.0
Chittoor	5.2	0.9	31.4	62.5	100.0
Total	5.4	12.7	52.6	29.3	100.0

Source: IDSAP Field Survey, 2020-21

Table 2.2: Agroclimatic zone wise, Farm category composition wise and District-wise Gender classification of Head of Households of CNF and non-CNF farmers

In percentages

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

Source: IDSAP Field Survey, 2020-21

Table 2.3: Agroclimatic zone wise and District-wise distribution of CNF and non-CNF farmers across Farm-size Groups

In percentages

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

Source: IDSAP Field Survey, 2020-21

Table 2.4: Agroclimatic zone wise, Farm-Size wise and District-wise distribution of CNF and non-CNF farmers according to Age of the Head of the Household

In percentages

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

Source: IDSAP Field Survey 2020-21

Table 2.5 Agroclimatic zone wise, Farm-Size wise and District-wise distribution of CNF and non-CNF farmers according to Education level of the Farmer Households

in Percentages

Zone/ farm category/ district	Illiterates	Up to Primary	Up to Secondary	Higher Secondary/ Diploma	Graduation & above	Total
I. Agroclimatic Zone						
<u>CNF Farmers</u>						
High Altitude Zone	50.6	8.8	21.6	12.5	6.6	100.0
North Coastal Zone	49.3	14.4	24.9	8.0	3.5	100.0
Godavari Zone	38.1	21.0	27.1	7.0	6.8	100.0
Krishna Zone	36.4	18.7	25.2	8.3	11.4	100.0
Southern Zone	37.8	13.1	36.3	5.4	7.3	100.0
Scarce Rainfall Zone	55.1	5.7	22.2	9.2	7.8	100.0
Total	42.1	14.4	28.8	7.5	7.2	100.0
<u>Non-CNF Households</u>						
High Altitude Zone	65.5	14.7	10.2	5.5	4.1	100.0
North Coastal Zone	61.7	5.5	22.7	7.9	2.2	100.0
Godavari Zone	35.4	19.0	35.1	5.9	4.6	100.0
Krishna Zone	49.7	20.2	21.3	5.5	3.4	100.0
Southern Zone	27.9	38.2	29.0	3.3	1.6	100.0
Scarce Rainfall Zone	47.4	24.8	14.0	13.1	0.8	100.0
Total	48.2	21.1	21.3	6.9	2.5	100.0
II. Farm-Size Composition						
<u>CNF Farmers</u>						
Pure Tenant	42.4	21.9	27.9	4.2	3.6	100.0
Marginal	40.8	13.5	31.3	7.0	7.4	100.0
Small	42.9	16.1	22.6	10.6	7.8	100.0
Medium & Large	52.4	5.4	29.0	5.2	8.1	100.0
Total	42.1	14.4	28.8	7.5	7.2	100.0
<u>Non-CNF Households</u>						
Pure Tenant	57.4	8.6	12.7	21.3	0.0	100.0
Marginal	50.8	21.7	20.7	5.2	1.7	100.0
Small	44.3	21.5	23.8	7.7	2.8	100.0
Medium & Large	40.8	19.8	19.6	11.4	8.3	100.0
Total	48.2	21.1	21.3	6.9	2.5	100.0
III. District-wise Distribution						
<u>CNF Farmers</u>						
Srikakulam	44.8	14.6	30.0	5.8	4.9	100.0
Vizianagaram	50.3	18.8	21.3	5.4	4.2	100.0
Visakhapatnam	50.5	6.8	24.0	13.8	4.8	100.0

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

Source: IDSAP Field Survey, 2020-21

Chapter 3: Impact of CNF on the farming conditions

3.1. Introduction

This chapter assesses the impact of natural farming which includes the pre monsoon dry sowing (CNF) practice, on three aspects of the farming, viz. (1) costs and returns from the crop cultivation, and (2) use of farm inputs and input markets, and (3) output marketing.

3.2. Costs and returns from the crop cultivation

This section assesses the impact of natural farming which includes the pre monsoon dry sowing (CNF) practice, on the cost of cultivation, crop yields and gross and net values of output for selected crops for the agricultural year 2020-21, i.e., Kharif plus Rabi seasons. It is already well established, in the previous years' studies, that Andhra Pradesh Community Managed Natural Farming (APCNF) substantially reduces the expenditure on plant nutrients and protection inputs (PNPIs).¹¹ The reduction in the expenditure on PNPIs, in turn, is resulting in a significant savings in the paid-out costs for the CNF farmers; and the yield level remained unchanged or increased for most of the crops, with a few exceptions. RySS has initiated pre-monsoon dry sowing (PMDS) cultivation to enhance soil fertility. This study covers only PMDS plots on which select crops grown under CNF during Kharif and/ or Rabi season of 2020-21. PMDS is expected to improve the yields of all crops.¹² On the other hand, being a little more labor-intensive process, CNF needs higher labour input vis-à-vis non-CNF, especially in the preparation of the biological inputs. Given the nature of the preparation of biological inputs, which involves a number of smaller tasks, which are spread over several days, they need to be performed by the family members. The tasks include collection and

¹¹ Expenditure on biological inputs such as Bheejamrutham, Jeevamrutham, Kashayams and Ashtrams under CNF cultivation and fertilizers and pesticides under non-CNF cultivation, together refereed as expenditure on plant nutrients and protection inputs (PNPIs), for the sake of comparative analysis.

¹² Cultivation of multiple (8 to 15) crops under PMDS is expected to enrich the soils through multiple ways. Firstly, the green manure from PMDS is expected to increase in soil corban. Secondly, the multiple crops under PMDS are expected to contribute for the biodiversity under the soil (subsoils). Thirdly, the plants, secrete part of nutrients, which they produce through photosynthesis, into the soils, enriching the soils and microorganism. Fourthly, the PMDS keep the soils under shade and protect the microorganism and soil moisture. And so on.

gathering of inputs such as cow dung, cow urine, leaves, etc., cleaning, grading, storing of raw materials, soaking, drying, grinding, mixing, fermenting, boiling/ cocking, and so on.

The results of 2020-21 survey are presented in this chapter. It may be noted that as the results of Kharif and Rabi surveys were separately analysed and reported in the form of the second and third interim reports (IDSAP, 2021a and 2021b), the *combined results of Kharif and Rabi*¹³ (*weighted average of Kharif and Rabi results*) are the focus of this chapter and the report.

The research questions addressed in this section are:

1. What are the changes in the expenditure on PNPIs?
2. What is the impact of CNF on the paid-out costs?
3. What are the changes in the crop yields because of CNF?
4. To what extent did the CNF produce fetch the higher prices?
5. What are the changes in gross value of output¹⁴?
6. What are the changes in the net value of output¹⁵ due to CNF?

Out of 13 crops selected for in-depth and comparative analysis in the present yearlong study, the survey got reasonable number of observations for nine crops, viz., Paddy, Groundnut, Cotton, Black gram, Maize, Red gram, Chilies, Green gram and Ragi. The study used the yields obtained through CCEs in the calculation of gross and net values of output.

Before discussing the impact of CNF on the farming conditions, a brief discussion about: (1) the structural differences in the project (treatment) sample and the control samples and (2) excess rainfall received across the state during the study period on the farming conditions is in order.

As seen in the previous chapter, the profiles of CNF and non-CNF sample differ considerably from each other, on certain crucial indicators. Broadly, the CNF sample households are from poorer and vulnerable sections and from poorer and interior areas. That is, the CNF sample farmers have certain disadvantage vis-à-vis non-CNF farmers and would have got lesser yields

¹³ The weighted average of Kharif and Rabi yields of each crop is obtained. The area under a crop in Kharif and Rabi seasons were used as the weights.

¹⁴ Instead of referring the gross value of crop output (crop output, obtained through adjusted CCEs, multiplied by realized or locally prevailing price reported by the sample farmers plus value of by-products, reported by the farmers) as “gross returns”, as the case in the earlier reports; it is referred in this report as gross value of output or gross value of crop or simply as gross value.

¹⁵ As discussed above, the term “net returns” is replaced with “net values of output” or simply “net values” or “net values of crops”.

and returns from conventional chemical farming. During the agriculture year 2020-21, the study period, the state has received about 26.8 percent excess rainfall during South-West Monsoon (from June to September, 2020); 25.1 percent excess rainfall during North-East Monsoon (from October to December, 2020); and 31.2 percent excess rainfall during the Winter Period (January and February 2021)¹⁶. Out of total 13 districts in the state, nine district, viz., East Godavari, West Godavari, Krishna, Guntur, SPSR Nellore, Chittoor, YSR Kadapa, Anantapuramu and Kurnool have received excess (20% and above) rainfall. Three districts, viz., Vizianagaram, Visakhapatnam and Prakasam have received normal (-19% to +19%) rainfall; and Srikakulam has received deficit (-20% to -59%) rainfall. Rayalaseema region has received about 55.7 % excess rainfall during the year.¹⁷ Many crops were adversely affected by the heavy rains. As of now, the official data about agricultural yields, are not available. The media, including the national media, covered extensively about the damages to agriculture in the state due to heavy rains in Kharif 2021.¹⁸ The local Telugu media covered stories and pictures of CNF crops' resistance to heavy rains. Many farmers, in the Focused Group Discussions (FGDs), said that CNF crops withstand heavy rains. For example, *in Mantenavari Palem village in Guntur district, the farmers, after seeing the resistance potential of CNF crops to heavy rains, during Kharif 2020, converted their entire cropped area into CNF farming during Rabi season 2020-21.*

3.2.1. Expenditure on Plant Nutrients and Protection Inputs

The biological inputs under CNF and the chemical inputs under non-CNF, together, are referred as plant nutrients and protection inputs (PNPIs). Crop wise expenditure on PNPIs under CNF and non-CNF are given at Figure 3.1. As expected, the CNF farmers are able to save in the expenditure on PNPIs in each and every crop. However, the savings are negligible in one crop, moderate in a few crops and substantial in others. As hypothesized and observed in earlier reports that the 'potential for savings in the expenditure on the PNPIs is higher in input intensive crops', once again proved to be correct in this survey also. The savings obtained in input intensive crops, such as Chilies (₹.22,359 per ha), Cotton (₹.9,919 per ha) and Paddy (₹.7,412) stand as the evidence to this. On the other hand, it is reestablished that the scope for

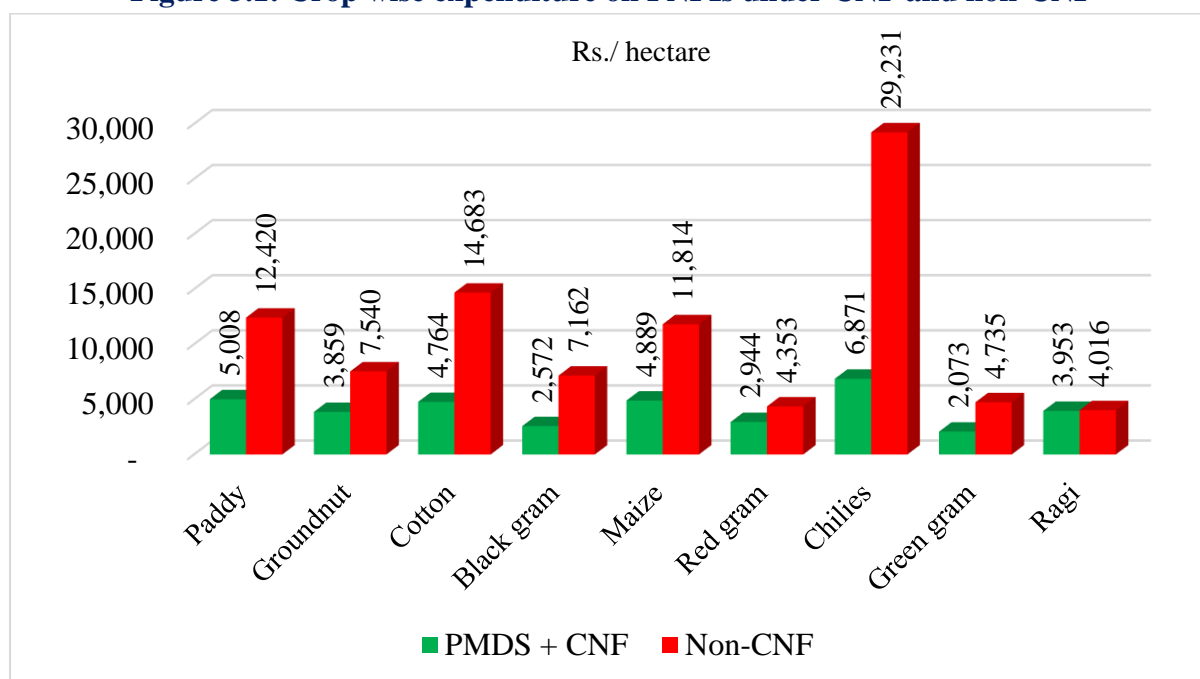
¹⁶ [https://apagrisnet.gov.in/2020/weekly/June/weekly_report_\(Rabi\)_21_09-03-2021.pdf](https://apagrisnet.gov.in/2020/weekly/June/weekly_report_(Rabi)_21_09-03-2021.pdf)

¹⁷ Ibid

¹⁸ See for example https://www.business-standard.com/article/economy-policy/crops-spread-over-800-000-hectares-damaged-in-flood-hit-andhra-121112300861_1.html
<https://timesofindia.indiatimes.com/city/amaravati/cyclone-nivar-rains-cause-extensive-damage-to-crops-in-andhra-pradesh/articleshow/79451111.cms>

reduction in expenditure on PNPIs is limited in less input intensive crops. Ragi and Red gram are cases in point.

Figure 3.1: Crop wise expenditure on PNPIs under CNF and non-CNF



Source: IDSAP Field Survey, 2020-21

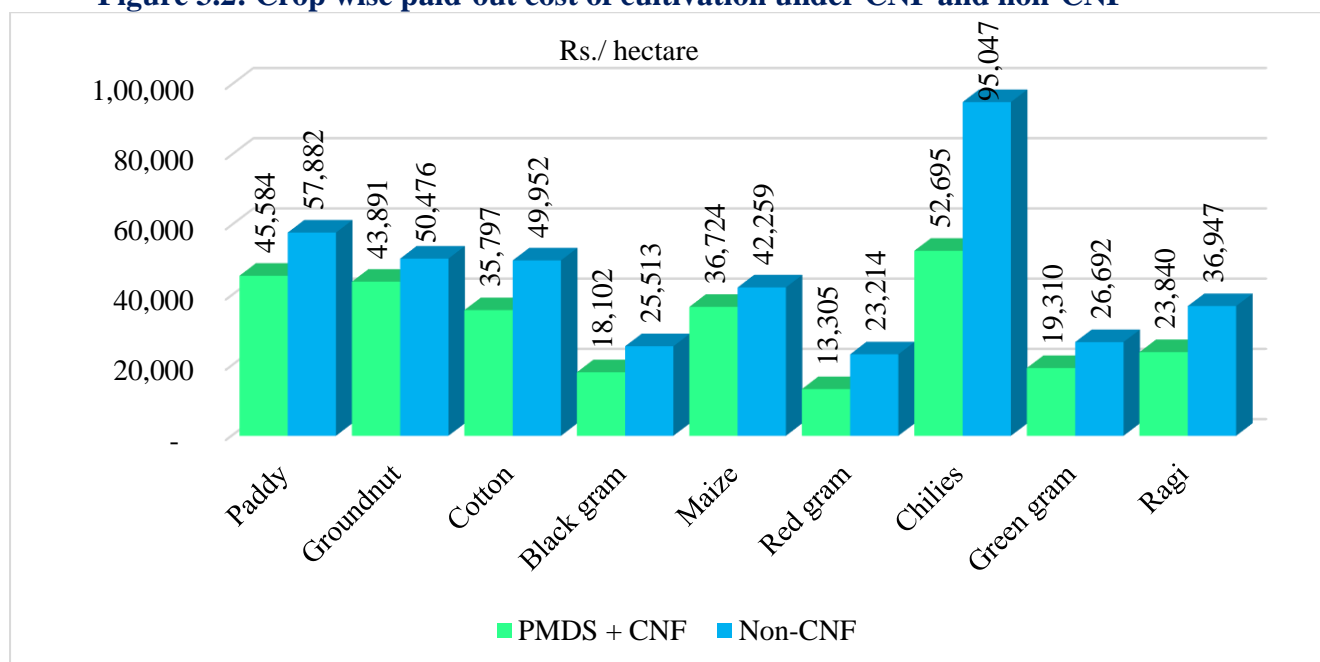
3.2.2. Costs of cultivation

Apart from expenditure on PNPIs, the survey has also collected the data about the costs of: (1) seeds, (2) human labour, (3) machine labour, (4) bullock labour, (5) implements, (6) farm-yard manure (FYM), and (7) Irrigation. In almost all items, the values of purchased items and own items are also collected. The values of all these purchased and own items (excluding own labour) used in the crop cultivation, together, are referred as the paid-out costs¹⁹ and presented in the Figure 3.2. As the case in PNPIs, the paid-out costs are less under CNF for each of the nine crops covered in this report. The savings are substantial in Chillies (₹.42,352 per ha), followed by Cotton (₹.14,155 per ha), Ragi (₹.13,107), Paddy (₹.12,298), and Red gram (₹.9,909 per ha). In percentage terms the savings, in paid-out costs, vary from 13.05% in Ragi to 44.56% in Chillies (Table 3.4). Per hectare savings in paid-out costs are over ₹.12,000 in four crops and over ₹.5,500 in remaining five crops. First time, it is observed that savings in the paid-out costs are larger than the saving obtained in the expenditure on PNPIs in eight out of nine crops considered. It is validating the claim of the CNF proponents that CNF needs less ploughing and other inputs, especially waters and electricity. As mentioned in the beginning of the chapter, the CNF farmers, who are relatively resource poor, naturally, spend less on

¹⁹ We have not included interest on working capital.

agriculture vis-à-vis non-CNF farmers. Further, it may be due to the fact that a part of paid-out costs, such as preparation of lands, might have been shifted to PMDS. If the costs of PMDS are included, the savings in the paid-out costs could be less than that of PNPIs.

Figure 3.2: Crop wise paid-out cost of cultivation under CNF and non-CNF

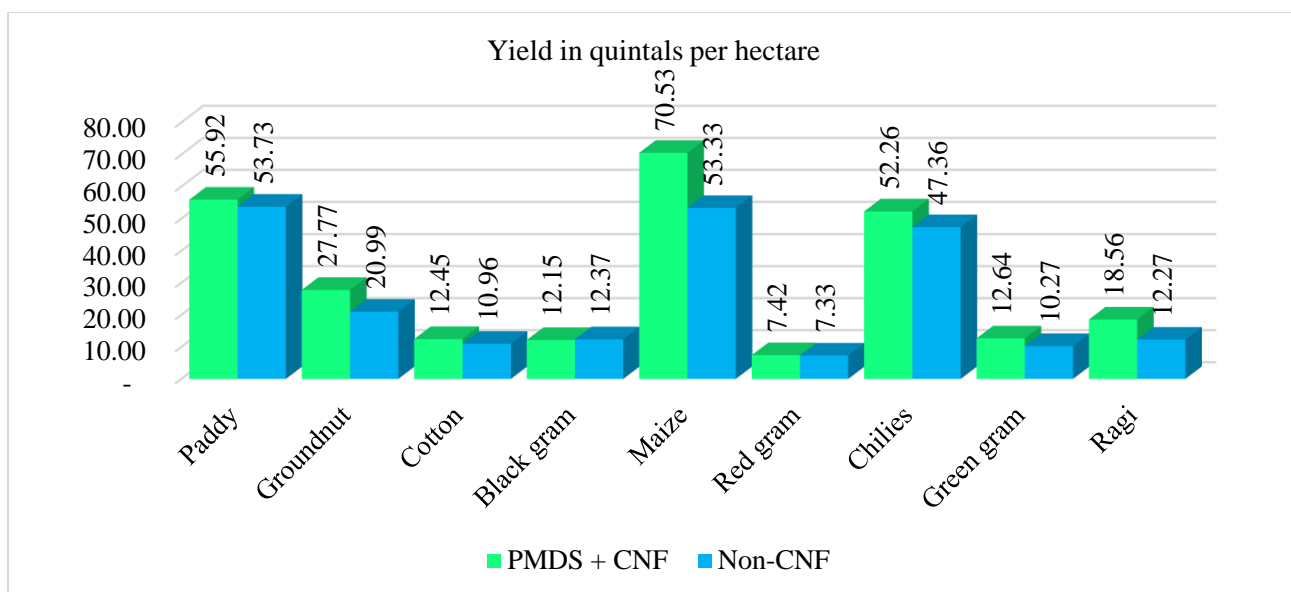


Source: IDSAP Field Survey, 2020-21

3.2.3. Crop yields

As mentioned in Chapter 1, the study has conducted CCEs for sample crops and farmers, to estimate the crop yields independently. CCEs are conducted for both CNF and non-CNF crops. Crop wise combined yields obtained during (Kharif+Rabi) 2020-21 under CNF and non-CNF condition are presented at Figure 3.3. Out of nine crops considered here, eight crops, viz. Paddy, Groundnut, Cotton, Maize, Red gram, Chillies, Green gram and Ragi have given higher yields under CNF. The only exception is Black gram, which has given 0.22 quintal per hectare lower yields under CNF. Among the eight crops, which have given higher yields, Maize has given 17 quintal per hectare higher yields under CNF, followed by Groundnut (6.78 quintals per ha), Ragi (6.29 quintals per ha), and Chillies (4.90 quintals per ha). In percentage terms also, CNF Ragi has recorded highest yield difference of 51.26% over non-CNF, followed by Groundnut (32.29%), Maize (32.25%) and Green gram (23.13). Paddy, which has mostly recorded lower yield under CNF vis-à-vis non-CNF, in the past surveys, has recorded 2.19 quintals (4.08%) higher yields under CNF during the study period. This time, Groundnut and Cotton, the second and third most widely cultivated crops in the state, also recorded notable and decisively higher yields under CNF (Table 3.5).

Figure 3.3: Crop wise combined (Kharif+Rabi) yields under CNF and non-CNF



Source: IDSAP Field Survey, 2020-21

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

As mentioned above, this year, the study has focused on PMDS, one of recent innovations and additions in the CNF. By improving the soil quality and productivity, PMDS is expected to enhance crop yields during Kharif 2020-21 season and beyond. The above yield analysis gives clear evidence about the efficacy of PMDS. Another way to know the potential impact of PMDS is to compare the CNF crop yields of last three years. Because of change in the sample frame and selection process in 2020-21, the current crop yields are not strictly comparable with those of last two years. Further, the variations in rainfall during last three years make the inter-year comparison of yields more complicated. To overcome these challenges, the season-wise differences between CNF and non-CNF yields of select crops during last three Kharif seasons and Rabi seasons are compared separately; as rainfall effect in the same season is not different between CNF and non-CNF. For all six crops, analyzed in the Kharif 2020-21 (second interim) report, comparable data is available for only three crops in 2018-19. Relevant data is available for four crops in 2019-20. The differences between CNF and non-CNF yields during last three Kharif seasons, in absolute and percentage terms are presented at Table 3.1. In the three crops of 2018-19, presented in Table 3.1, the differences between CNF and non-CNF are large in all three crops in 2020-21 compared to those of 2018-19. In the top three widely cultivated crops, viz., Paddy, Groundnut and Cotton, the CNF yields are higher than non-CNF yields during 2020-21 by 2.20, 2.53 and 1.49 quintals per hectare respectively. The same were -2.47, 1.83,

and 0.63 quintals per hectare in 2018-19. Compared to 2019-20, the differences between the CNF and non-CNF yields are considerably high in 2020-21 in Groundnut and Cotton and less in Paddy.

Table 3.1: Difference between CNF and non-CNF yields during last three Kharif seasons
In Percentage

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

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

The Rabi season results of last three year have categorically proved the efficacy of PMDS in enhancing the crop yields and crops' resilience to heavy rains. The gap between CNF and non-CNF yields in 2020-21 are higher than that of 2018-19 in all five crops considered here (Table 3.2). The gap in 2020-21 is higher than that of 2019-20 in all, but for one crop. The CNF Paddy yields were less than that of non-CNF during Rabi seasons of 2018-19 and 2019-20 by 4.52 and 4.81 quintals per ha respectively. However, the CNF Paddy yields of Rabi 2020-21 are 5.45 quintals higher than that of non-CNF. It must be the impact of PMDS in yield enhancement and crop resilience to the heavy rains. To sum up, the results indicate that PMDS has a reassuring impact in yield enhancements and crop resilience to the weather anomalies.

Table 3.2: Difference between CNF and non-CNF yields during last three Rabi seasons
In Percentage

Crop	Differences in quintals per ha			Differences in percentages		
	2018-19	2019-20	2020-21	2018-19	2019-20	2020-21
Paddy	-4.52	-4.81	5.45	-6.83	-7.02	9.54
Groundnut	0.57	1.28	10.62	3.34	4.76	41.47
Black gram	-0.83	0.27	-0.08	-11.10	2.40	-0.61
Maize	5.75	6.31	12.85	11.12	8.94	20.39
Green gram	-0.03		2.37	-0.41		23.08

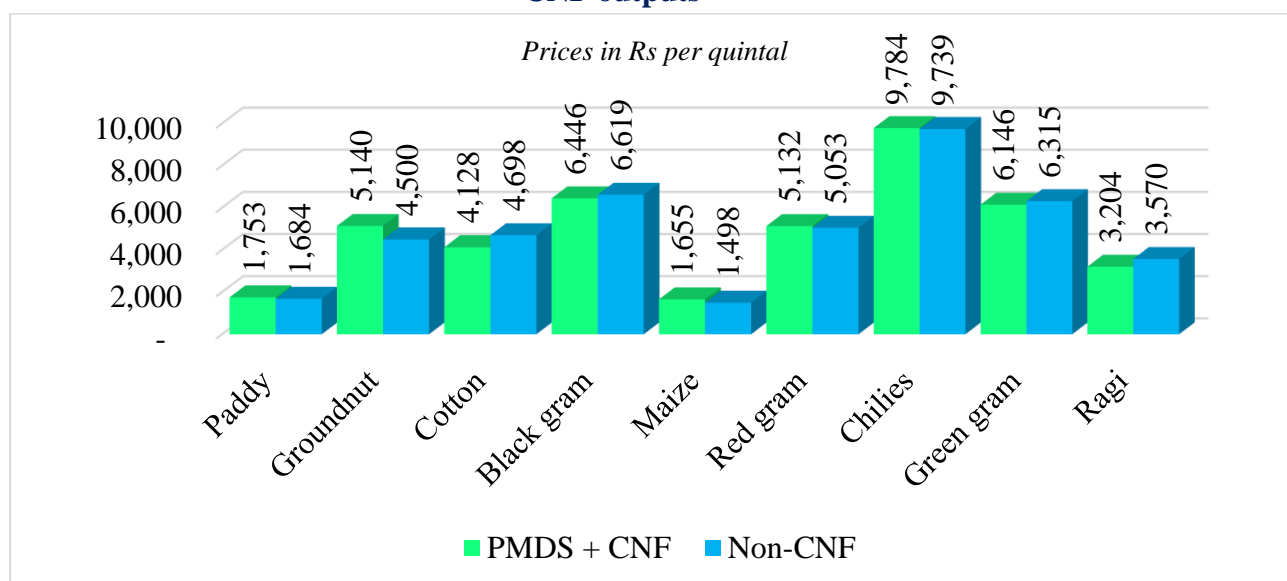
Source: IDSAP Field Surveys, 2018-19, 2019-20, 2020-21

3.2.4. Prices

Prices are another important factor for the expansion of CNF in the state. CNF farmers are expecting premium prices for their CNF produces. Crop wise combined (Kharif+Rabi) average prices realized/ reported by CNF and non-CNF farmers are presented at Figure 3.4. Out of nine

crops, considered in this report, five CNF crops got higher prices and four got lesser than non-CNF prices. The rising interest in natural farming may be the reason for realized higher prices for CNF output. Less than non-CNF prices for four CNF crops is unexpected and surprising outcome. One of the possible reasons could be the location of project and control sample farmers. While CNF farmers are concentrated in north-coastal districts, including hilltops and sloped areas, which have relatively less market infrastructure and market, the non-CNF farmers are spread evenly across the state. There could be a few crops specific reasons. In case of Cotton, which got 12% less price for CNF Cotton, the possible reason could be the alteration in the fibre-seed ratio in CNF cotton. It is believed that CNF will results in heavier and larges seeds/ grain. Heavy grain or seed need not be beneficial in all crops, especially in the fibre crops. In case of Ragi, which got over 10% lesser price, the location of CNF sample farmers could be one possible reason. Ragi is predominantly grown in the tribal areas. Some of the CNF tribal sample farmers are located on hilly areas. Because of the logistic issues, they might have got less price (Figure 3.4 and Table 3.6).

Figure 3.4: Crop wise combined (Kharif+Rabi) average price realized for CNF and non-CNF outputs



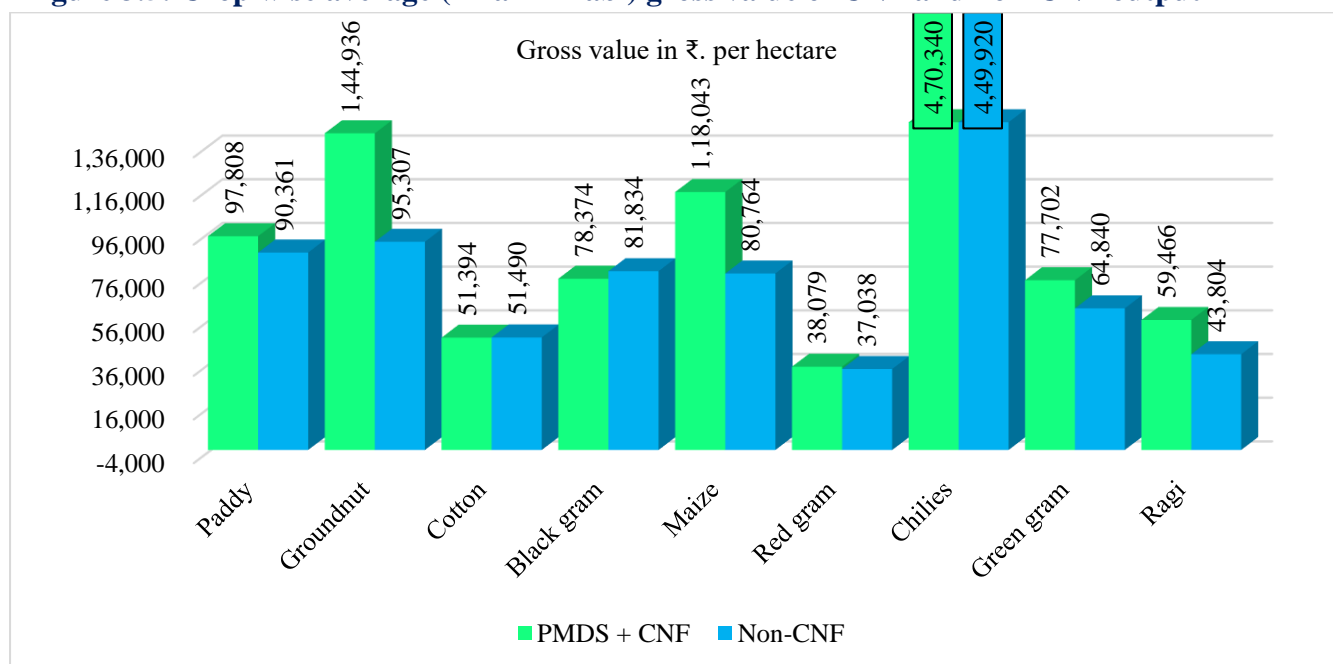
Source: IDSAP Field Survey, 2020-21

3.2.5. Gross value of the output

The gross value of crop output is given by crop output, obtained through CCEs, multiplied by realized or locally prevailing price reported by the sample farmers plus value of by-products, reported by the farmers. It may be noted that the study used the crop yields obtained through CCEs in the estimation of gross value of output. Crop wise combined (Kharif+Rabi) gross values obtained, under CNF and non-CNF are shown at Figure 3.5. Out of total nine crops

considered here; the gross values of CNF crops are higher than those of non-CNF crops in seven crops. Out of seven crops, which have given higher gross value for CNF farmers, Groundnut has generated highest difference of ₹.49,629 per ha, followed by Maize (₹.37,279), Chilies (₹.20,420) and Green gram (₹.12,862), In percentage terms, Groundnut has given 52% higher gross value for CNF farmers, followed by Maize (46%), Ragi (36%) and Green gram (20%). Needless to say, that the higher gross values of CNF crops are the effect of higher yields under CNF and/ or higher price realization for CNF crops. Black gram, under CNF, which got 1.81% lower yields and 2.60% lower price got 4.23% lower gross value. On the other hand, CNF Cotton, which got 13.59% higher yields, got marginally (0.19%) lower gross value of output due to lower price realization (by 12.13%). The following two questions have to be answered to understand the reason for low price of CNF cotton. Is heavy seed vis-à-vis fiber quantity a contributory factor for low realized price? Or higher yields and bumper production/ larger supply of CNF cotton compared to the local demand is the reason for lower realized price? On the other hand, Ragi and Green gram which got over 10.25% and 2,67% lower prices respectively, got 35.76% and 19.84% higher gross values, respectively, due to higher yields.

Figure 3.5: Crop wise average (Kharif+Rabi) gross value of CNF and non-CNF output



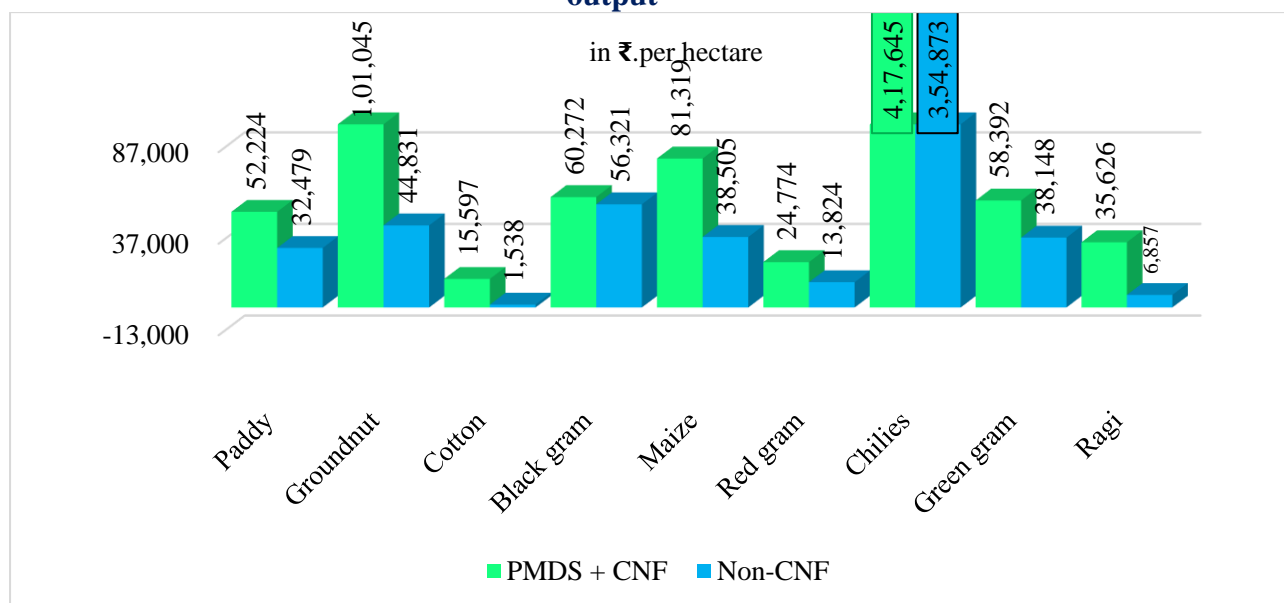
Source: IDSAP Field Survey, 2020-21

3.2.6. Net value of output

The crop wise net values of output are obtained by subtracting the paid-out cost of a crop from the gross value of that crop. Figure 3.6 shows crop wise average (Kharif+Rabi) net values of output under CNF and non-CNF. Out of total nine crops analyzed here; the net values of all nine CNF crops are positive. Further, in all nine crops, the net value of CNF crops is higher

than that of non-CNF crops. The differences vary from ₹.3,859 per hectare in Black gram to ₹.62,772 per hectare in Chilies. The net values of CNF Groundnut and Maize are higher than that of non-CNF by ₹.55,214 per hectare and ₹.42,814 per ha, respectively. In percentage terms the CNF crops got higher returns than that of non-CNF in all nine crops, ranging from 7% in Black gram to 914% in Cotton (Table 3.8). All these results indicate that the saving obtained in the paid-out costs is one of the principal contributory-factors for higher net values of the output for CNF crops. In case of Black gram, despite lower yields and lower realized prices, the net value is higher than that of non-CNF due to higher savings in the paid-out costs.

Figure 3.6: Crop wise average (Kharif+Rabi) net value of CNF and non-CNF crop output



Source: IDSAP Field Survey, 2020-21

It may be noted that higher net values of CNF crops are the upshots of (1) reduction in cost of cultivation, which in turn is the effect of the reduction in the expenditure on PNPIs, (2) increase in yields, and (3) increase in prices obtained. A comparative analysis of average gross values and average net values, indicate that reduction in the cost of cultivation is the major contributory factor to the increase in net value of crop output. PMDS appeared to be promising in enhancing yields in coming years.

3.3. Impact of CNF on farm inputs use and inputs market

Under chemical-based agriculture, farmers became hostages to the input, credit and output markets. Farmers were induced to apply more and more purchased agriculture inputs, especially, the chemical-based inputs. Farmers were also conditioned and compelled²⁰ to use

²⁰ The compelling reasons include loss of moisture retention capacity in the soils, practices of mono-cropping, which result in peak demand for water, to name a few.

excess water in their cultivation.²¹ As the share of purchased inputs increased in the cost of cultivation, farmers' dependency on credit market has increased significantly. Excess application of chemical-based agriculture inputs led to the loss of ecological services, which in turn leads to excess application of external inputs. Continues sinking of new bore-wells and deepening of existing bore-well is one simple illustration. Farmers are forced into a vicious circle. All these led to degradation of the natural resources, deterioration of environment and climate change. Farmers were also habituated to grow mono crops in place of multiple crops, and single crops in place of mixed crops. These practices have resulted in:

- a. Excess application of agriculture inputs, especially, fertilizers, pesticides and irrigation.
- b. Forcing the farmers to borrow heavily for agriculture investment, especially from informal sources with exploitative terms and conditions.
- c. Crops' vulnerability to pests and diseases.
- d. Crops' vulnerability to the weather vagaries
- e. Labour shortages during certain periods and distorted mechanization.
- f. Farmers dependency on output markets and their vulnerability to the corresponding exploitations.

In the chemical-based agriculture, farmers were tangled in with the input, credit and output markets, their surpluses are being squeezed out. They may be losing a part of the imputed value of their own labour, own land rent, and the services of other assets, year after year, resulting in the negative returns year after year. They are left high and dry. In this context, CNF, with its principles and practices of biological inputs, crop diversity, improvement of natural resources quality, improvement in cropping intensity, reduction in water use, reduction in the peak-time demand for labour, etc., proved to be a ray of hope to the farmers in the state and the country.

In this background, the impact of CNF on the use of the select agriculture inputs, viz. land, labour, purchased inputs, irrigation, farm investment and/ or credit, and technical practices, have been analysed. It may be noted that some of technical aspects such as measuring the use of water in a field/ crop, and quality of the soil, etc., are beyond the scope of this study. Therefore, only limited quantitative evidence is presented in this section. Apart from quantitative evidence the qualitative information, i.e., farmers responses to various questions with respect to inputs use and farm practices are also presented.

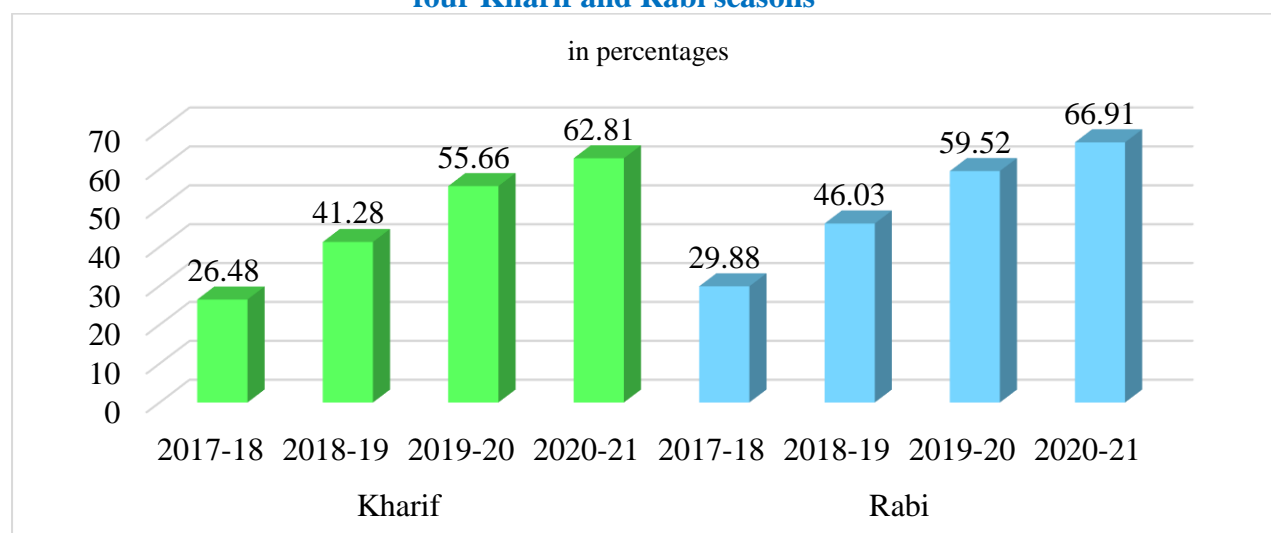
²¹ Irrigation is also becoming one of the top priorities of every government at centre and state.

3.3.1. Impact of CNF on land use

Under this section the trends in the allocation of land towards CNF and changes in the cropping pattern are examined. As the CNF participating farmers are reaping multiple benefits from CNF program, it is expected that there will be an increase in the land allocation towards CNF. As the CNF is encouraging and facilitating crop diversity, mixed cropping and higher cropping intensity, it is also expected that there will be an increase in the sustainable cropping practices by the CNF farmers compared to non-CNF farmers.

Area allocated to CNF farming by (cross-section) sample CNF farmers during last four years is shown at Figure 3.7. As anticipated, the CNF farmers are allocating higher proportions of their operational areas to CNF over the years. The proportion of operational area allocated to CNF has increased from 26.48 percent in Kharif 2017-18 to 62.81 percent in Kharif 2020-21. Similarly, the share of CNF area in the average operational holdings has increased from 29.88 percent in Rabi 2017-18 to 66.91 percent in Rabi 2020-21. The steep increase in the percentage of operational holding allocated to CNF, during last four years, demonstrates the potential of CNF, in benefiting the farmers.

Figure 3.7 Percentage of operational area put under CNF, by CNF farmers during last four Kharif and Rabi seasons

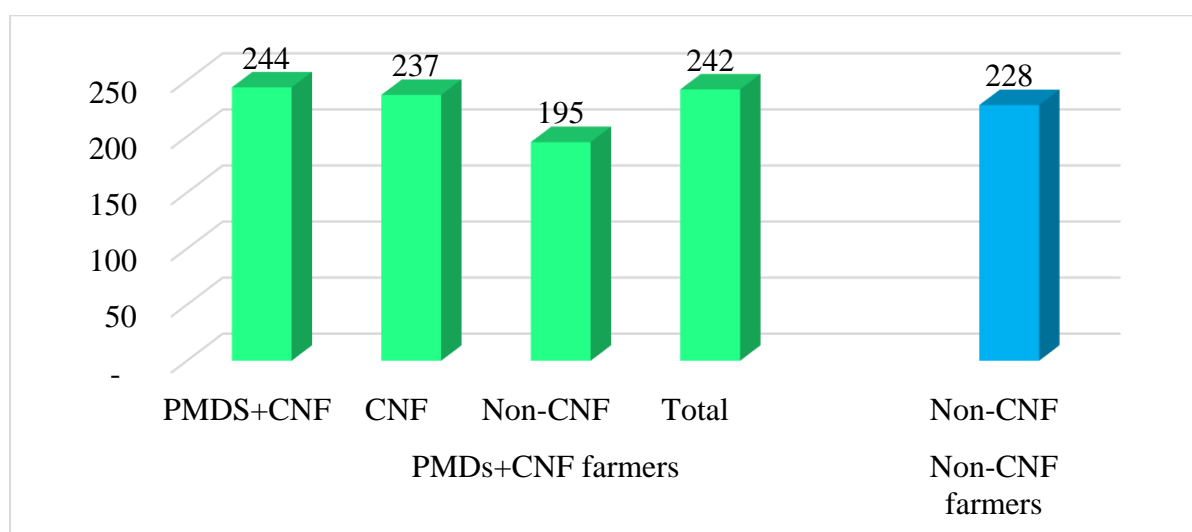


Source: IDSAP, Field Survey, 2020-21

Apart from allocating higher percentages operational holdings over the years, the CNF farmers are using the land intensively and more productively. For the first time the CNF and non-CNF farmers were asked how many days, crops were standing in their fields during the agriculture years 2020-21, i.e., from June 2020 to May 2021. Farmers' responses are presented in Figure 3.8. It may be noted that the length of crop cover on fields depends on many factors, especially access to irrigation. Other factors including soil type, local cultural factors, availability of labour, especially family labour, Agri markets, etc. CNF

is one of the major factors, that influence the length of the crop cover on the fields. As mentioned, above that higher percentage of non-CNF farmers and their fields have canal irrigation, by more than 10 percentage points, particularly during Rabi season. It implies that non-CNF farmers have distinct advantage of possible double cropping, etc. Given their better economic status and other advantages, the non-CNF farmers are in a better position to take up long duration and multiyear horticulture crops. Still CNF farmers on average, have a greater number of days of crop covers on their fields vis-à-vis non-CNF farmers. Among the fields cultivated by CNF farmers, the fields under CNF crops have highest number of crop cover days (244 days), followed by ‘only CNF’ fields (237 days) and non-CNF fields (195 days). It may be noted that CNF farmers some time also have some operated area under non-CNF.

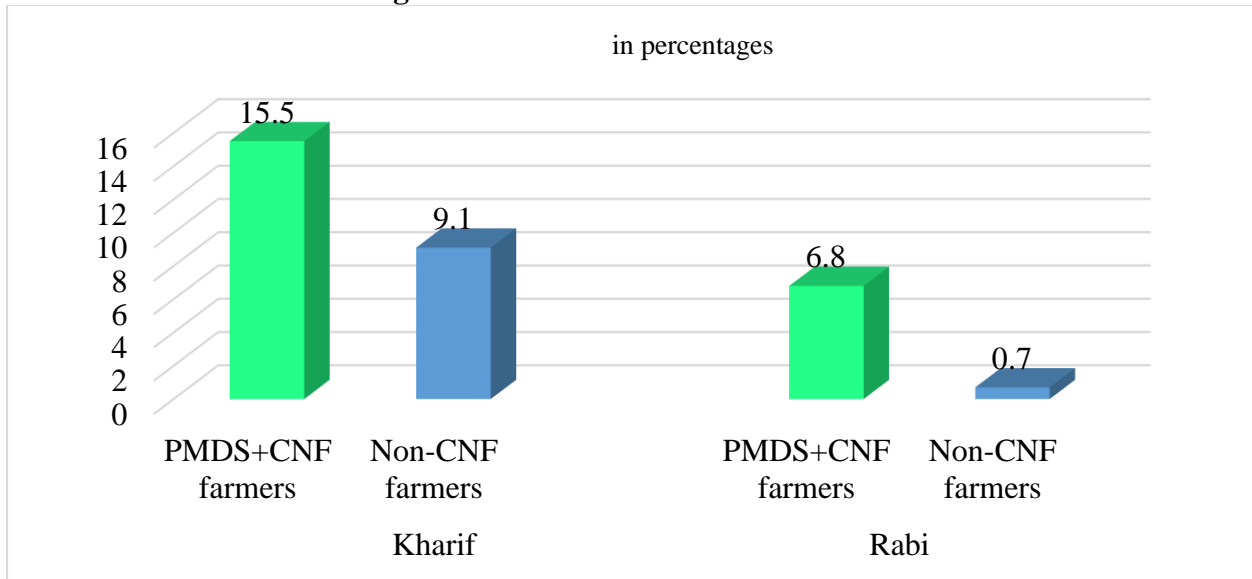
Figure 3.8: Duration of crop cover on different types of fields during 2020-21
(Number of days)



Source: IDSAP Field Survey 2020-21

Further, CNF is advocating and facilitating an improved cropping practices including model crops such as multi-layer crops, pre-monsoon dry sowing (PMDS), kitchen gardens, integrated farming, 36X36 model, crop rotation, inter cropping, and mixed cropping. These practices enable farmers to optimize the use of the horizontal, vertical, and temporal space of their fields. But in almost all these innovations, the counterfactual evidence is not available. However, among all these practices, the mixed cropping is one of traditional practices, which is being practiced even now, albeit in small extent, in the state, has some comparative evidence from control sample. The comparative results are shown at Figure 3.9. During Kharif 2020-21, 15.5% of CNF farmers have taken up mixed cropping. During the same time, 9.1 percent non-CNF farmers have cultivated mixed crops; the difference is 6.4 percentage points. Though only 6.8 percent farmers cultivated mixed crops during Rabi season, it is 6.1 percentage points more than non-CNF farmers (0.7 percent) (Figure 3.9).

Figure 3.9: Percentage of CNF and non-CNF farmers cultivating mixed cropping during Kharif and Rabi seasons in 2020-21

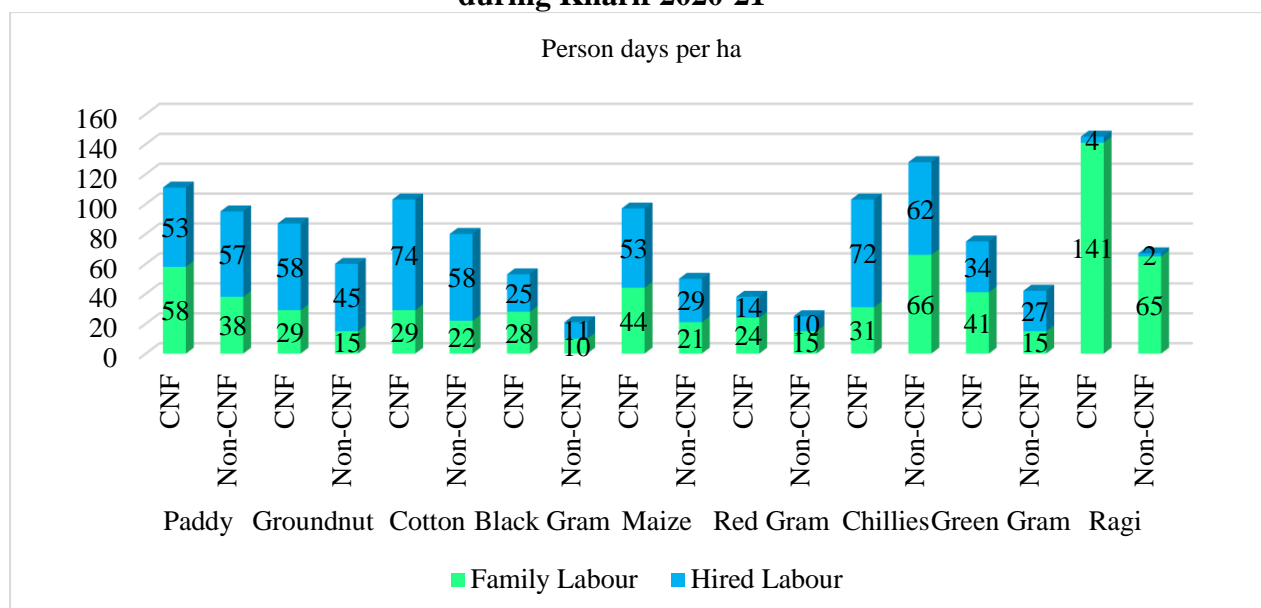


Source: IDSAP Field Survey 2020-21

3.3.2. Impact on labour use

This year data (Figure 3.10) also confirms that CNF is a labor-intensive method of cultivation. Instead of purchasing readymade inputs such as fertilizers and pesticides, the CNF farmers, usually, prepare their own inputs, at least partially. Further, the cropping practices of model crops, mixed cropping, inter-cropping, etc., reduce the scope for the use of machinery. Human labour has to be used in such conditions. Another reason for higher use of human labour in CNF farming is associated with higher yields obtained under CNF. Yet another reason for the use of higher labour input in CNF farming, is the improved farming practices. CNF advises the participating farmers to sow the seeds instead of broadcasting, and line transplantation of Paddy and Ragi, instead of random transplantation, to the extent possible. In each of nine crops of Kharif season 2020-21 presented in Figure 3.10, a greater number of person days are used in CNF farming vis-à-vis non-CNF farming. As expected, a greater number of own labour days are used in CNF crops compared non-CNF crops, in all but one crop, i.e., chilies. Except in three pulses crops, viz., Black gram, Red gram and Green gram, the share of hired labour is higher in all CNF and non-CNF crops. In the pulses' crops, the share of own labour is higher, particularly in CNF crops. Among all crops considered, only use of own labour for Ragi crop looks abnormal. Usually, a high number of labour days are used under CNF, due to line sowing and a greater output. Ragi, which, is being predominantly cultivated in the tribal areas, reported a higher labour input; due to some variations in their perceptions about time units and the length of working hours. This needs further investigation.

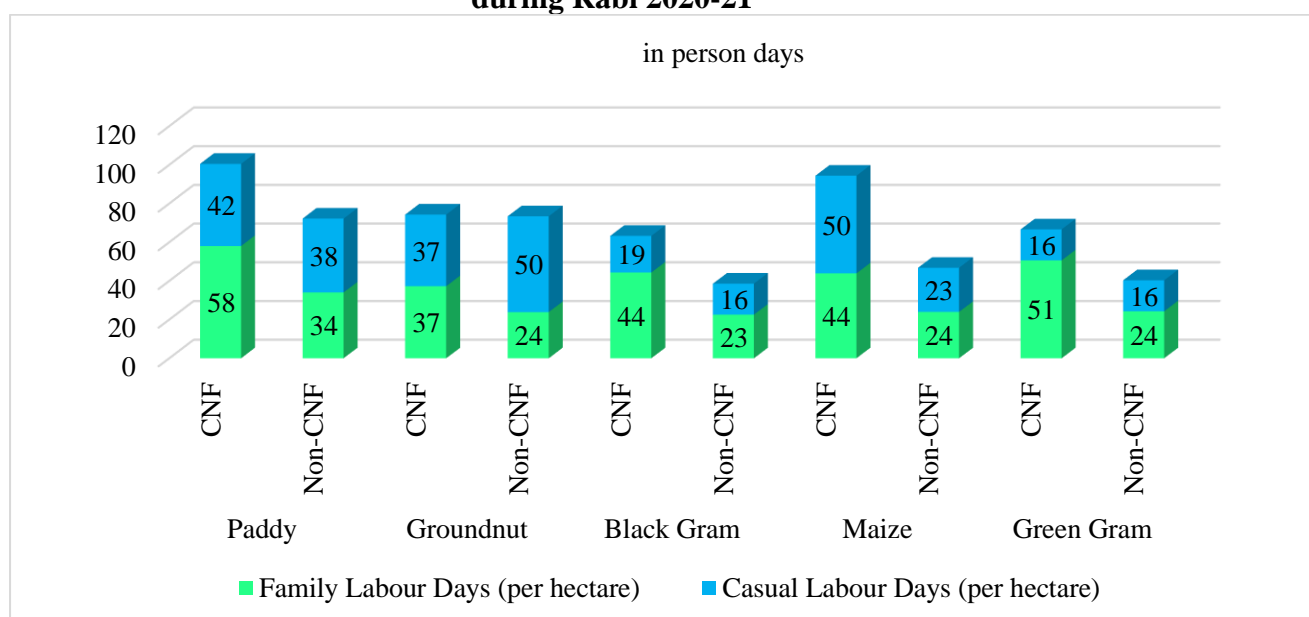
Figure 3.10: Crop wise own and hired labour used in CNF and non-CNF farming during Kharif 2020-21



Source: IDSAP Field Survey 2020-21

In Rabi season also, a higher labour input is used in CNF vis-à-vis non-CNF, in each crop (Figure 3.11). On average 25 additional labour days are used in CNF. This is a blessing in the labour surplus countries like India. It is important to note that after Covid 19, the rural people are, reluctant to migrate to urban areas and faraway places; and prefer to stay in their own villages. In such circumstances, labour intensive CNF would be very useful way to employ such people productively in the agriculture.

Figure 3.11: Crop wise own and hired labour used in CNF and non-CNF farming during Rabi 2020-21

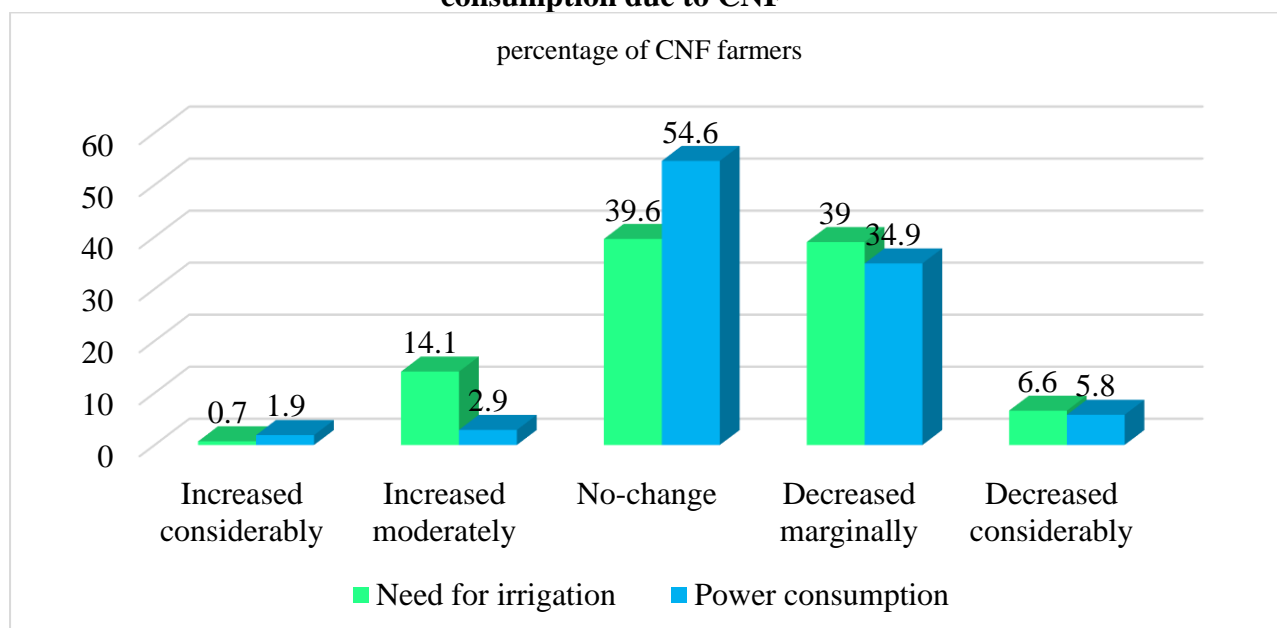


Source: IDSAP Field Survey 2020-21

3.3.3. Impact on water use and power consumption

Quantitative data was collected on water use in Paddy under bore-well irrigation. Information on the depth of bore-well/ groundwater table and motor capacity in horsepower (HP) was collected. Irrigation details of number of hours required per irrigation and number of irrigations given to the crop were collected. But the data got scattered thinly across different combinations of “bore-well depth and motor capacity”, and the results proved to be inconsistent. Further, soil type also found to be another influencing factor of irrigation. Hence quantitative results are not presented in this report. However, the qualitative information, i.e., farmers’ perceptions or experience about changes in water and power consumption in CNF crops vis-à-vis non-CNF crops, were recorded on the five-point scale, from all CNF households. The same is presented in Figure 3.12. While 39 percent farmers reported a moderate decline in water consumption in CNF crops vis-à-vis non-CNF crops, 6.6 percent reported a considerable decrease. On the other hand, 14.1 percent farmers have reported a moderate increase in water consumption in CNF crops and 0.7 percent farmers have experienced a considerable increase in the water consumption. Similar pattern is observed in the farmers’ response with respect to power consumption in CNF crops.

Figure 3.12: Percentage of CNF farmers reporting changes in water and power consumption due to CNF



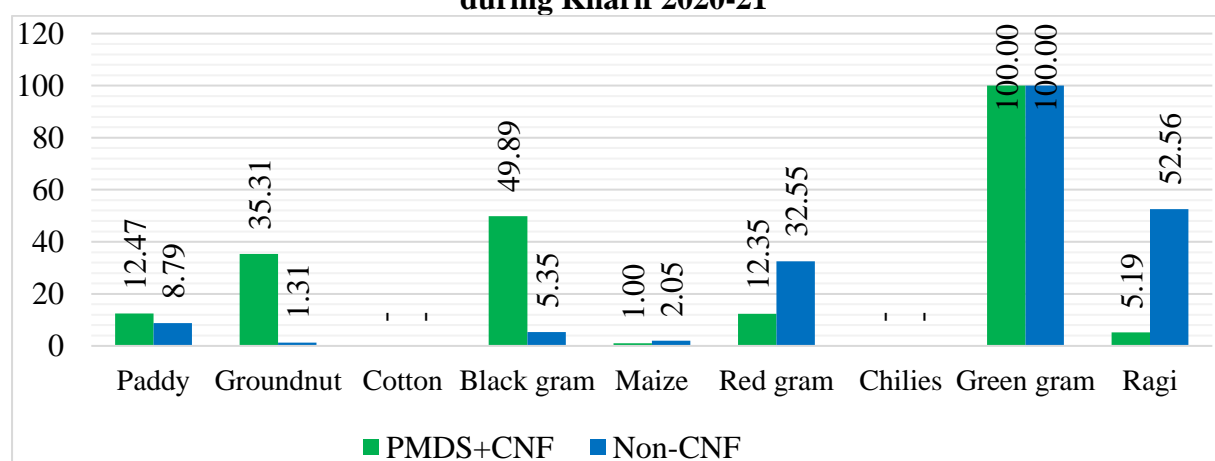
Source: IDSAP Field Survey 2020-21

3.3.4. Purchased inputs from the market

As mentioned above the share of purchased inputs from the market is very high in the chemical-based agriculture. This is one of the major factors for the farmers’ distress in the state and also

in the country. Fertilizers and pesticides are, traditionally, major items purchased from the market. As can be seen in the previous section and also in chapter 7 that on average non-CNF farmers have spent over ₹.11,250 per hectare on fertilizers and pesticides. This is per hectare savings made by CNF farmers, by not applying fertilizers and pesticides. Along with agrichemicals, seeds are an important and expensive item purchased by the farmers from the market. There are serious issues such as high prices, timely availability and adulteration, associated with the seeds, purchased from the market. RySS is advocating and facilitating the CNF farmers to use their own seed or local seed. The CNF farmers too believe that continuous use of their own or local seed (purchased from fellow CNF farmers or local CNF seed bank) is the effective way to remove the agrichemicals induced toxins in the grains, which give real health benefits. They also believe that once the toxins are removed from the seeds, the crops yields will improve considerably. Crop wise share of own seeds used by CNF and non-CNF farmers, during Kharif 2020-21, is shown at Figure 3.13. Out of nine crops considered in this report, none of the sample farmers have used own seed in Cotton and Chilies and negligible percentage of farmers used own seeds in Maize. On the other hand, 100 percent of CNF and non-CNF farmers used own seeds in Green gram. In the remaining, five crops, higher percentage of CNF farmers have used own seeds in Paddy, Groundnut and Black gram, which are predominant crops in the state. On the other hand, higher percentage of non-CNF farmers have used own seeds in Red gram and Ragi.

Figure 3.13: Crop-wise percentage of CNF and non-CNF farmers using own seeds during Kharif 2020-21

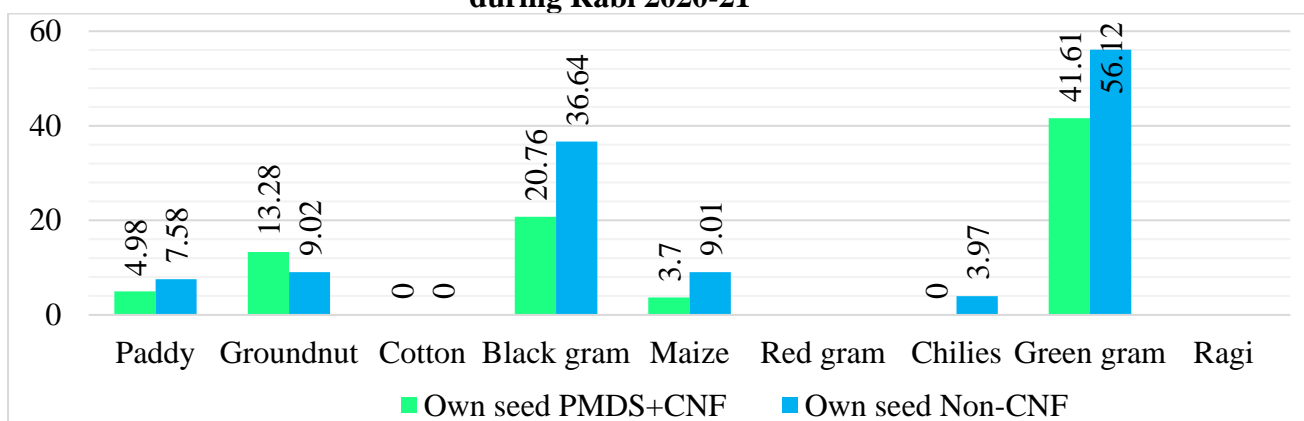


Source: IDSAP Field Survey 2020-21

Overall, CNF farmers used more own seeds in the Kharif season. But in Rabi, a higher percentage of non-CNF farmers have used own seeds in five out of six crops, in which comparable data is presented in Figure 3.14; the only exception is Groundnut. This is not an encouraging development. RySS should reflect on this issue. There are other factors which

influence the choice of the sources of seeds. These include government supply of seeds at subsidized prices, its availability and timing of availability; farmers ability, i.e., financial strength to hold the seeds and physical infrastructure to store the seeds, and contract farming arrangements. *RySS should consider all these factors and encourage and facilitate development of local seed bank system in every village, which is essential to obtain higher prices for the output and to maximise the health benefits from CNF.* RySS may facilitate the state government to procure the seeds from the CNF farmers/ villages, for the supply of seeds across the state.

Figure 3.14: Crop-wise percentage of CNF and non-CNF farmers using own seeds during Rabi 2020-21



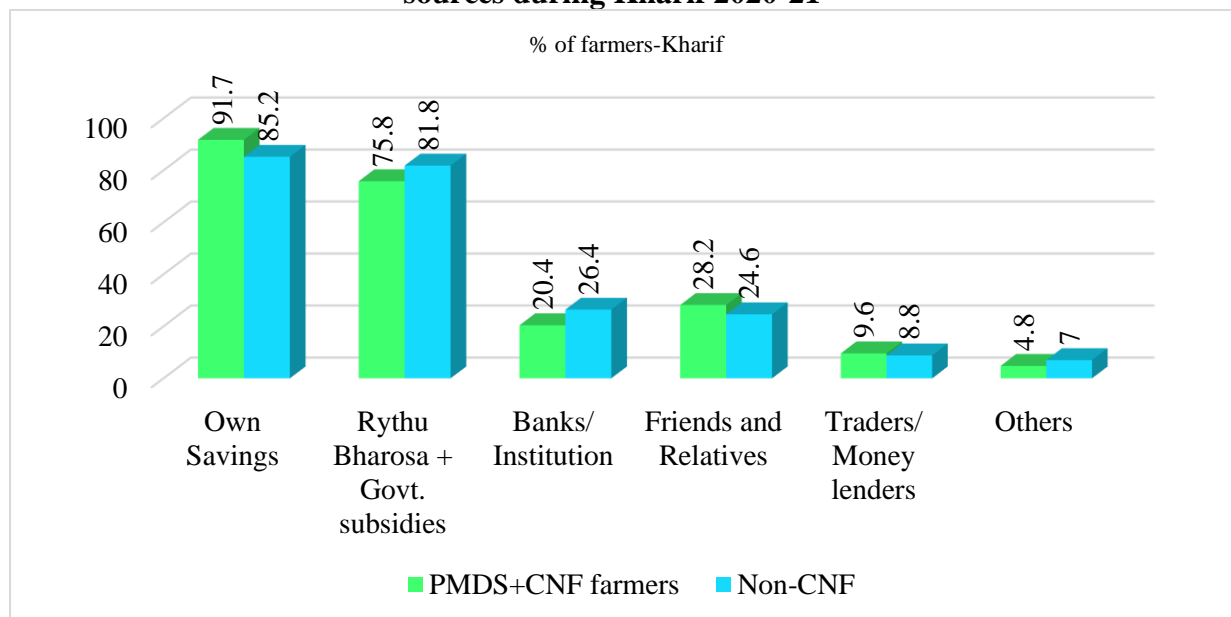
Source: IDSAP Field Survey 2020-21

3.3.5. Impact on credit sources

It is well known fact that credit is one of critical inputs in agriculture. As the institutional credit is not available in desired amounts, farmers are compelled to raise the credit from the non-institutional sources. The incidence of credit in rural Andhra Pradesh is very high compared to rural India. Compared to 35 percent households in rural India, 62.8 percent rural households in the state are indebted. Average amount of debt in rural AP is ₹.1.27 lakh compared to ₹.0.60 lakh in rural India. The average value of debt in rural AP is equal to 9.1 percent of average household assets value. The same in rural India is 3.8 percent. The share of non-Institutional sources in total debt in rural AP is 64 percent vis-à-vis 34 percent in rural India (Government of India, 2021). On the other hand, the average indebted amount per each reported household in rural AP is ₹.2.03 lakh vis-à-vis ₹.1.71 lakh in rural India (Ibid). The above data clearly indicates that indebtedness is one of major distress factor in rural AP. As CNF is reducing the cost of cultivation, it is expected, that there will be some reduction in the indebtedness related stress. As can be seen in Figure 3.15, CNF farmers' dependence on external sources is less vis-à-vis non-CNF farmers in Government subsidies, banks and institutional credits and others. A greater percentage of CNF farmers have met their funding needs from own savings and from friends and relatives. It was observed in the field that the CNF farmers in many villages are getting advances for CNF food items to

be supplied after the harvesting. This practice is quite different from the traditional practice of output pledging or mortgaging to the traders and money lenders.

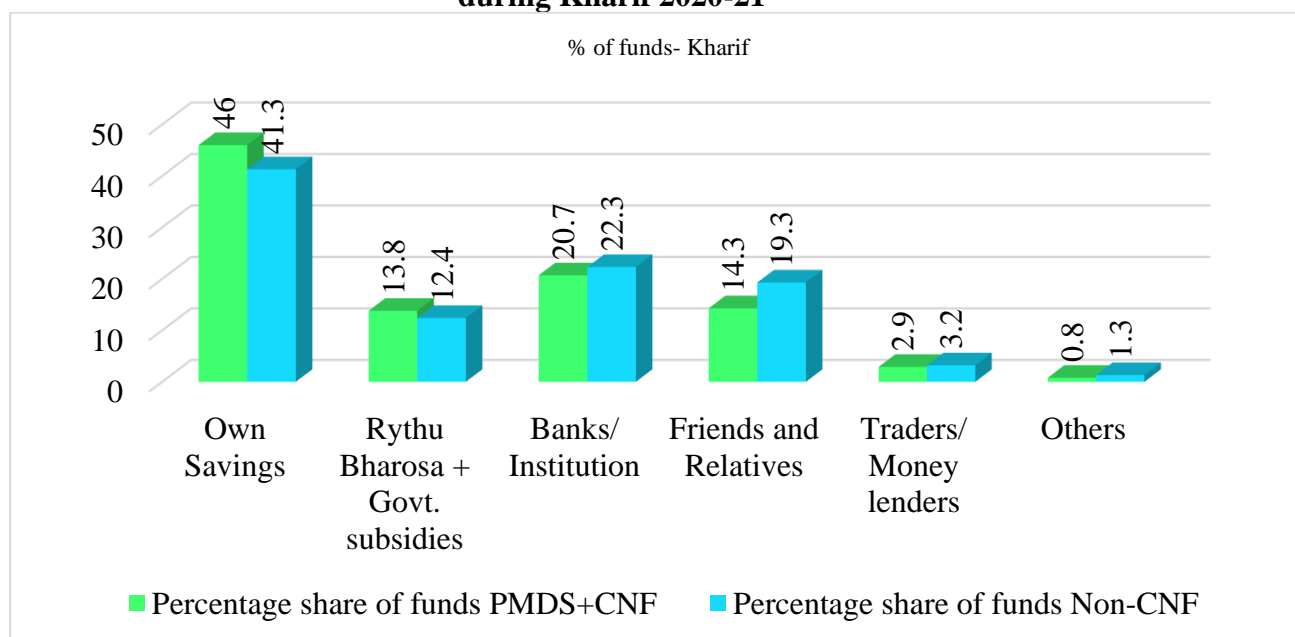
Figure 3.15: Percentage of CNF and non-CNF farmers obtaining funds from different sources during Kharif 2020-21



Source: IDSAP Field Survey 2020-21

The percentage share of funds obtained from different sources clearly indicates the CNF farmers’ reduced dependency on the borrowed funds vis-à-vis non-CNF farmers. A lower need for funds for CNF by the farmers is indicated in lower paid-out costs of all crops. The CNF farmers have met over 60 percent funds needs from own sources and government transfers. It is about seven percentage points higher than that of non-CNF farmers (Figure 3.16).

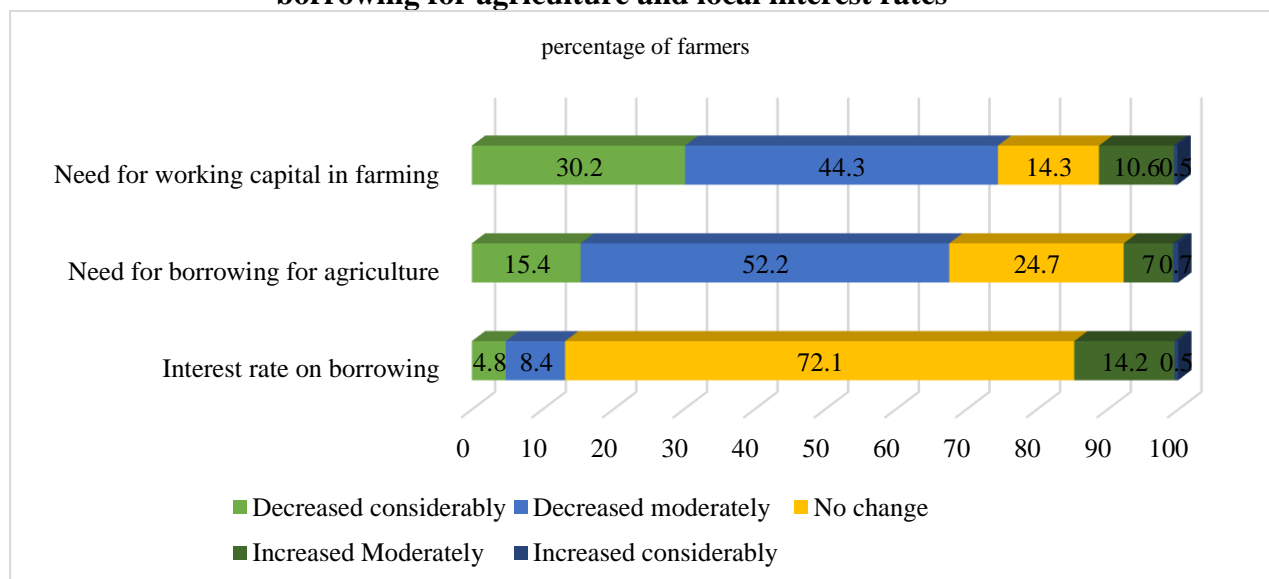
Figure 3.16: Source wise percentage of funds obtained by CNF and non-CNF farmers during Kharif 2020-21



Source: IDSAP Field Survey 2020-21

As mentioned in chapter 1, there are considerable variations in the profiles of CNF and non-CNF sample farmers. These differences influence the credit access by the CNF and non-CNF farmers. To understand the exact influence of CNF on funds need for agriculture investments, the CNF farmers were asked directly three questions, viz. (1) changes in working capital requirement in agriculture, (2) need for borrowing for agriculture and (3) interest rates on borrowing. Farmers' response is recorded on five points scale and presented at Figure 3.17. Over 30 percent CNF farmers said the need for working capital for farming has declined considerably due to CNF. Further, over 44 percent farmers experienced a moderate decline in the working capital needs. Over 14 percent have stated no change and 10.6 percent felt a moderate increase in the working capital needs. Over two-thirds of CNF farmers have indicated moderate to considerable decline in borrowing for agriculture and about one-fourth experienced no change in the borrowing status. Not surprisingly, over 72 percent CNF farmers have stated no change in local interest rates on the borrowings. While 13.2 percent CNF farmers experienced some decline in the interest rates, 14.2 percent felt some increase. The latter could be a natural phenomenon.

Figure 3.17: CNF farmers responses to changes in working capital requirements, borrowing for agriculture and local interest rates



Source: IDSAP Field Survey 2020-21

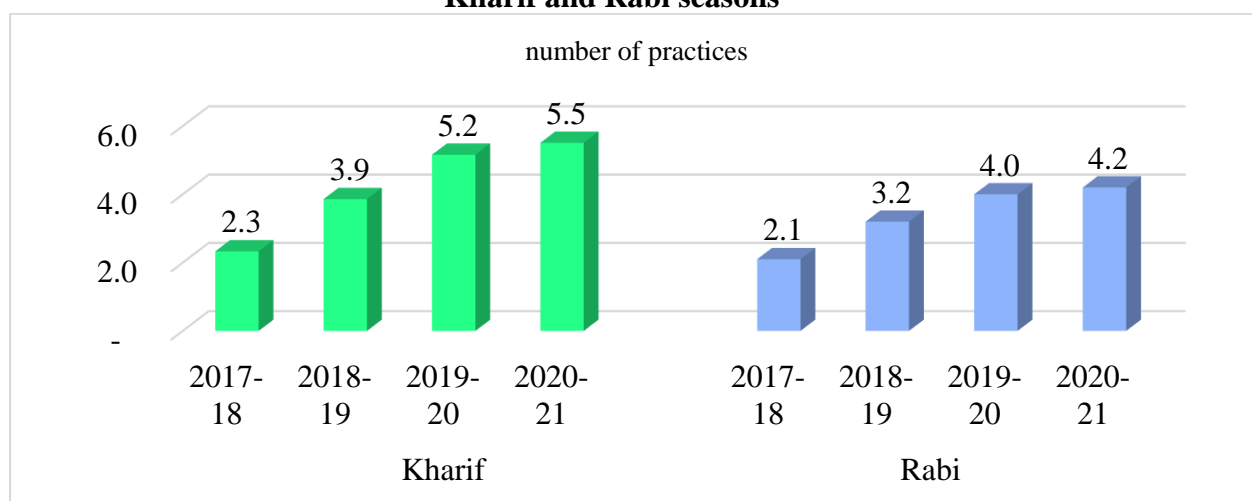
3.3.6. Changes in inputs, technologies, and practices

Technologies and agriculture practices are another important set of the factors of production in agriculture. CNF has been facilitating a number of new farm inputs and practices in place of conventional inputs and practices under chemical-based agriculture. These include Beejamurutham, Ghanajeevamrutham, Dravajeevamrutham, Kashayams/ Ashtrams, and variety of farming and cropping improvement practices such as Inter-Cropping, Boarder Cropping, Bund Cropping, Multi-layer Models, Integrated Farming, Pre-Monsoon Dry Sowing (PMDS) and System of Rice Intensification (SRI). There

is a gradual increase in the number of practices being introduced over the time. Needless to say, that project has also transferred the technologies to the participating farmers to prepare the inputs and related improved cropping and farming practices. It may be noted that though the project has introduced more than 10 inputs and practices, all of these need not be applicable and useful in all regions.

There is a consistent increase in the number of CNF practices adopted by the participants over the years. During the Kharif seasons, the average number of adopted CNF practices has increased from 2.3 in 2017-18 to 5.5 in 2020-21. The number of adopted CNF practices has increased from 2.1 in Rabi 2017-18 to 4.2 in Rabi 2020-21 (Figure 3.18). It is surprising to note that the average number of adopted CNF practices in Rabi seasons are consistently low compared to Kharif seasons. One of the possible reasons could be that the impact of some inputs applied during Kharif season, may be continuing during the Rabi season also.

Figure 3.18: Average number of CNF practices adopted by CNF farmers during last Kharif and Rabi seasons



Source: IDSAP Field Survey 2020-21

3.4. Output marketing

Marketing of agriculture output is one of the big challenges, the farmers under the chemical-based agriculture, face. Because of increase in crop diversity and growing demand for chemical free food items²², the CNF farmers, at least in some villages, are able to sell their CNF crop output easily and at some premium.²³ Because of good demand for CNF food items, the farmers are selling their products, albeit in small quantities, through variety of channels such as online, door delivery, retail shops, stalls, etc. RySS is also facilitating new marketing channels and opportunities. It has facilitated weekly shandies in some districts and sales outlets in Rythu Bazars and other places. Recent RySS's agreement with Tirumala Tirupati Devasthanam (TTD), for the supply of CNF food grains, is one of the important

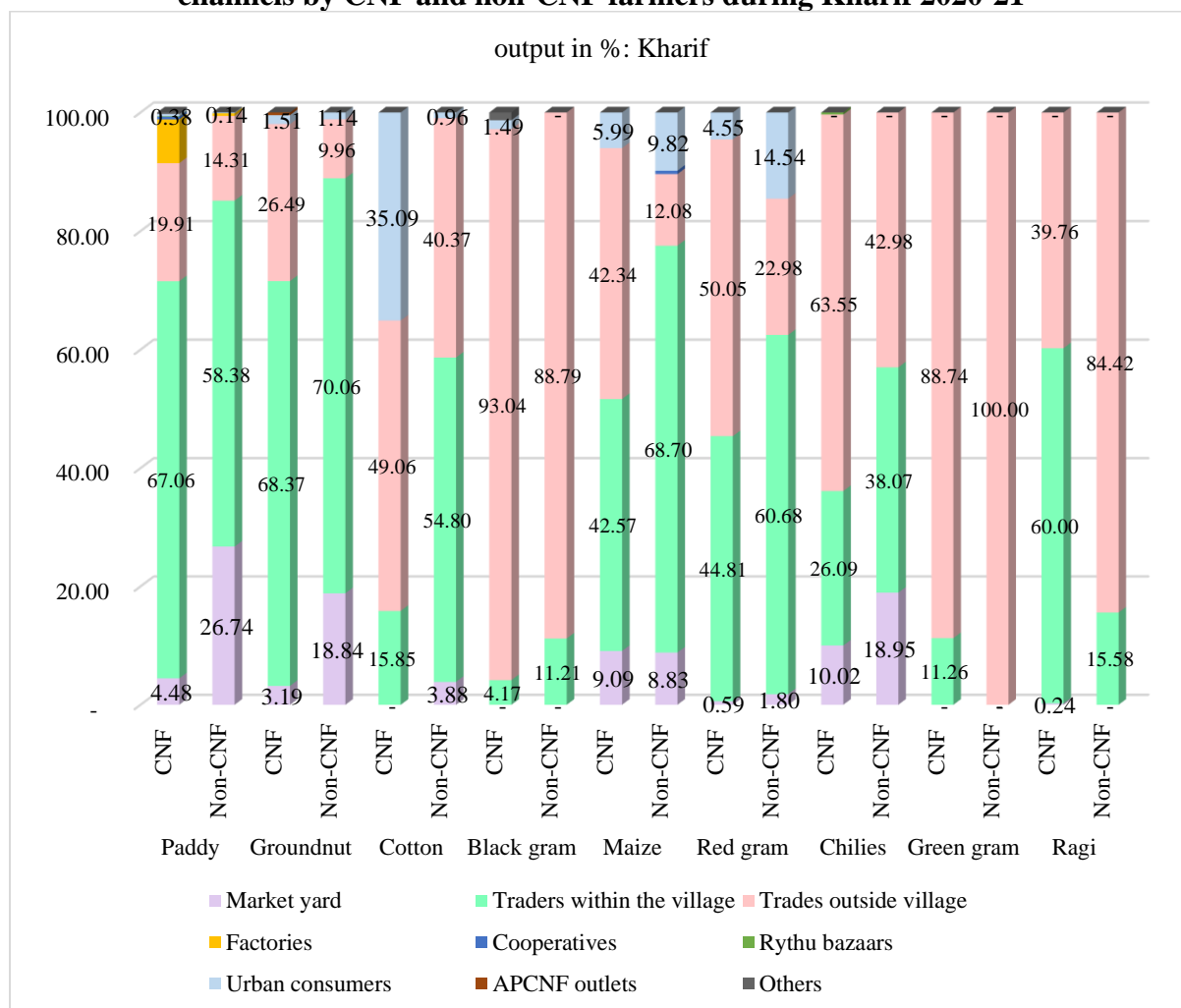
²² Farmers in many FGDs said that due to Covid 19 and Eluru incident, the village people are preferring to consume chemical free food items. Because they believe that food items produced through natural farming enhances the people's immunity.

²³ In some FGDs in East and West Godavari and Krishna districts, the CNF farmers said that they are getting up to 50% premium price for CNF Rice vis-à-vis non-CNF Rice.

milestones in the marketing. In this section, the changes in marketing due to CNF, and CNF farmers' perceptions and experiences are analyzed.

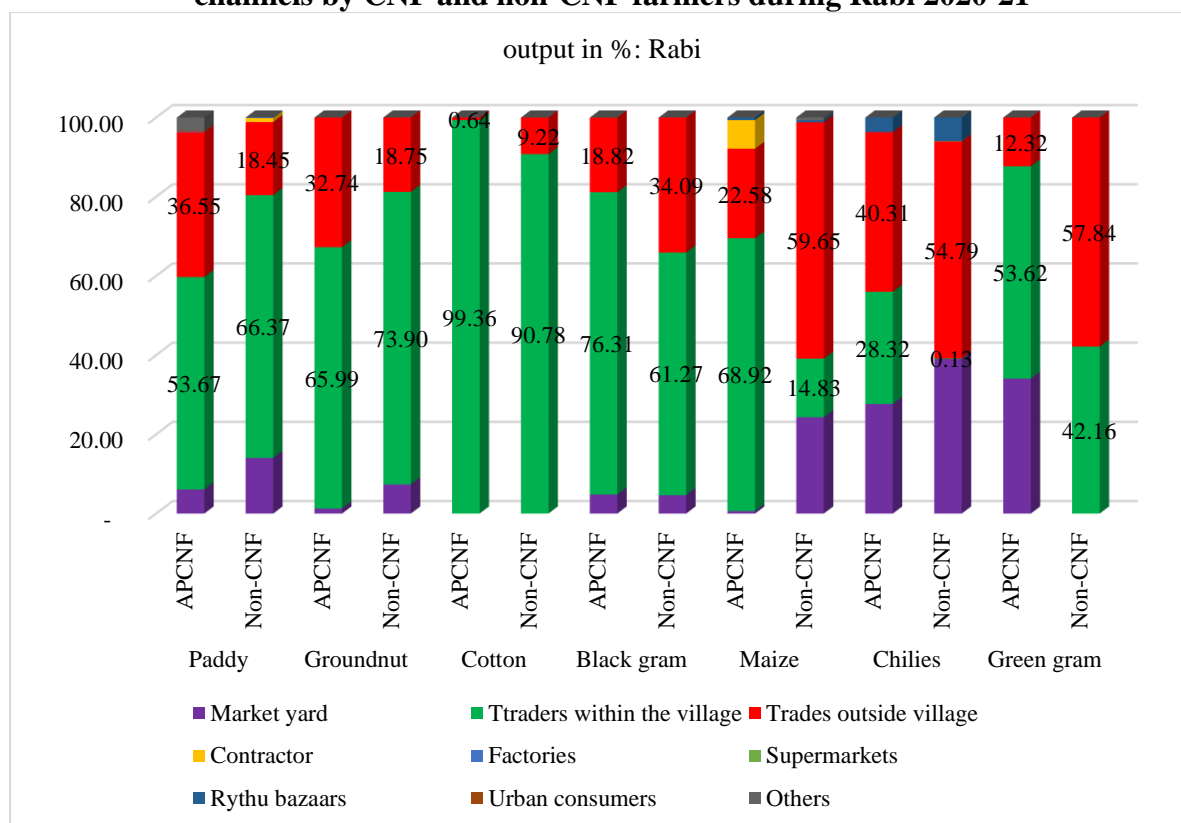
Percentage of crop output sold in different market channels by CNF and non-CNF farmers during Kharif and Rabi seasons are shown in Figure 3.19 and 3.20 respectively. Though CNF output marketing started recently, some clear changes can be seen in the marketing. CNF crop output are being sold in greater number of market channels in both Kharif and Rabi seasons. Compared to non-CNF, relatively lesser percentages of CNF output were sold in the Market-yards, which are, in recent times, perceived to be less farmer friendly. Relatively a greater percentages of CNF output are sold to the Traders within the villages. It indicates a growing local interest for CNF crops' output. It also indicates that CNF outputs are attracting a number of Traders to those villages. All these developments suggest that the CNF also is positively impacting the agricultural output marketing. By and large, similar trends can be seen in both Kharif and Rabi seasons (Figure 3.19 and 3.20).

Figure 3.19: Percentage of CNF and non-CNF crop output sold in different markets channels by CNF and non-CNF farmers during Kharif 2020-21



Source: IDSAP Field Survey 2020-21

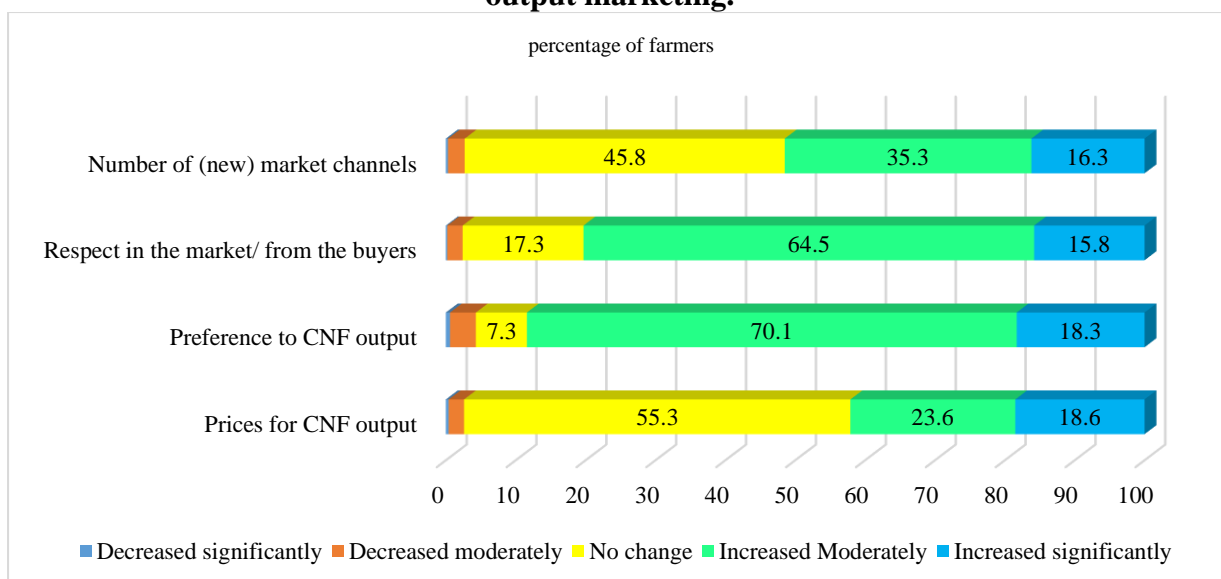
Figure 3.20: Percentage of CNF and non-CNF crop output sold in different markets channels by CNF and non-CNF farmers during Rabi 2020-21



Source: IDSAP Field Survey 2020-21

The above observed changes such as more marketing channels, lesser sales in the market-yards and higher sales in the local markets, etc., do not automatically indicate an improvement in the output marketing. Further, the differences in the profiles of CNF and non-CNF sample farmers might have been one of the reasons for the observed variations in the output marketing. More evidence is required to indicate a positive impact of CNF on the output marketing. To get a better insight about the changes in the output marketing, the CNF farmers were asked about the changes in (1) number of output market channels, (2) respect in the market/ from the buyers, (3) preference to CNF output, and (4) prices for CNF output. Farmers' responses are presented in the five-point scale in Figure 3.21. Majority of CNF farmers have experienced an emergence of new market channels for CNF output. More than 80% farmers are experiencing an increased respect in the market and from the buyers and over 88% is witnessing an increased preference for CNF output. But only about 45% of CNF farmers reported that they are getting higher prices for CNF output. While 23.6% farmers realized a moderately higher prices, 18.6 percent of total CNF farmers got considerably higher prices for their CNF output.

Figure 3.21: CNF farmers responses (in percentages) with respect to changes in CNF output marketing.



Source: IDSAP Field Survey 2020-21

3.5. Conclusions

CNF once again proved its potential to reduce the cost of cultivation. There is a possibility of splitting of the cost of cultivation of CNF crops between PMDS and Kharif crop season; i.e., a part of costs of cultivation, particularly the land preparation, might be borne by the farmers at the time of PMDS. It indicates a staggered use of family labour, farm machinery, biological inputs, etc. It would optimize the use of those inputs and reduce the peak time demands.

The CNF farmers are able to get higher yields, higher gross values of output and higher net value of output vis-à-vis non-CNF farmers in almost all crops, studied this year. The trends in gross and net values of CNF crops output indicate that reduction in the cost of cultivation is the major benefit from the CNF. Increased yields are second most important benefit. Higher prices for CNF output are realized to a limited extent. Government may procure the CNF output for seed distribution, public distribution system, mid-day meals and Anganwadi programs.

CNF farmers are allocating a higher proportion of their operational holdings year after year to CNF farming. They are also practicing and using higher number of CNF methods and inputs over the years. These indicate that CNF is benefiting the farmers and getting their acceptance. CNF is enabling the farmers to reduce the water use and investment in the crop cultivation. It is freeing the farmers from the clutches of the input and credit markets. It is also reducing farmers' vulnerability in the output marketing.

Chapter 3 Tables

Table 3.3: Crop wise expenditure on PNPIs under CNF and non-CNF and their differences

in ₹. per ha

Crop	PMDS + CNF	Non-CNF	absolute difference	Relative difference (%)
Paddy	5,008	12,420	-7,412	-60
Groundnut	3,859	7,540	-3,681	-49
Cotton	4,764	14,683	-9,919	-68
Black gram	2,572	7,162	-4,590	-64
Maize	4,889	11,814	-6,925	-59
Red gram	2,944	4,353	-1,409	-32
Chilies	6,871	29,231	-22,360	-76
Green gram	2,073	4,735	-2,662	-56
Ragi	3,953	4,016	-63	-2

Source: IDSAP Field Survey 2020-21

Table 3.4: Crop wise paid-out costs under CNF and non- CNF and the difference

in ₹. per ha

Crop	PMDS + CNF	Non-CNF	absolute difference	Relative difference (%)
Paddy	45,584	57,882	-12,298	-21.25
Groundnut	43,891	50,476	-6,585	-13.05
Cotton	35,797	49,952	-14,155	-28.34
Black gram	18,102	25,513	-7,411	-29.05
Maize	36,724	42,259	-5,535	-13.10
Red gram	13,305	23,214	-9,909	-42.69
Chilies	52,695	95,047	-42,352	-44.56
Green gram	19,310	26,692	-7,382	-27.66
Ragi	23,840	36,947	-13,107	-35.47

Source: IDSAP Field Survey 2020-21

Table 3.5: Crop wise yield under CNF and non- CNF and the difference

in quintal per ha

Crop	PMDS + CNF	Non-CNF	absolute difference	Relative difference (%)
Paddy	56	54	2	4
Groundnut	28	21	7	32
Cotton	12	11	1	14

Black gram	12	12	-0	-2
Maize	71	53	17	32
Red gram	7	7	0	1
Chilies	52	47	5	10
Green gram	13	10	2	23
Ragi	19	12	6	51

Source: IDSAP Field Survey 2020-21

Table 3.6: Crop wise realized price for CNF and non- CNF output and the difference
in ₹. per quintal

Crop	PMDS + CNF	Non-CNF	absolute difference	Relative difference (%)
Paddy	1,753	1,684	69	4
Groundnut	5,140	4,500	640	14
Cotton	4,128	4,698	-570	-12
Black gram	6,446	6,619	-172	-3
Maize	1,655	1,498	157	11
Red gram	5,132	5,053	79	2
Chilies	9,784	9,739	44	0
Green gram	6,146	6,315	-169	-3
Ragi	3,204	3,570	-366	-10

Source: IDSAP Field Survey 2020-21

Table 3.7: Crop wise gross value of CNF and non- CNF output and the difference
in ₹. per ha

Crop	PMDS + CNF	Non-CNF	absolute difference	Relative difference (%)
Paddy	97,808	90,361	7,447	8
Groundnut	1,44,936	95,307	49,629	52
Cotton	51,394	51,490	-96	-0
Black gram	78,374	81,834	-3,460	-4
Maize	1,18,043	80,764	37,279	46
Red gram	38,079	37,038	1,041	3
Chilies	4,70,340	4,49,920	20,420	5
Green gram	77,702	64,840	12,862	20
Ragi	59,466	43,804	15,662	36

Source: IDSAP Field Survey 2020-21

**Table 3.8: Crop wise net value CNF and non- CNF output and the difference
in ₹. per ha**

Crop	PMDS + CNF	Non-CNF	absolute difference	Relative difference (%)
Paddy	52,224	32,479	19,745	60.79
Groundnut	1,01,045	44,831	56,214	125.39
Cotton	15,597	1,538	14,059	914.11
Black gram	60,272	56,321	3,951	7.02
Maize	81,319	38,505	42,814	111.19
Red gram	24,774	13,824	10,950	79.21
Chilies	4,17,645	3,54,873	62,772	17.69
Green gram	58,392	38,148	20,244	53.07
Ragi	35,626	6,857	28,769	419.56

Source: IDSAP Field Survey 2020-21

Chapter 4: Agro-climatic zone wise impact of CNF

4.1. Introduction

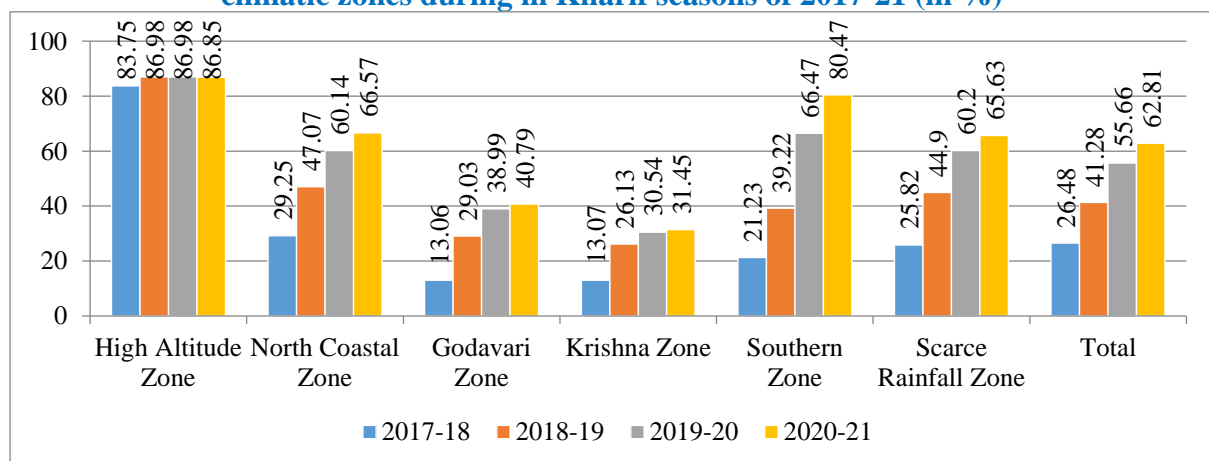
This chapter is basically to examine the impact of CNF on the farming conditions in different agroclimatic zones. The farming conditions have been analysed in terms of costs and returns of crops. The utilisation pattern of resources such as land, labour, water for irrigation and credit mobilised for meeting expenditure towards growing crops and household needs on one hand and adoption of CNF practices for raising crops on the other, are the factors that determine costs and returns of crops. Hence, the determinants have been analysed in terms of resource use and adoption of CNF practices. In this backdrop, this chapter addresses two major objectives:

1. Whether resource use pattern and adoption of CNF practices differ across the agroclimatic zones?
2. How far these variations have contributed to the variations in costs and return across zones?

4.2. Resource use pattern and adoption of CNF practices

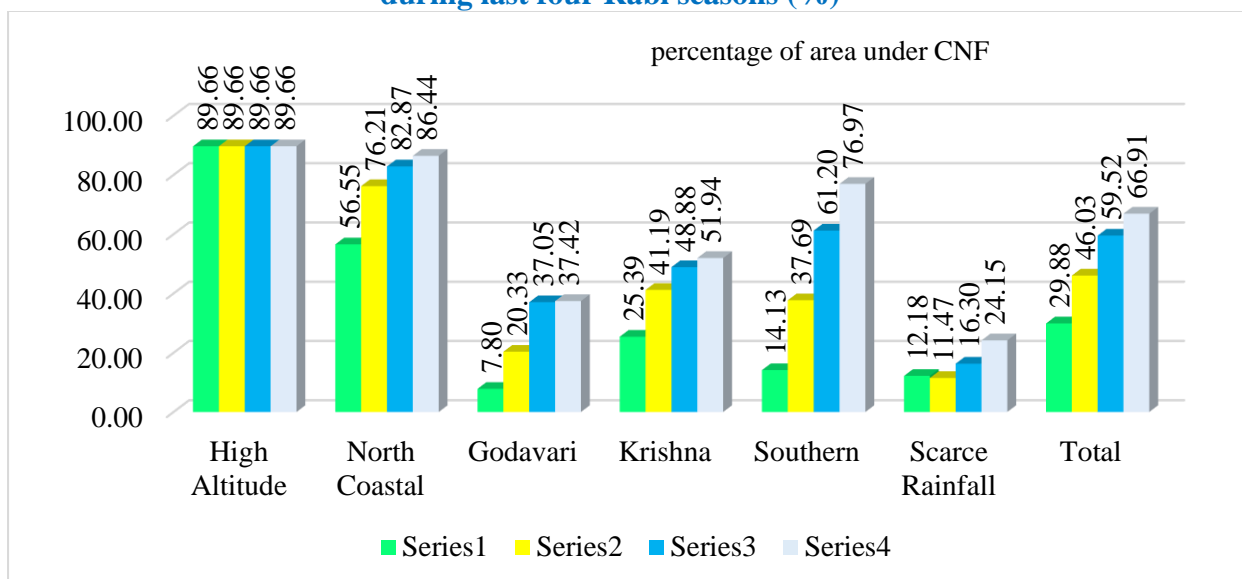
Area under CNF as a percentage in the area cultivated in Kharif season is higher in rainfall dependent zones such as high-altitude zone, North Coastal, Southern Zone and Scarce Rainfall Zones compared to other assured irrigation Zones namely Godavari Zone and Krishna Zone in the agricultural year 2020-21. But this has been increasing over years since 2017-18 (Figure 4.1 and table 4.1). Similarly, the same is true in Rabi season also (Figure 4.2 and table 4.2).

Figure 4.1: Percentage of area allocated to APCNF by CNF farmers in different agro climatic zones during in Kharif seasons of 2017-21 (in %)



Source: IDSAP Field Survey, 2020-21

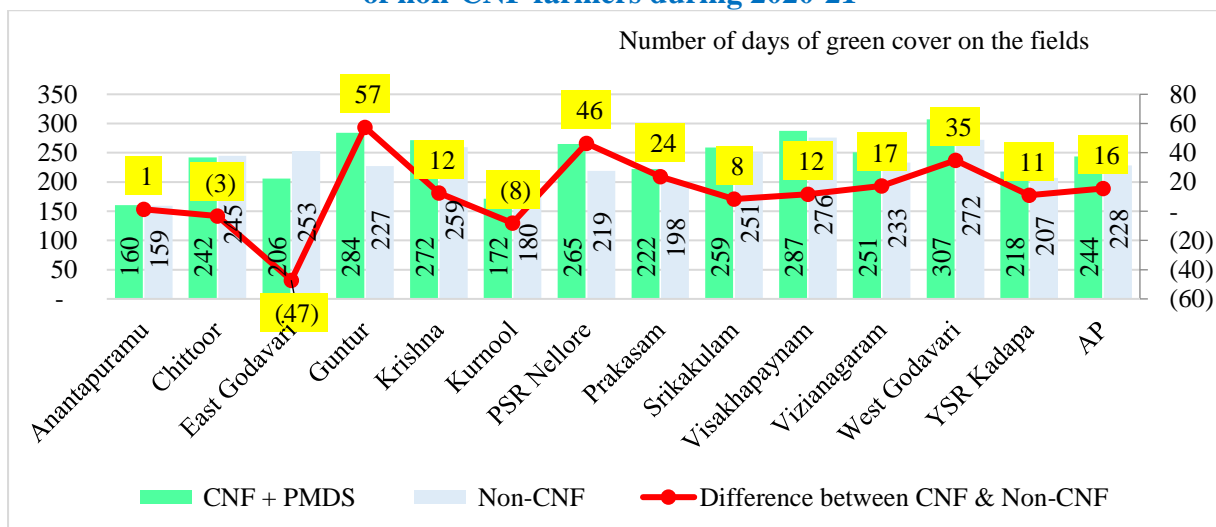
Figure 4.2: Agroclimatic zone wise percentage of operational area allocated to CNF during last four Rabi seasons (%)



Source: IDSAP Field Survey, 2020-21

As mentioned in the previous chapter, the CNF farmers are able to keep crop cover/ green cover for longer periods in their PMDS+CNF fields compared to non-CNF farmers. However, there are wider variations across the state. Out of total 13 districts in the state, CNF farmers have kept crop cover for longer periods vis-à-vis non-CNF farmers, in as many as 10 districts (Figure 4.3 and table 4.3). It varies from one day in Anantapuramu district to 57 days in Guntur district. On the other hand, the number of days of crop covers on PMDS+CNF fields are less than that of non-CNF fields in three districts. The range is 3 days in Chittoor to 47 days in East Godavari district.

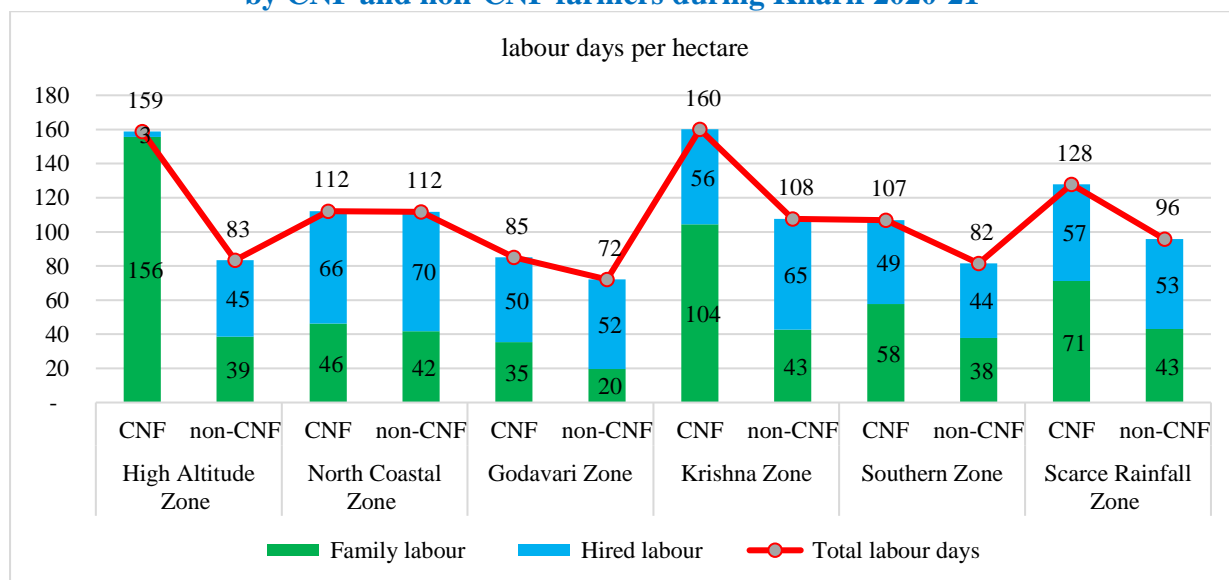
Figure 4.3: Crop cover days on PMDS+CNF fields of CNF farmers and non-CNF fields of non-CNF farmers during 2020-21



Source: IDSAP Field Survey, 2020-21

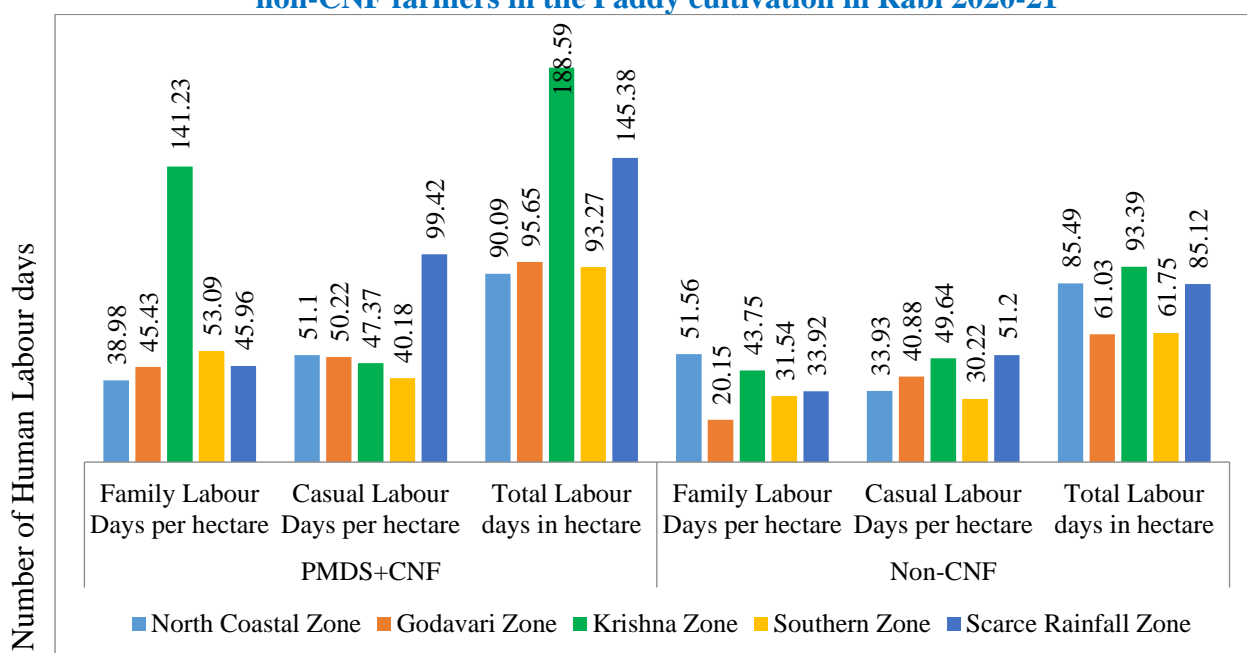
The labour days per hectare are higher under CNF over non-CNF across all the zones. The family labour days as well as hired labour are higher for the CNF farmers than those for non-CNF farmers across almost all the zone, expect a slightly higher number of hired labour per hectare in Krishna district for non-CNF cultivation This indicates that labour is intensively used to cultivate crops under CNF compared to the cultivation of crops under non-CNF (Figure 4.4 and Figure 4.5 and table 4.4 and 4.5).

Figure 4.4: Agroclimatic zone wise number of labour days used in the Paddy cultivation by CNF and non-CNF farmers during Kharif 2020-21



Source: IDSAP Field Survey, 2020-21

Figure 4.5: Agroclimatic zone wise number of labour days per hectare used by CNF and non-CNF farmers in the Paddy cultivation in Rabi 2020-21

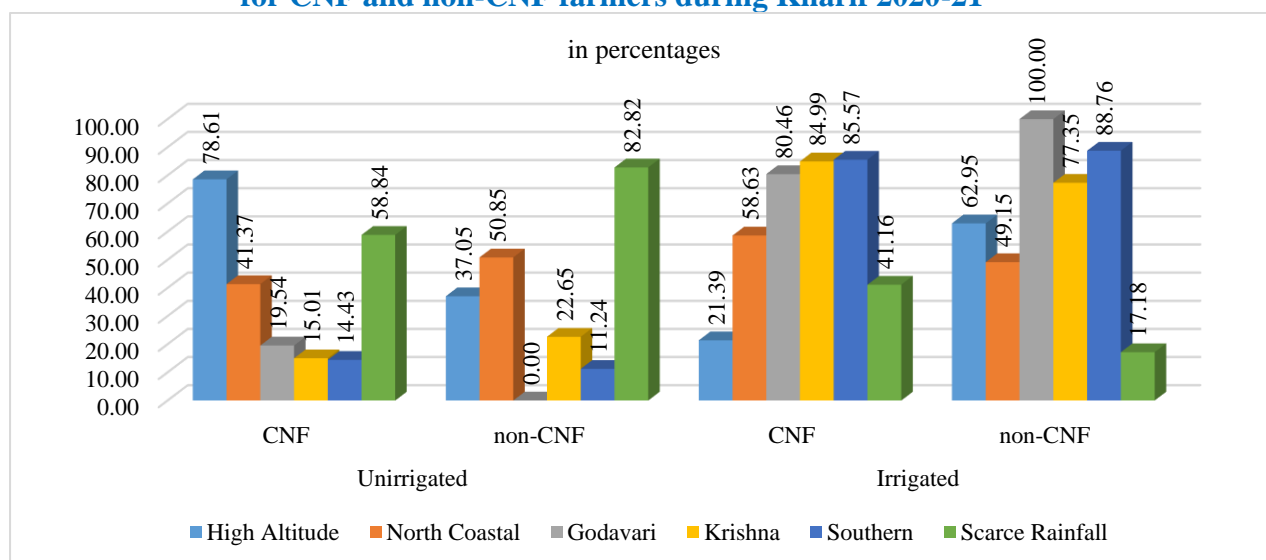


Source: IDSAP Field Survey, 2020-21

The higher engagement of family labour with crop growing may result in higher yields of crops under CNF over non-CNF. Similarly, the higher level of use of hired labour by CNF compared to non-CNF may result in higher labour cost of growing crops.

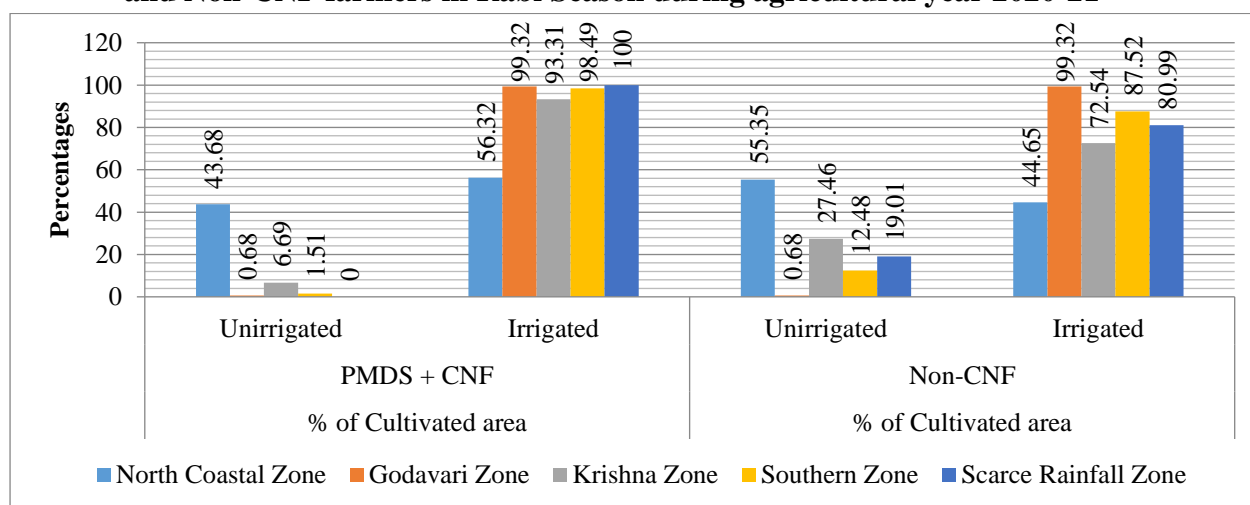
The irrigated area constitutes larger percentage in the cultivated area for the CNF farmers over the non-CNF farmers in Rabi season (Figure 4.6 and 4.7 and table 4.6 and 4.7). But larger percentage of irrigated area is under controlled irrigation such as borewell irrigation under CNF farmers compared to non-CNF farmers (Figure 4.8 and 4.9 and table 4.8 and 4.9). The controlled irrigation is more suitable to CNF for growing crops. This may have positive implication for higher yield of crops.

Figure 4.6: Agroclimatic zone wise percentage share of irrigated and unirrigated area for CNF and non-CNF farmers during Kharif 2020-21



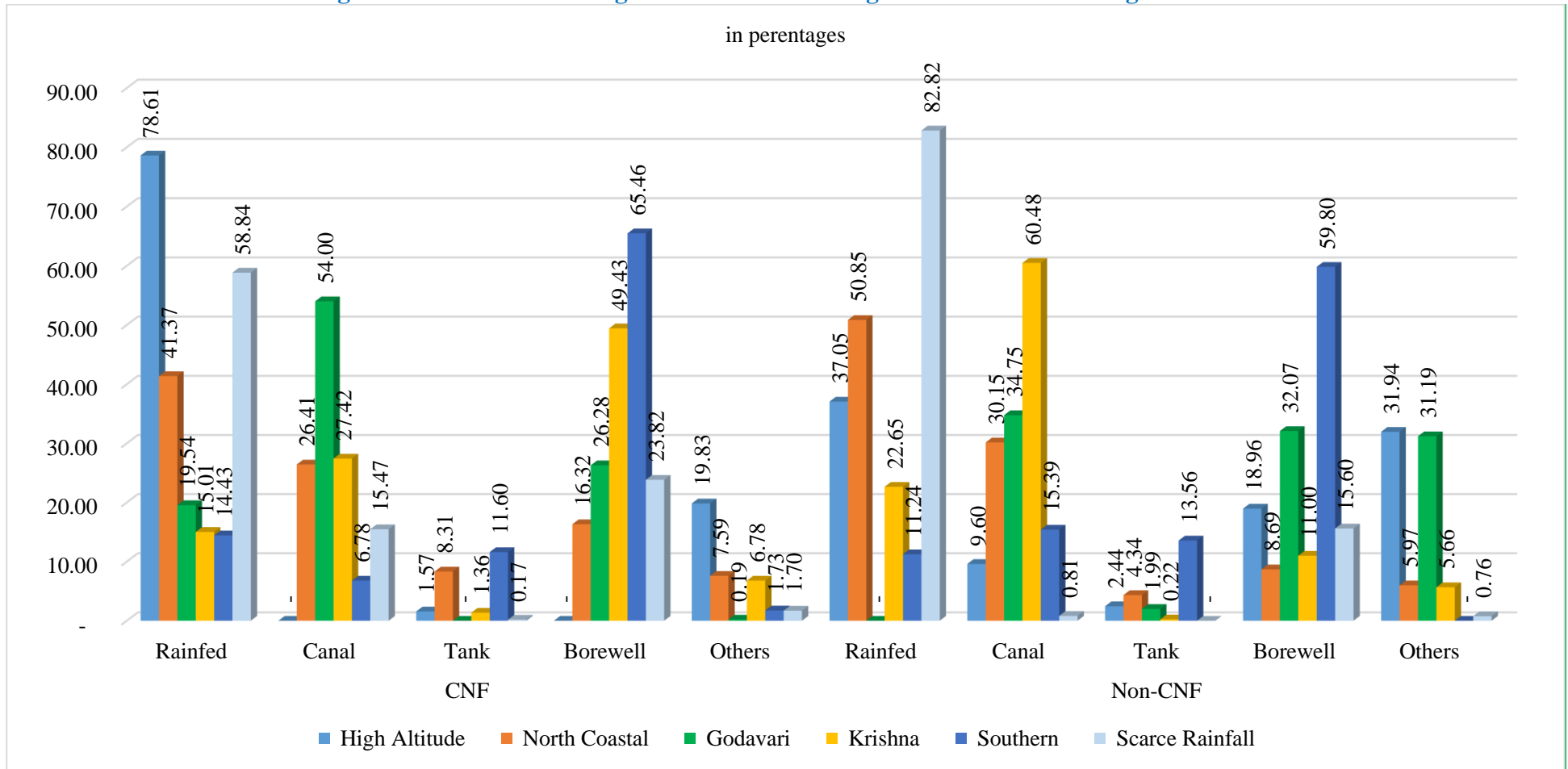
Source: IDSAP Field Survey, 2020-21

Figure 4.7: Percentage of irrigated area in the total cultivated area for PMDS + CNF and Non-CNF farmers in Rabi Season during agricultural year 2020-21



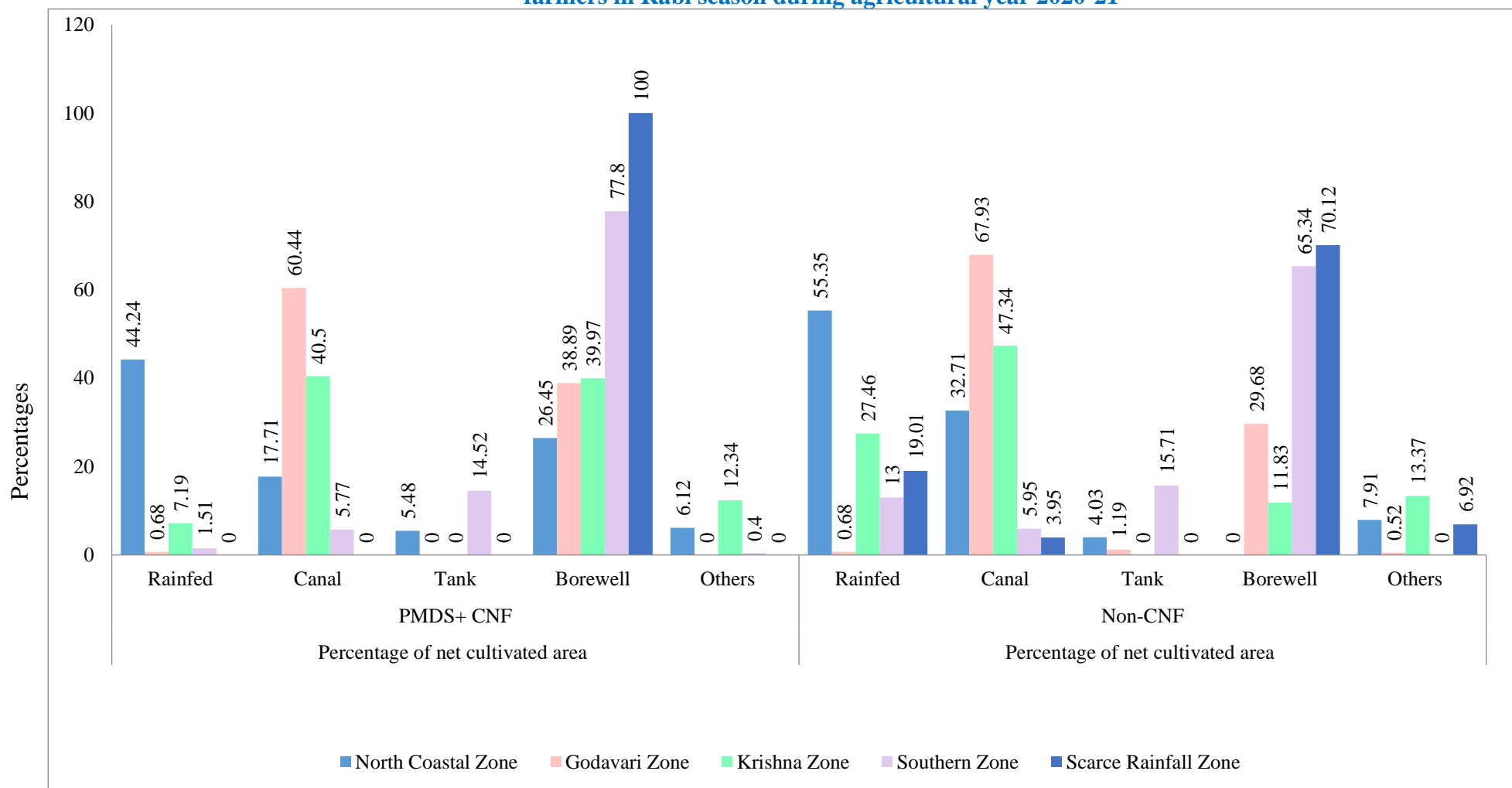
Source: IDSAP Field Survey, 2020-21

Figure 4.8: Source wise irrigated area across the agroclimatic zones during Kharif 2020-21



Source: IDSAP Field Survey, 2020-21

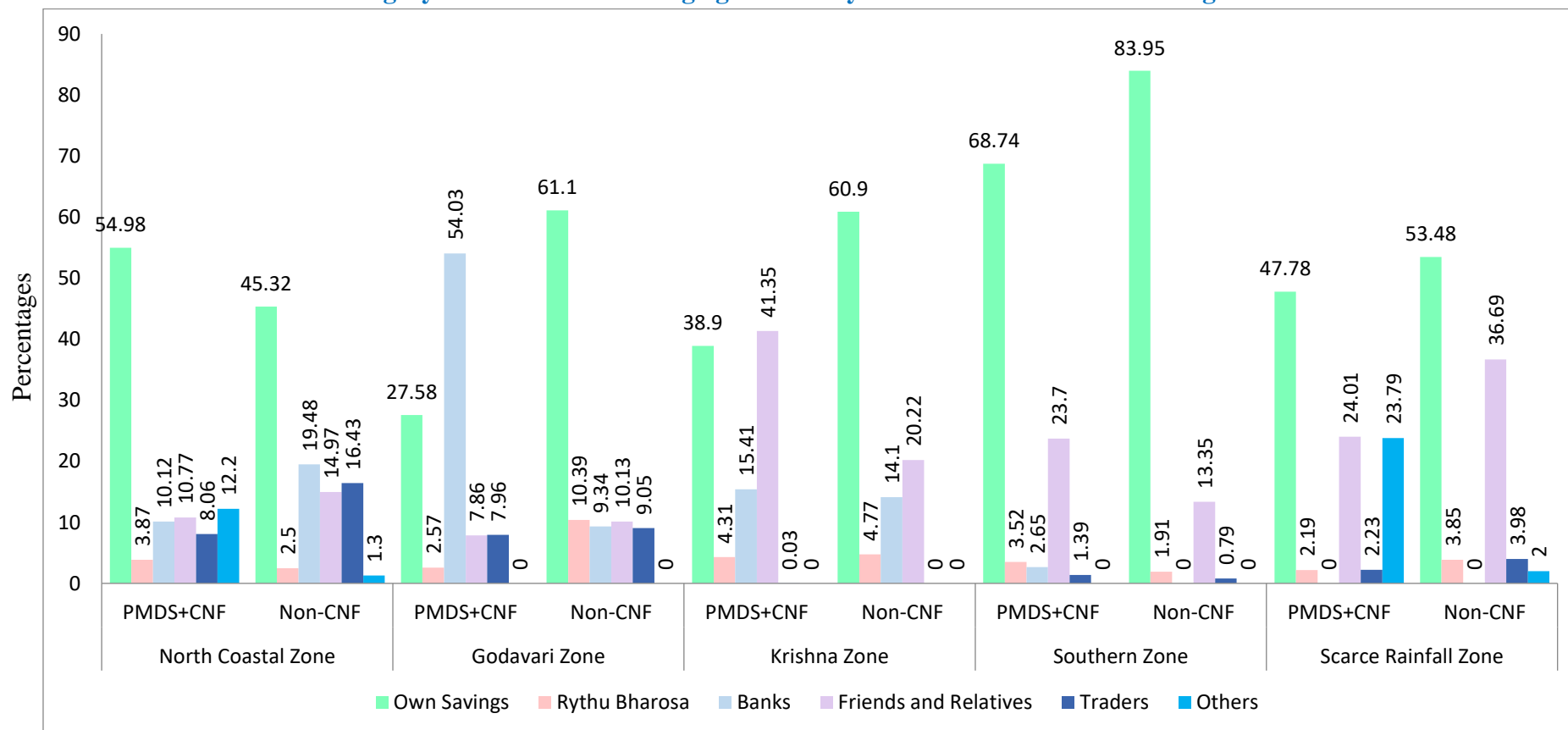
Figure 4.9: Percentage of irrigated area under different sources in the total cultivated area in Rabi Season for the PMDS + CNF and Non-CNF farmers in Rabi season during agricultural year 2020-21



Source: IDSAP Field Survey, 2020-21

The dependency on money lenders and traders is lower for CNF farmers compared to the non-CNF farmers for meeting the expenditure towards raising crops and household needs (Figure 4.10 and table 4.10). This will reduce the interest on working capital and thereby costs of growing crops.

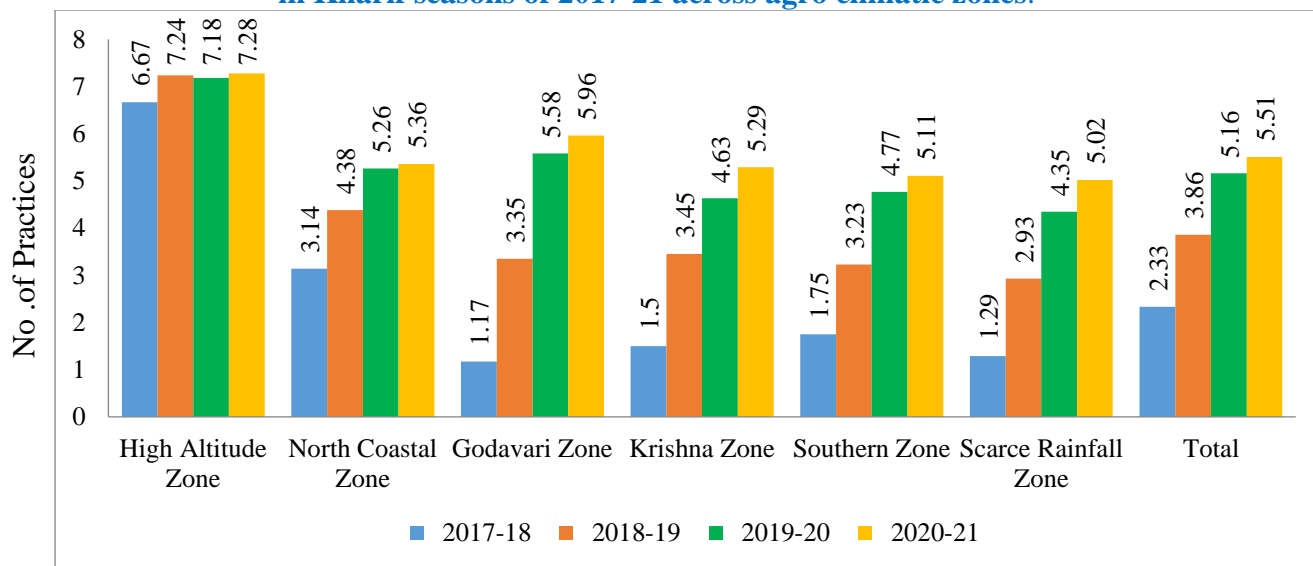
Figure 4.10: Percentage of farmers mobilizing funds from different sources for agricultural and Non-Agricultural purpose by PMDS + CNF and Non-CNF category in Rabi season during agricultural year 2021-21 across different agro climatic zones



Source: IDSAP Field Survey, 2020-21

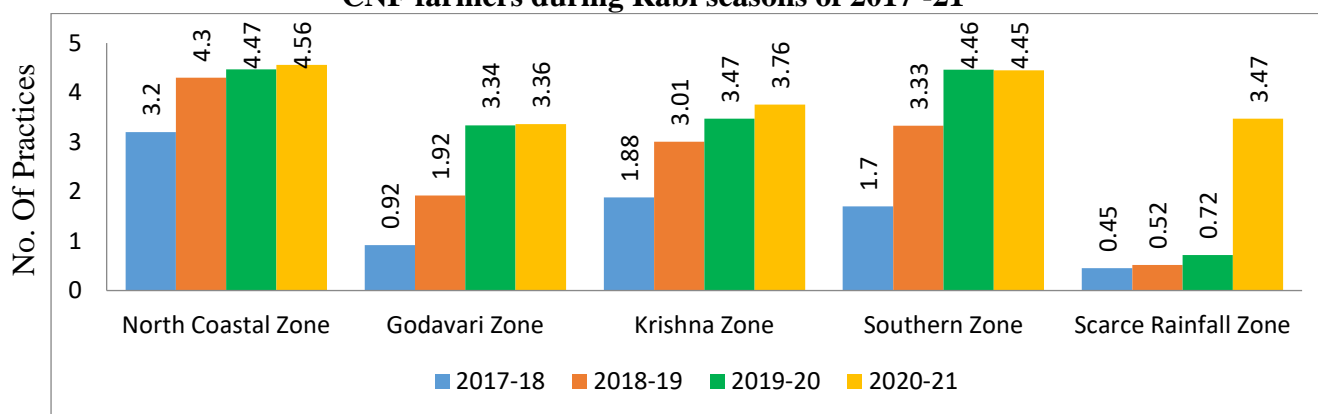
The number of CNF practices adopted for growing crops has been increasing over years from 2017-18 to 2020-21 in Kharif as well as Rabi across the agroclimatic zones. It is the highest in the High-Altitude Zone among the tribal communities. The adoption in the rainfall zones is more or less equal to the assured irrigated areas (Figure 4.11 and 4.12 and tables 4.11 and 4.12). The increased number of practices adopted leads to reduction in the cost of cultivation and improvement in crop yields.

Figure 4.11: Average number of CNF inputs and practices adopted by the CNF farmers in Kharif seasons of 2017-21 across agro climatic zones.



Source: IDSAP Field Survey, 2020-21

Figure 4.12: Agro-climatic zone wise number of CNF practices, on average, adopted by CNF farmers during Rabi seasons of 2017 -21

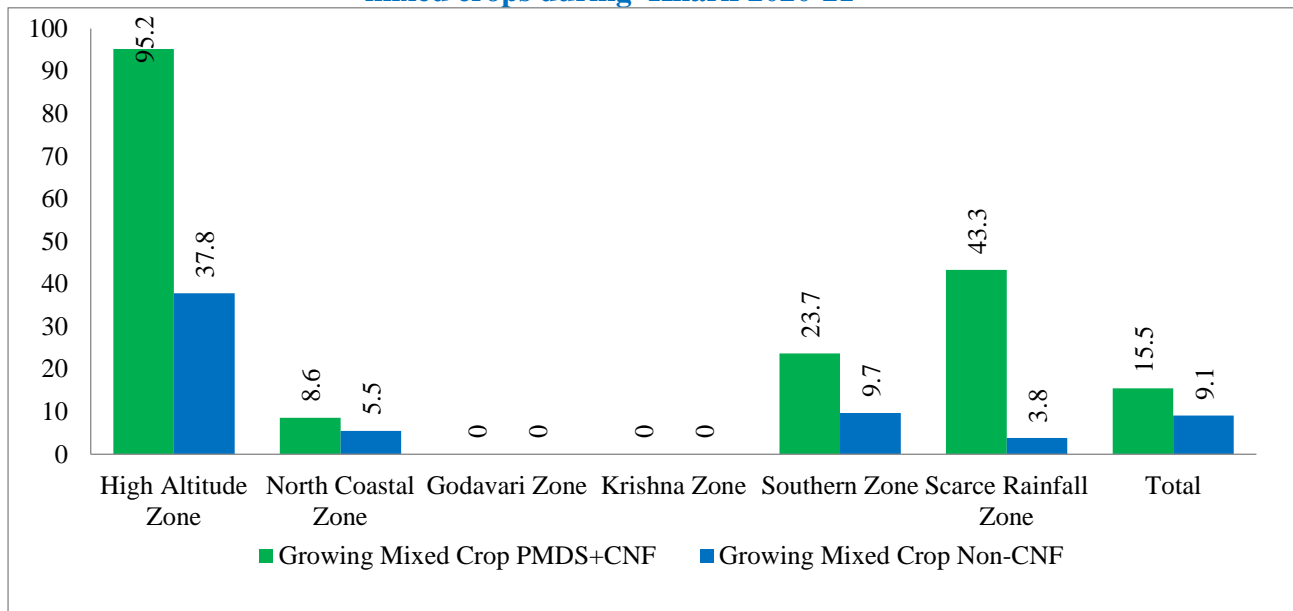


Source: IDSAP Field Survey, 2020-21

Further, the penetration of mixed cropping practices is relatively higher among CNF farmers compared to non-CNF farmers in all the zones except in Godavari and Krishna zones. Area under mixed cropping as a percentage of total area is still very small and less than one percent

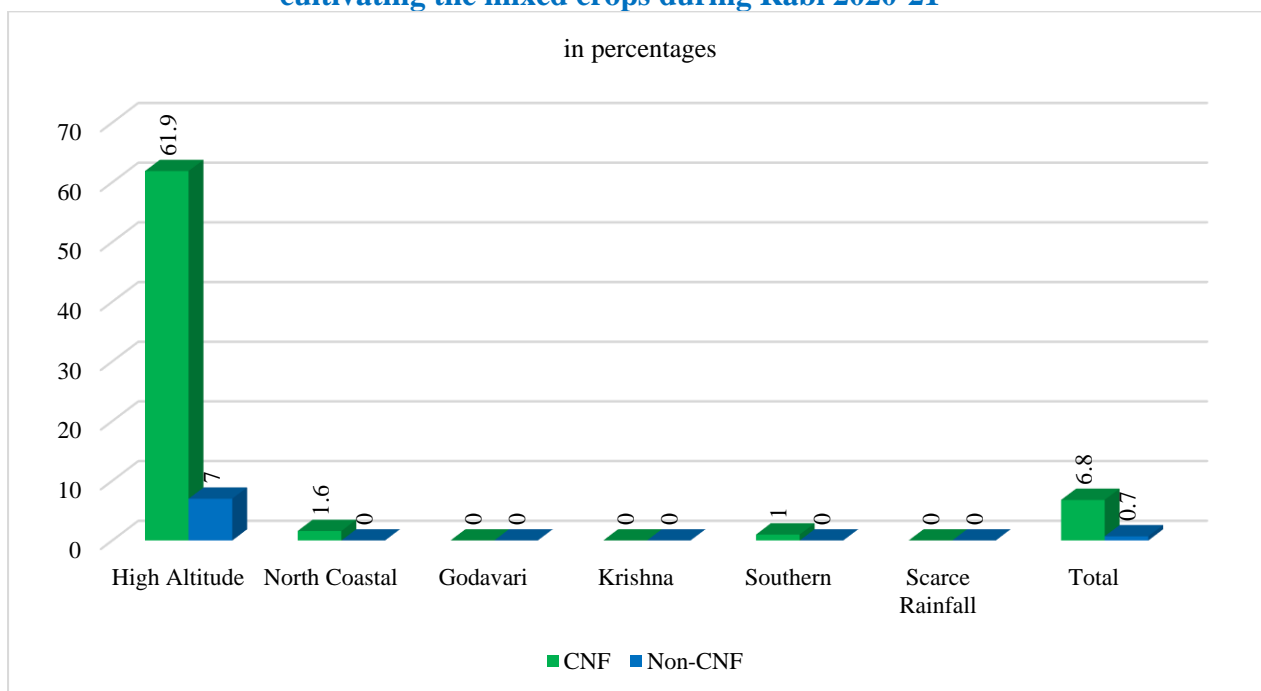
(Figure 4.13 and 4.14 and tables 4.13). Mixed cropping has the potential to reduce production risks of the farmers.

Figure 4.13: Agroclimatic zone wise percentage of CNF and non-CNF farmers growing mixed crops during Kharif 2020-21



Source: IDSAP Field Survey, 2020-21

Figure 4.14: Agroclimatic zone wise percentage of CNF and non-CNF farmers cultivating the mixed crops during Rabi 2020-21

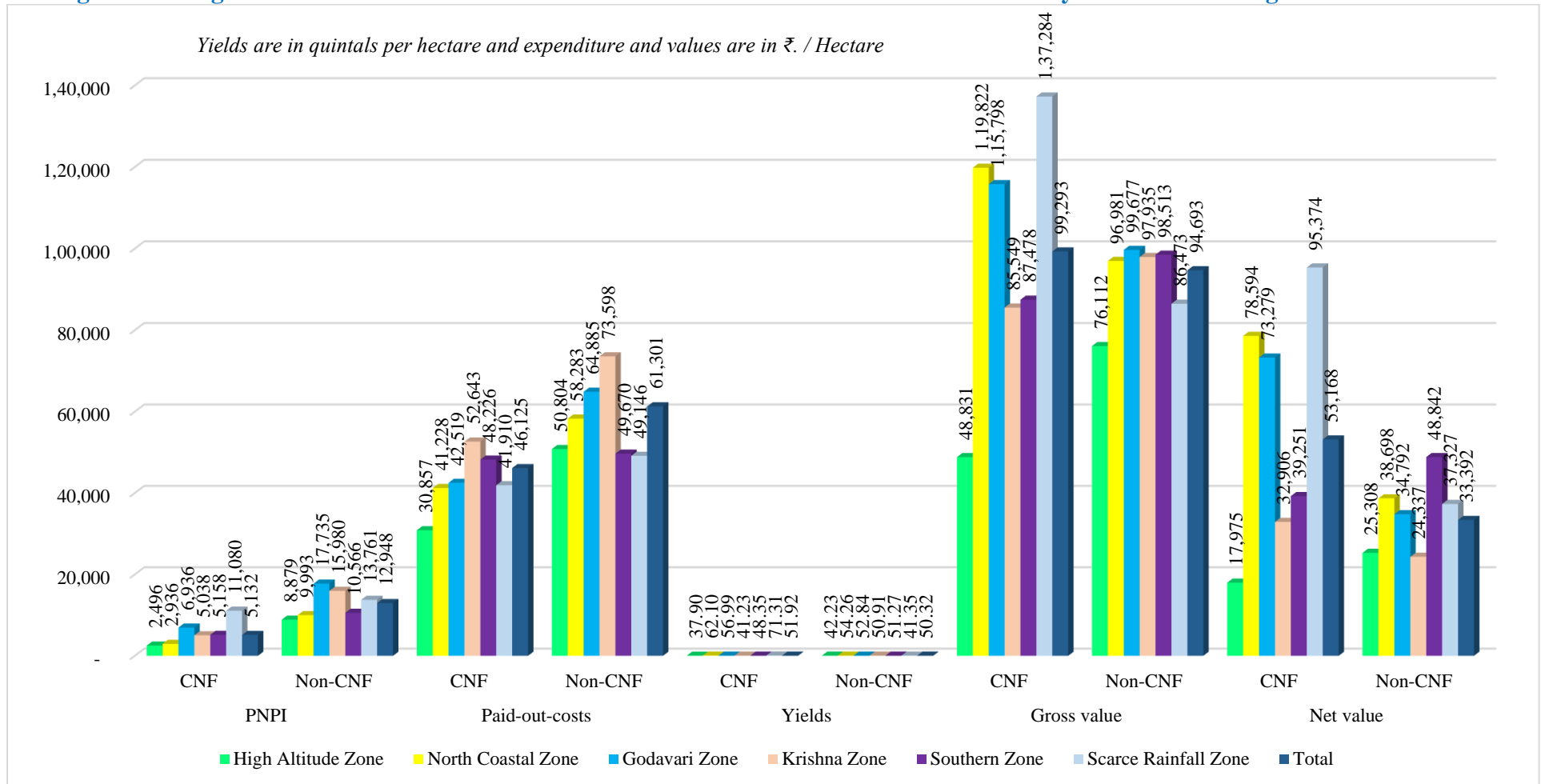


Source: IDSAP Field Survey, 2020-21

4.3. Costs and returns

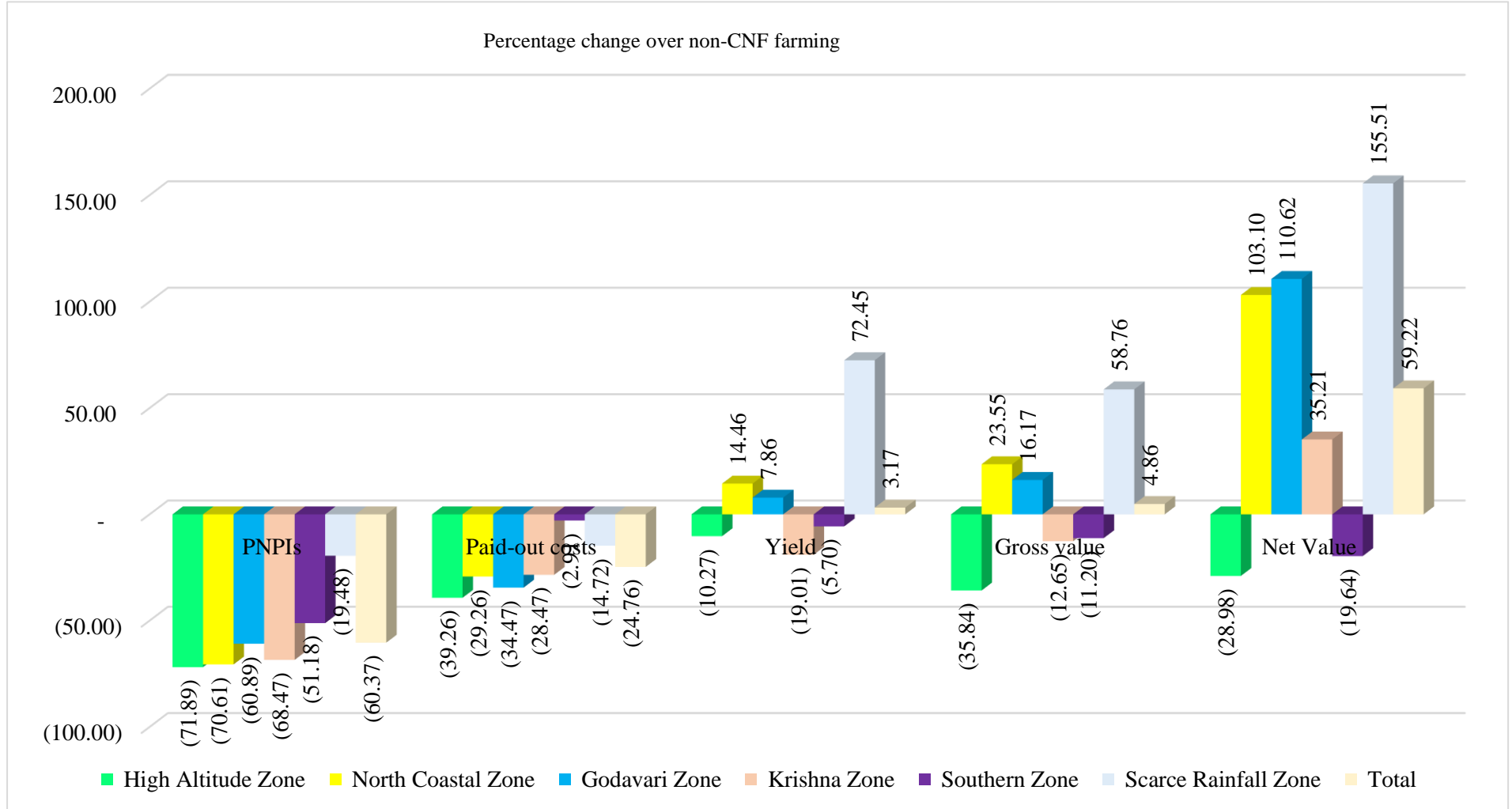
The analysis of cost and returns is confined to paddy crop only since it has adequate sample size for conducting analysis. Biological inputs of CNF and Chemical inputs of non-CNF together are called plant nutrition and plant protection inputs (PNPIs). The use of biological inputs per hectare for paddy crop have reduced considerably the PNPIs costs under CNF in relation to non-CNF for growing crop. The extent of reduction is higher for the assured irrigated zones-Godavari and Krishna Zones- compared to that for the rainfall dependent zones. This is true in Kharif as well as Rabi seasons. The paid-out costs are lower for the CNF farmers in Kharif season and higher for Rabi season due to higher use of hired labour for adopting crop practices under CNF compared to non-CNF. The yields of CNF are substantially higher in Rabi season in southern zone and scarce rainfall region due to the use more of controlled irrigation for growing paddy under CNF over non-CNF. The yields of Paddy in the Kharif season are lower for CNF in Krishna zone and Southern zones. The yields are lower in Godavari and North coastal regions in Rabi season. The reduction in in paid out costs are lower for CNF compared to non-CNF in Kharif season for all the zones but higher than the non-CNF Paddy in the Rabi season in all the zones except North coastal zone. The net value of Paddy output per hectare was higher for CNF farmers in all the zones except in Southern zone during the Kharif season. In the Rabi season the net value of Paddy output per hectare was higher in all zones except in Godavari zone. (Figures 4.15 to 4.18 and tables 4.14 to 4.17).

Figure 4.15: Agroclimatic zone wise values of selected indicators of CNF and non-CNF Paddy cultivation during Kharif 2020-21



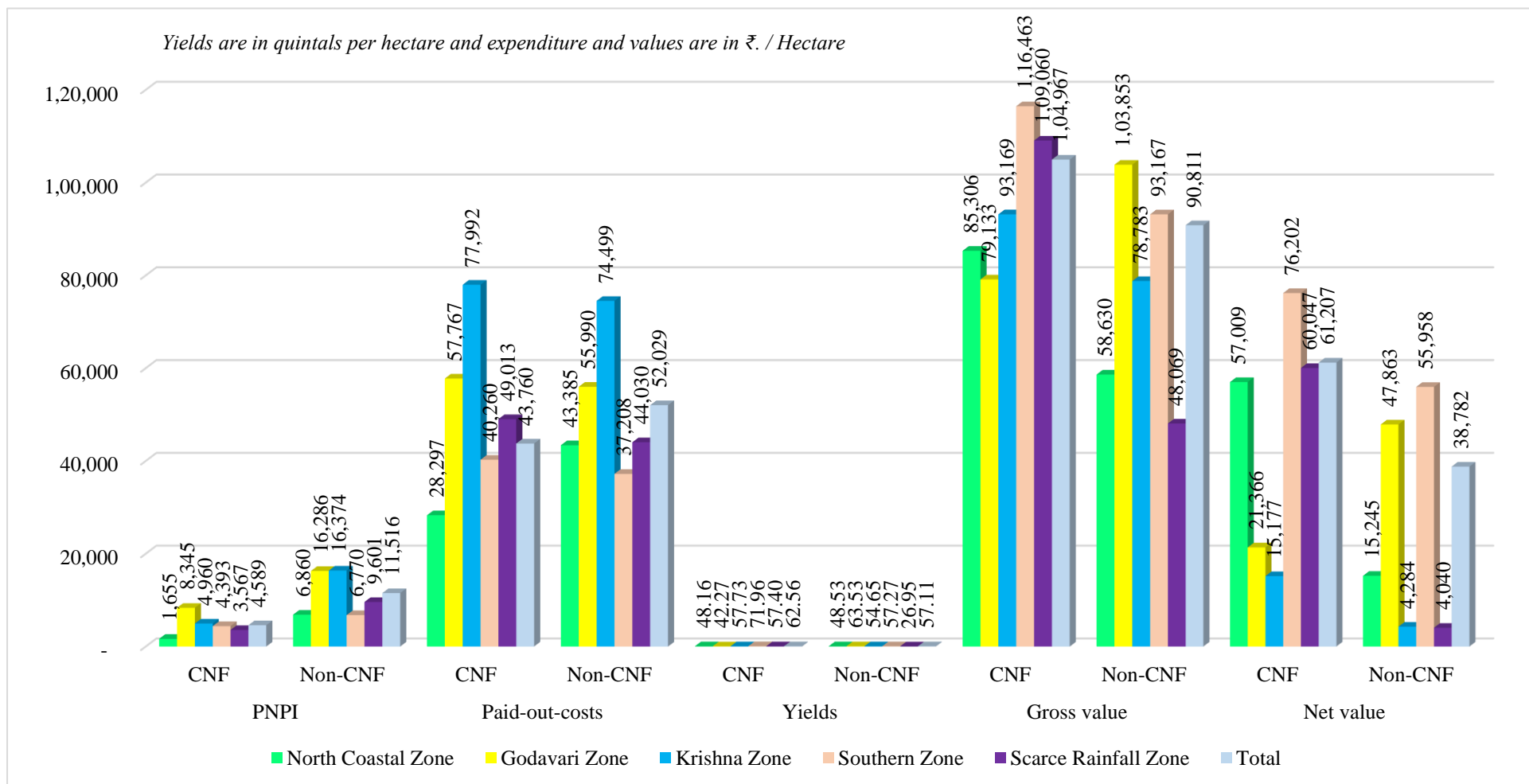
Source: IDSAP Field Survey, 2020-21

Figure 4.16: Agroclimatic zone wise percentage differences between the values of selected indicators of CNF and non-CNF Paddy cultivation in Kharif 2020-21



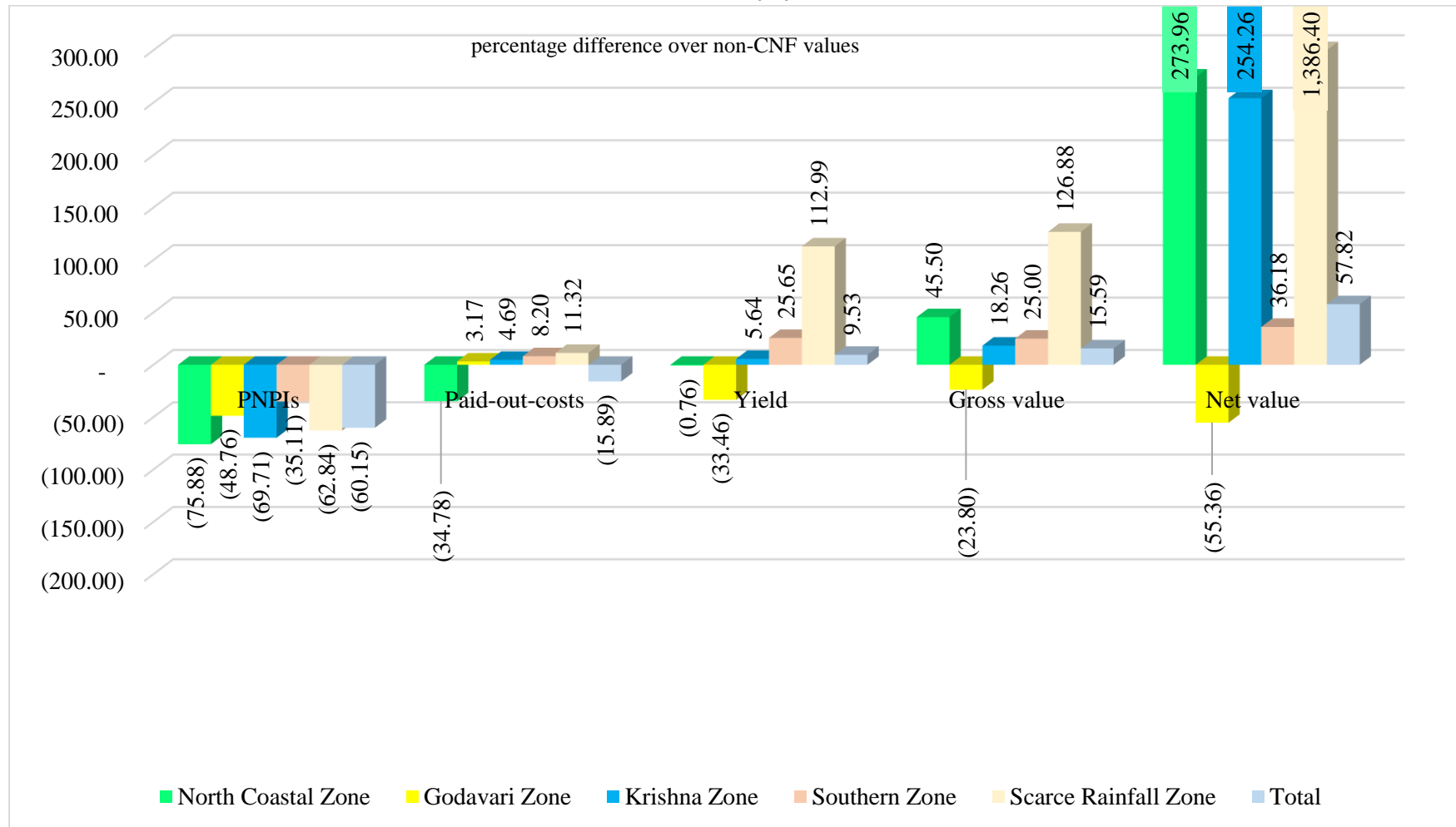
Source: IDSAP Field Survey, 2020-21

Figure 4.17: Agroclimatic zone wise values of selected indicators of CNF and non-CNF farming during Rabi 2020-21



Source: IDSAP Field Survey, 2020-21

Figure 4.18: Agroclimatic zone wise percentage difference between CNF and non-CNF values of selected farming indicators during Rabi 2020-21



Source: IDSAP Field Survey, 2020-21

4.4. Conclusions

The intensive use of land and labour, higher cultivated area under controlled irrigation, lower dependency on money lenders and traders and higher adoption of CNF practices has contributed for the variation in cost and returns of crops across the agroclimatic zones. The rainfall dependent zones have obtained higher net returns in Rabi except southern zone in Kharif season.

Tables - Chapter 4

Table 4.1: Percentage of area allocated to CNF in Kharif Season by CNF farmers in different agro climatic Zones during agricultural years 2017-21

Agro-Climatic Zone	% Of Operational area under APNCF			
	2017-18	2018-19	2019-20	2020-21
High Altitude Zone	83.75	86.98	86.98	86.85
North Coastal Zone	29.25	47.07	60.14	66.57
Godavari Zone	13.06	29.03	38.99	40.79
Krishna Zone	13.07	26.13	30.54	31.45
Southern Zone	21.23	39.22	66.47	80.47
Scarce Rainfall Zone	25.82	44.9	60.2	65.63
Total	26.48	41.28	55.66	62.81

Source: IDSAP Field Survey, 2020-21

Table 4.2: Agroclimatic zone wise CNF cultivated area as a % of total cultivated area in Rabi seasons of 2017 -21 by CNF Farmers

Agro-Climatic Zone	% Of Operational area under APNCF			
	2017-18	2018-19	2019-20	2020-21
North Coastal Zone	56.55	76.21	82.87	86.44
Godavari Zone	7.8	20.33	37.05	37.42
Krishna Zone	25.39	41.19	48.88	51.94
Southern Zone	14.13	37.69	61.2	76.97
Scarce Rainfall Zone	12.18	11.47	16.3	24.15
Total	116.05	186.89	246.3	276.92

Source: IDSAP Field Survey, 2021

Table 4.3: District wise number of days of crop cover on PMDS + CNF and non-CNF fields during 2020-21

District	CNF + PMDS (in days)	Non-CNF (in days)	Difference between CNF and non-CNF	
			in days	in percentages
Srikakulam	259	251	8	3.32
Visakhapatnam	287	276	12	4.22
Vizianagaram	251	233	17	7.45
East Godavari	206	253	(47)	(18.66)
West Godavari	307	272	35	12.83
Guntur	284	227	57	25.32
Krishna	272	259	12	4.78
Prakasam	222	198	24	11.97
Chittoor	242	245	(3)	(1.31)
PSR Nellore	265	219	46	21.25

YSR Kadapa	218	207	11	5.33
Anantapuramu	160	159	1	0.79
Kurnool	172	180	(8)	(4.55)
AP	244	228	16	6.86

Source: IDSAP Field Survey, 2021

Table 4.4: Agroclimatic zone wise labour used in Paddy cultivation by CNF and non-CNF farmers in Kharif 2020-21

Labour days per hectare

Agroclimatic zone	Family Labour		Hired labour		Total labour days	
	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF
High Altitude	156	39	3	45	159	83
North Coastal	46	42	66	70	112	112
Godavari	35	20	50	52	85	72
Krishna	104	43	56	65	160	108
Southern	58	38	49	44	107	82
Scarce Rainfall	71	43	57	53	128	96

Table 4.5: Agroclimatic zone wise number of labour days used in the Paddy cultivation by CNF and non-CNF farmers in Rabi 2020-21

Labour days per hectare

Agroclimatic zone	CNF			Non-CNF		
	Family Labour Days per hectare	Casual Labour Days per hectare	Total Labour days in hectare	Family Labour Days per hectare	Casual Labour Days per hectare	Total Labour days in hectare
North Coastal Zone	38.98	51.1	90.09	51.56	33.93	85.49
Godavari Zone	45.43	50.22	95.65	20.15	40.88	61.03
Krishna Zone	141.23	47.37	188.59	43.75	49.64	93.39
Southern Zone	53.09	40.18	93.27	31.54	30.22	61.75
Scarce Rainfall Zone	45.96	99.42	145.38	33.92	51.2	85.12

Source: IDSAP Field Survey, 2021

Table 4.6: Agroclimatic zone wise percentage share of irrigated and unirrigated area for CNF and non-CNF farmers during Kharif 2020-21

In percentage

Agroclimatic zone	Unirrigated		Irrigated	
	CNF	non-CNF	CNF	non-CNF
High Altitude	78.61	37.05	21.39	62.95
North Coastal	41.37	50.85	58.63	49.15
Godavari	19.54	0.00	80.46	100.00
Southern	14.43	11.24	85.57	88.76
Scarce Rainfall	58.84	82.82	41.16	17.18
Total	31.63	34.24	68.37	65.76

Source: IDSAP Field Survey, 2020-21

Table 4.7: Percentage of irrigated area in the total cultivated area of CNF and non-CNF farmers in Rabi 2020-21

Agroclimatic zone	CNF			Non-CNF		
	Cultivated Area in hectare	% of Cultivated area		Cultivated Area in hectare	% of Cultivated area	
		Unirrigated	Irrigated		Unirrigated	Irrigated
North Coastal	76.07	43.68	56.32	43.18	55.35	44.65
Godavari	29.76	0.68	99.32	50.82	0.68	99.32
Krishna	64.75	6.69	93.31	132.67	27.46	72.54
Southern	100.64	1.51	98.49	118.18	12.48	87.52
Scarce Rainfall	5.46	0	100	40.95	19.01	80.99

Source: IDSAP Field Survey, 2021

Table 4.8: Source wise percentage of irrigated area for the CNF and non-CNF farmers during Kharif 2020-21 across agroclimatic zone

Agroclimatic zone	CNF						Non-CNF					
	Cultivated Area in hectare	Percentage of net cultivated area					Cultivated Area in hectare	Percentage of net cultivated area				
		Rainfed	Canal	Tank	Borewell	Others		Rainfed	Canal	Tank	Borewell	Others
High Altitude	38.78	78.61	0.00	1.57	0.00	19.83	81.67	37.05	9.60	2.44	18.96	31.94
North Coastal	317.16	41.37	26.41	8.31	16.32	7.59	62.48	50.85	30.15	4.34	8.69	5.97
Godavari	108.11	19.54	54.00	0.00	26.28	0.19	50.82	0.00	34.75	1.99	32.07	31.19
Krishna	194.00	15.01	27.42	1.36	49.43	6.78	184.09	22.65	60.48	0.22	11.00	5.66
Southern	210.01	14.43	6.78	11.60	65.46	1.73	149.33	11.24	15.39	13.56	59.80	0.00
Scarce Rainfall	118.76	58.84	15.47	0.17	23.82	1.70	124.38	82.82	0.81	0.00	15.60	0.76
Total	986.83	31.63	23.10	5.49	34.64	5.14	652.76	34.24	27.52	4.04	25.45	8.74

Source: IDSAP Field Survey, 2020-21

Table 4.9: Source wise percentage of irrigated area for the CNF and Non-CNF farmers in Rabi 2020-21 across agroclimatic zones

Agroclimatic zone	CNF						Non-CNF					
	Cultivated Area in hectare	Percentage of net cultivated area					Cultivated Area in hectare	Percentage of net cultivated area				
		Rainfed	Canal	Tank	Borewell	Others		Rainfed	Canal	Tank	Borewell	Others
North Coastal	76.07	44.24	17.71	5.48	26.45	6.12	43.18	55.35	32.71	4.03	0	7.91
Godavari	29.76	0.68	60.44	0	38.89	0	50.82	0.68	67.93	1.19	29.68	0.52
Krishna	64.75	7.19	40.5	0	39.97	12.34	132.67	27.46	47.34	0	11.83	13.37
Southern	100.64	1.51	5.77	14.52	77.8	0.4	118.18	13	5.95	15.71	65.34	0
Scarce Rainfall	5.46	0	0	0	100	0	40.95	19.01	3.95	0	70.12	6.92

Source: IDSAP Field Survey, 2020-21

Table 4.10: Percentage of CNF and non-CNF farmers mobilizing funds from different sources in Rabi 2021-21 across agroclimatic zones

Source	North Coastal Zone		Godavari Zone		Krishna Zone		Southern Zone		Scarce Rainfall Zone	
	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF
Own Savings	54.98	45.32	27.58	61.1	38.9	60.9	68.74	83.95	47.78	53.48
Rythu Bharosa	3.87	2.5	2.57	10.39	4.31	4.77	3.52	1.91	2.19	3.85
Banks	10.12	19.48	54.03	9.34	15.41	14.1	2.65	0	0	0
Friends & Relatives	10.77	14.97	7.86	10.13	41.35	20.22	23.7	13.35	24.01	36.69
Traders	8.06	16.43	7.96	9.05	0.03	0	1.39	0.79	2.23	3.98
Others	12.2	1.3	0	0	0	0	0	0	23.79	2

Source: IDSAP Field Survey, 2021

Table 4.11: Average number of CNF inputs and practices adopted by the CNF farmers in Kharif seasons of 2017-21 across agroclimatic zones

Agro climatic zones	2017-18	2018-19	2019-20	2020-21
High Altitude	6.67	7.24	7.18	7.28
North Coastal	3.14	4.38	5.26	5.36
Godavari	1.17	3.35	5.58	5.96
Krishna	1.5	3.45	4.63	5.29
Southern	1.75	3.23	4.77	5.11
Scarce Rainfall	1.29	2.93	4.35	5.02
Total	2.33	3.86	5.16	5.51

Source: IDSAP Field Survey, 2020-21

Table 4.12: Agroclimatic zone wise average number of CNF inputs and practices adopted by CNF farmers during Rabi seasons of 2017 -21

Agroclimatic zone	2017-18	2018-19	2019-20	2020-21
North Coastal	3.2	4.3	4.47	4.56
Godavari	0.92	1.92	3.34	3.36
Krishna	1.88	3.01	3.47	3.76
Southern	1.7	3.33	4.46	4.45
Scarce Rainfall	0.45	0.52	0.72	3.47

Source: IDSAP Field Survey, 2020-21

Table 4.13: Percentage of CNF and non-CNF farmers growing mixed crops in Kharif 2020-21

Agro Climatic Zone	Growing Single Crop		Growing Mixed Crop	
	CNF	Non-CNF	CNF	Non-CNF
High Altitude Zone	95.2	37.8	61.9	7.0
North Coastal Zone	8.6	5.5	1.6	0.0
Godavari Zone	0	0	0.0	0.0
Krishna Zone	0	0	0.0	0.0
Southern Zone	23.7	9.7	1.0	0.0
Scarce Rainfall Zone	43.3	3.8	0.0	0.0
Total	15.5	9.1	6.8	0.7

Source: IDSAP Field Survey, 2020-21

Table 4.14: Agroclimatic zone wise values of selected indicators of CNF and non-CNF farming during Kharif 2020-21

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

Agroclimatic zones	PNPI		Paid-out-costs		Yields		Gross value		Net value	
	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF
High Altitude	2,496	8,879	30,857	50,804	37.90	42.23	48,831	76,112	17,975	25,308
North Coastal	2,936	9,993	41,228	58,283	62.10	54.26	1,19,822	96,981	78,594	38,698
Godavari Zone	6,936	17,735	42,519	64,885	56.99	52.84	1,15,798	99,677	73,279	34,792
Krishna Zone	5,038	15,980	52,643	73,598	41.23	50.91	85,549	97,935	32,906	24,337
Southern Zone	5,158	10,566	48,226	49,670	48.35	51.27	87,478	98,513	39,251	48,842
Scarce Rainfall	11,080	13,761	41,910	49,146	71.31	41.35	1,37,284	86,473	95,374	37,327
Total	5,132	12,948	46,125	61,301	51.92	50.32	99,293	94,693	53,168	33,392

Source: IDSAP Field Survey, 2020-21

Table 4.15: Agroclimatic zone wise differences between the values of selected indicators of CNF and non-CNF farming during Kharif 2020-21

Agroclimatic zones	Absolute in differences in Rs./ quintals per ha					Relative differences in % per ha				
	PNPIs	Paid-out costs	Yield in quintal	Gross value	Net Value	PNPIs	Paid-out costs	Yields in quintals	Gross value	Net value
High Altitude	-6,383	-19,947	-4.34	-27,281	-7,334	-71.89	-39.26	-10.27	-35.84	-28.98
North Coastal	-7,056	-17,055	7.85	22,841	39,896	-70.61	-29.26	14.46	23.55	103.10
Godavari	-10,799	-22,366	4.15	16,122	38,488	-60.89	-34.47	7.86	16.17	110.62
Krishna	-10,941	-20,955	-9.68	-12,386	8,569	-68.47	-28.47	-19.01	-12.65	35.21
Southern	-5,408	-1,444	-2.92	-11,035	-9,591	-51.18	-2.91	-5.70	-11.20	-19.64
Scarce Rainfall	-2,681	-7,237	29.96	50,811	58,047	-19.48	-14.72	72.45	58.76	155.51
Total	-7,817	-15,176	1.60	4,599	19,776	-60.37	-24.76	3.17	4.86	59.22

Source: IDSAP Field Survey, 2020-21

Table 4.16: Agroclimatic zone wise values of selected indicators of CNF and non-CNF farming during Rabi 2020-21

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

Agroclimatic zones	PNPI		Paid-out-costs		Yields		Gross value		Net value	
	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF
North Coastal	1,655	6,860	28,297	43,385	48.16	48.53	85,306	58,630	57,009	15,245
Godavari	8,345	16,286	57,767	55,990	42.27	63.53	79,133	1,03,853	21,366	47,863
Krishna	4,960	16,374	77,992	74,499	57.73	54.65	93,169	78,783	15,177	4,284
Southern	4,393	6,770	40,260	37,208	71.96	57.27	1,16,463	93,167	76,202	55,958
Scarce Rainfall	3,567	9,601	49,013	44,030	57.40	26.95	1,09,060	48,069	60,047	4,040
Total	4,589	11,516	43,760	52,029	62.56	57.11	1,04,967	90,811	61,207	38,782

Source: IDSAP Field Survey, 2020-21

Table 4.17: Agroclimatic zone wise differences between the values of selected indicators of CNF and non-CNF farming during Rabi 2020-21

Agroclimatic zones	Absolute difference in Rs./ quintals per ha					Relative difference in % per ha				
	PNPIs	Paid-out-costs	Yield in quintals	Gross value	Net value	PNPIs	Paid-out-costs	Yield in quintals	Gross value	Net value
North Coastal	-5,206	-15,088	-0	26,676	41,764	-75.88	-34.78	-0.76	45.50	273.96
Godavari	-7,941	1,777	-21	-24,720	-26,497	-48.76	3.17	-33.46	-23.80	-55.36
Krishna	-11,414	3,493	3	14,386	10,893	-69.71	4.69	5.64	18.26	254.26
Southern	-2,377	3,052	15	23,296	20,244	-35.11	8.20	25.65	25.00	36.18
Scarce Rainfall	-6,034	4,984	30	60,991	56,007	-62.84	11.32	112.99	126.88	1,386.40
Total	-6,927	-8,270	5	14,156	22,425	-60.15	-15.89	9.53	15.59	57.82

Source: IDSAP Field Survey, 2020-21

Chapter 5: Farm category wise impact of CNF on farming conditions

5.1. Introduction

The marginal and small landholders constitute 82 percent of farmers in the state of Andhra Pradesh. They own around 48 per cent of the farmland in the state (Government of India, 2021). The key issue is to know how far the CNF has improved farming conditions of marginal and small landholders and how far has the pattern of utilization of resources such as land, labour, water for irrigation and mobilization of funds for meeting the expenditure towards agricultural operation and household needs changed. The level of adoption of CNF practices and their contribution to the costs and returns of Paddy crop is of prime interest. This chapter is an attempt in this direction. In order to assess the contribution of CNF to the costs and returns of crops, a comparison has been made between CNF farmers and non-CNF farmers of small holdings. Moreover, a comparison of marginal and small landholders with medium and large landholders is also made to assess the impact of CNF across the farm size categories.

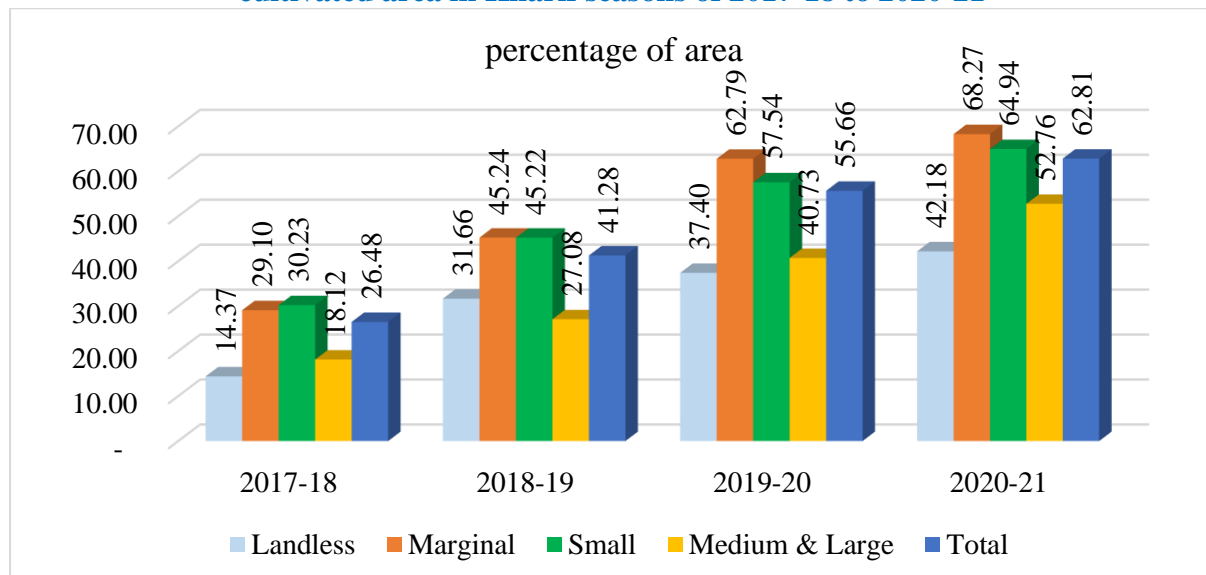
5.2. Pattern of Resource utilization and adoption of CNF practices

The area under CNF as a percentage of area cultivated by the small and marginal farmers is higher compared to that of the medium and large landholders in Kharif as well as Rabi seasons of the agricultural year 2020-21. It has been increasing over years from 26.48 percent in 2017-18 in Kharif to 62.81 percent in Kharif 2020-21 (Figures 5.1).²⁴ It is interesting to note that the small and marginal farmers have been consistently allocating a higher percentage of their operational holding to the CNF compared to the medium and large landholders in Kharif season. But landless or pure tenant farmers have allocated relatively lesser percentage of their operational holding to CNF, even less than that of the medium and large landholders during the Kharif seasons. But in the Rabi season, the tenant farmers and marginal farmers have allocated higher percentage of operational holdings than the small, medium and larger landholders, to the CNF during last three years (Figure 5.2). One possible reason for these perplexing trends, may be the tenant farmers are more concerned about land rent payment

²⁴ All tables are given at the end of the chapter

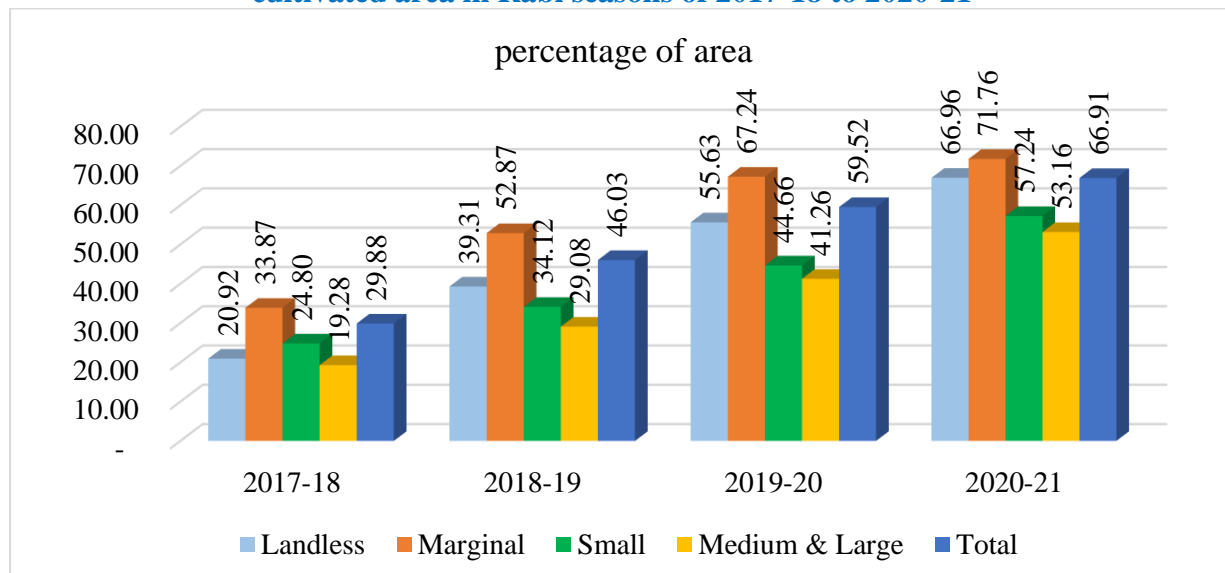
during the Kharif season and do not want to take any risk about the crop yields. Once the land rent was paid, they may be free to experiment or want CNF food for their own consumption. However, the percentage of area allocated to CNF has been steadily increasing over the period for all categories of farmers (Figures 5.1 and 5.2 and tables 5.1 and 5.2).

Figure 5.1: Farm category wise percentage of area allocated to CNF in the total cultivated area in Kharif seasons of 2017-18 to 2020-21



Source: IDSAP Field Survey, 2020-21

Figure 5.2: Farm category wise percentage of area allocated to CNF in the total cultivated area in Rabi seasons of 2017-18 to 2020-21

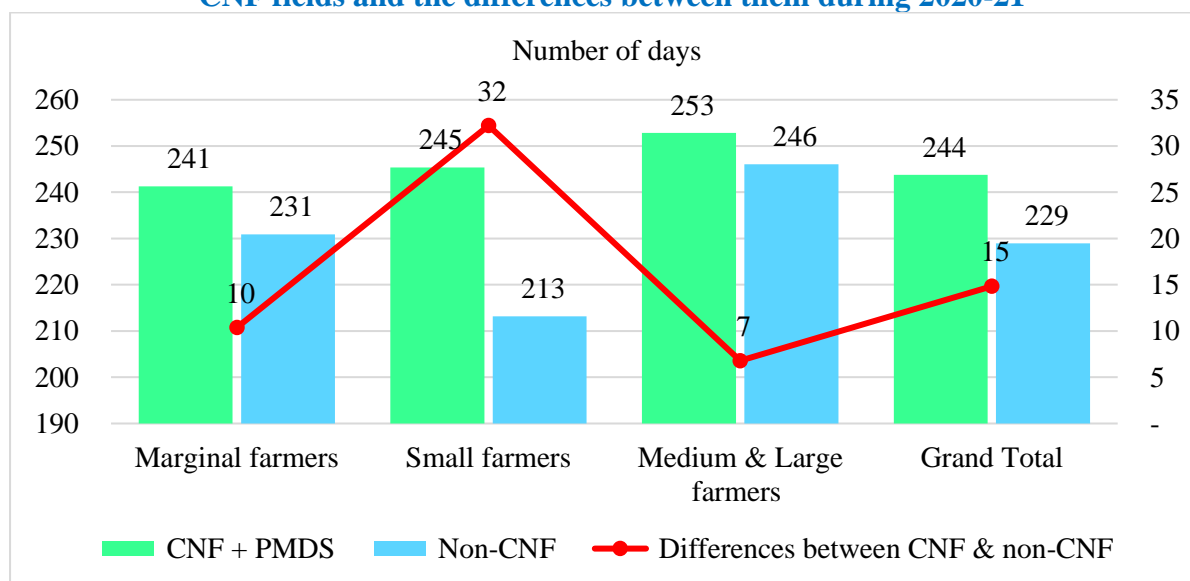


Source: IDSAP Field Survey, 2021

As discussed in Chapter 3, despite the structural challenges in taking the second crop in an agricultural year, the CNF farmers are able keep the green cover in their PMDS+CNF fields

for the longer periods vis-à-vis in non-CNF farmers in their fields (Figure 5.3 and Table 5.3). While on the whole, the CNF farmers are able keep the green cover on their fields by 15 days more than their counterparts. The gap in the green cover between PMDS+CNF fields of CNF farmers and non-CNF fields of control farmers is highest for the small farmers (32 days) and least for the medium and large farmers (7 days).

Figure 5.3: Farm category wise number of days of crop cover on PMDS+CNF and non-CNF fields and the differences between them during 2020-21



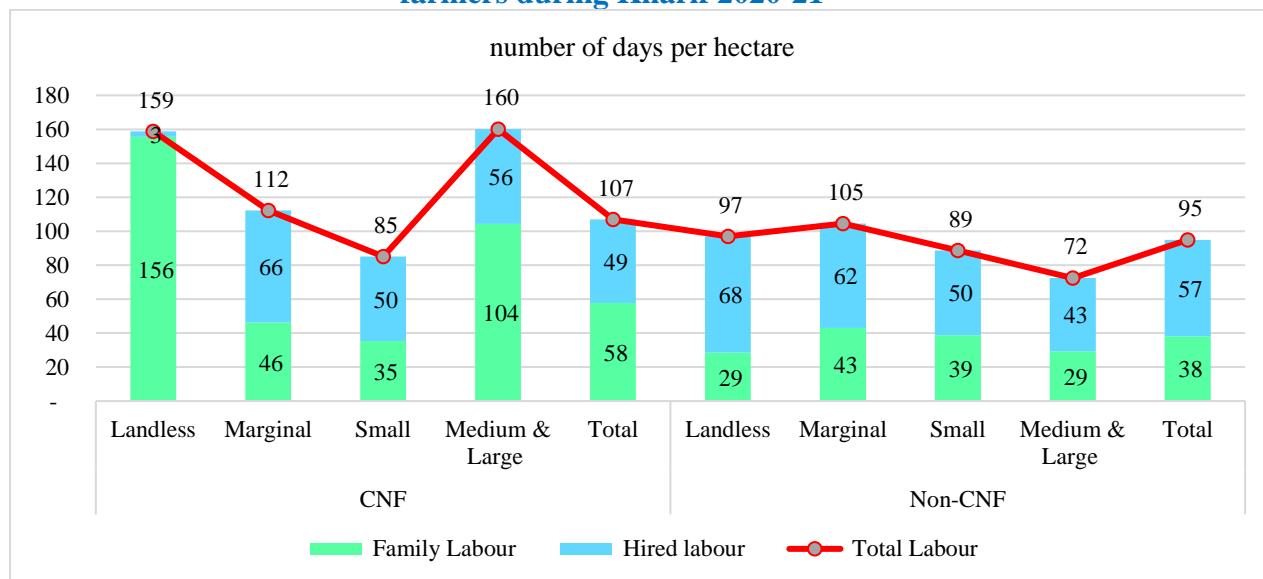
Source: IDSAP Field Survey, 2020-21

As anticipated the labour use under CNF Paddy cultivation is high compared to non-CNF in both Kharif and Rabi seasons. But there are wide variations across the farm categories. The labour use under CNF is quite higher for medium and large farmers and pure-tenant farmers²⁵ compared to their counterparts in non-CNF in both the seasons. This is true in case family and hired labour use for all the category of CNF farmers over non-CNF farmers (Figure 5.4 & 5.5 and table 5.4 & 5.5). This implies that expenditure on hired labour wages will be higher for CNF cultivation. It increases the labour costs of Paddy in the total costs of cultivation for CNF farmers over non-CNF for all size classes of farmers and more so for medium and large farmers than the marginal and small landholders. The higher use of family labour under CNF in relation to non-CNF farmers in all size classes indicates the higher engagement of family labour with CNF. Very high use of family labour under CNF compared to non-CNF in both seasons is a surprising result. It may include the attached labour. Overall, the use of family labour is very high under CNF in all but one farm categories. The only exception is small farmers. This may

²⁵ The words landless farmers and pure-tenant farmers are used in this report interchangeably

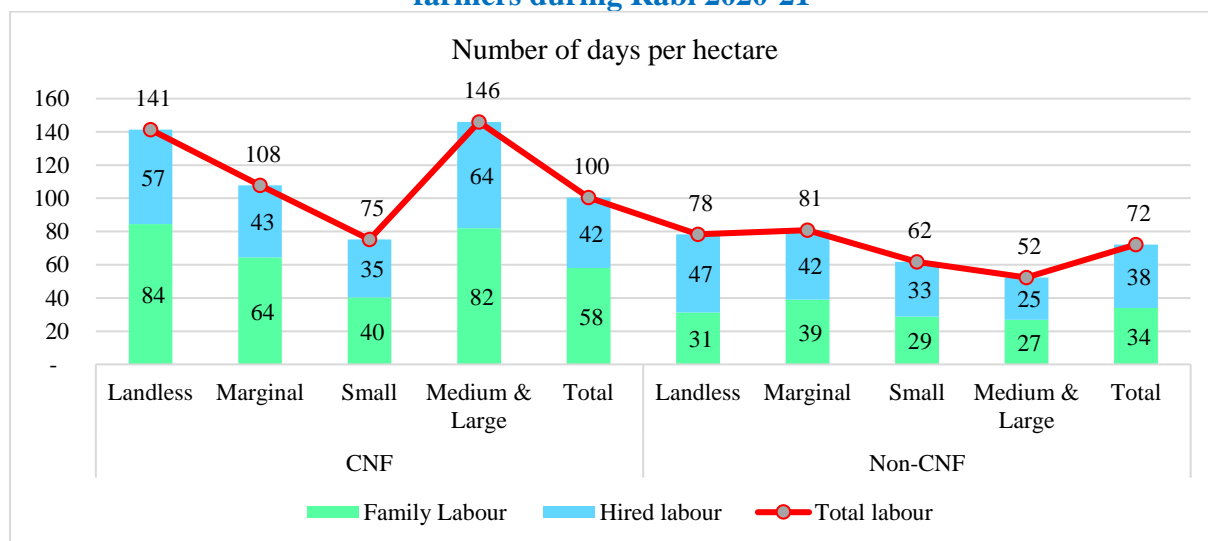
have positive impact on the yields of crops. The employment pattern indicates that natural farming has generated productive employment in the rural areas.

Figure 5.4: Farm size wise labour used in the Paddy cultivation by CNF and non-CNF farmers during Kharif 2020-21



Source: IDSAP Field Survey, 2020-21

Figure 5.5: Farm size wise labour used in the Paddy cultivation by CNF and non-CNF farmers during Rabi 2020-21

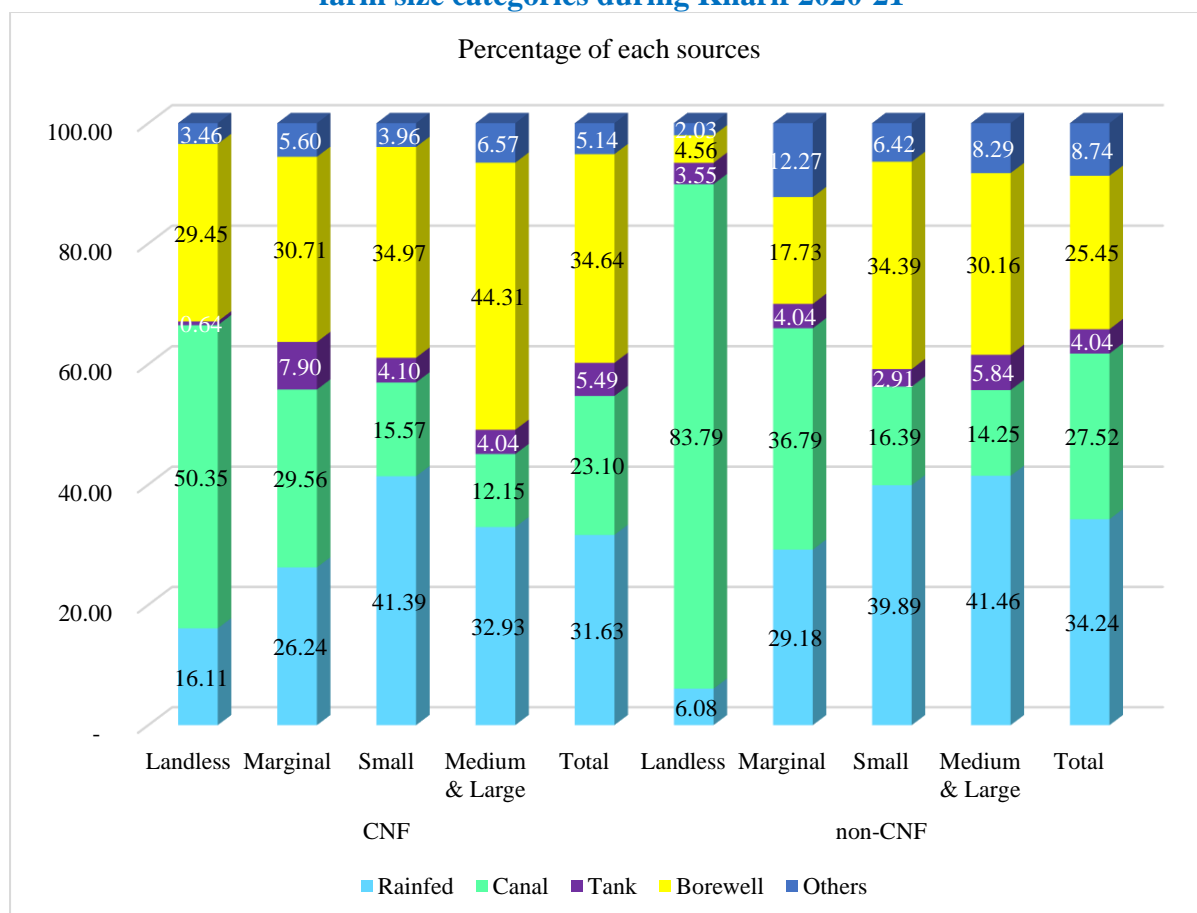


Source: IDSAP Field Survey, 2020-21

Though the CNF farmers have slightly a higher percentage of irrigated area vis-à-vis non-CNF farmers, there are many variations in the disaggregation. The cultivated area under rainfed condition is lower for the landless and marginal farmers of CNF and non-CNF categories. It implies that these categories are preferring irrigated lands for cultivation. It implies they may be averting the risks associated with rainfed agriculture. However, relatively a higher

percentage (ten percentage points) of CNF landless/ pure-tenant farmers have cultivated on the rainfed area during the Kharif season (Figure 5.6 and 5.7 and table 5.6 and 5.7). It implies that CNF is giving confidence to tenant farmers to cultivate on the rainfed fields also.

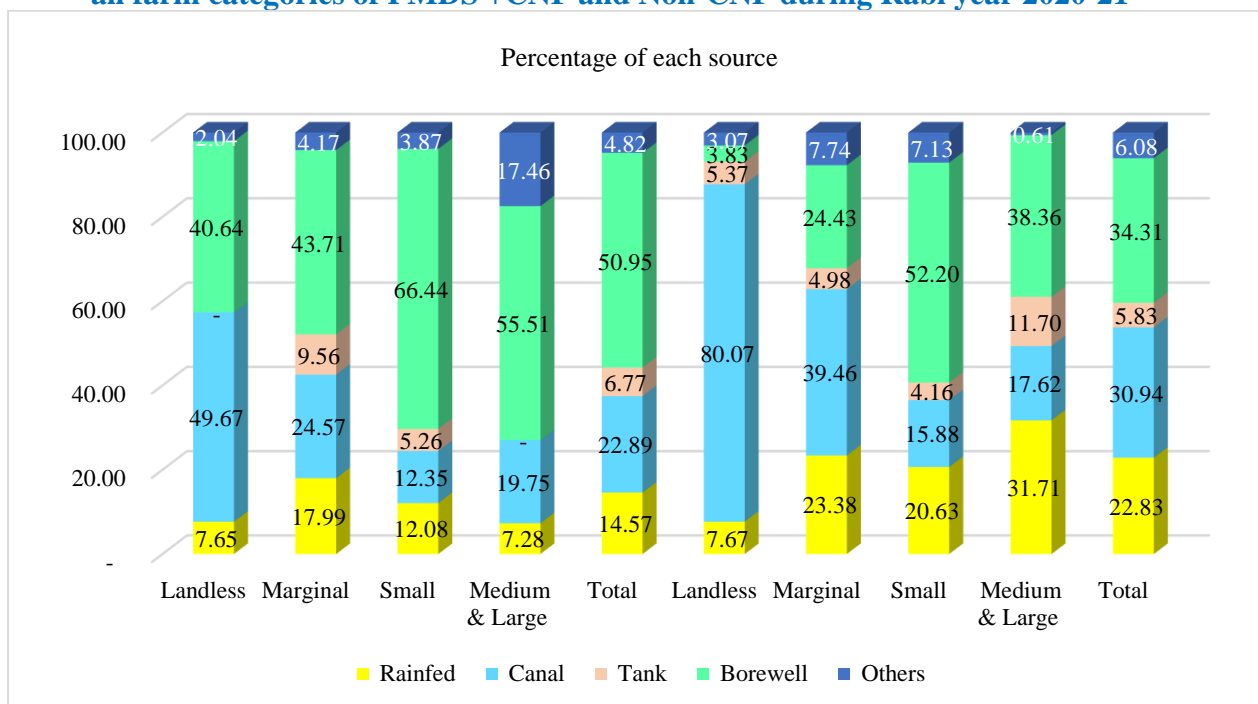
Figure 5.6: Irrigation status of cultivated area of CNF and Non-CNF farmers across farm size categories during Kharif 2020-21



Source: IDSAP Field Survey, 2020-21

Relatively a larger percentage of area is under irrigation for the CNF farmers in relation to non-CNF farmers in Rabi season. This is also true for large landholders. Moreover, higher percentage of CNF area of all categories of landholder is under borewell irrigation in Rabi season (Figure 5.7 & 5.8 and table 5.7 & 5.8). Further, a larger percentage of irrigated area is under controlled irrigation for all categories among the CNF farmers over non-CNF farmers. This controlled irrigation may improve the yield of crops under CNF. This means the yields of crops for small landholders may be higher for the CNF farmers over non-CNF farmers.

Figure 5.7: Distribution of total area cultivated across different sources of irrigation for all farm categories of PMDS +CNF and Non-CNF during Rabi year 2020-21

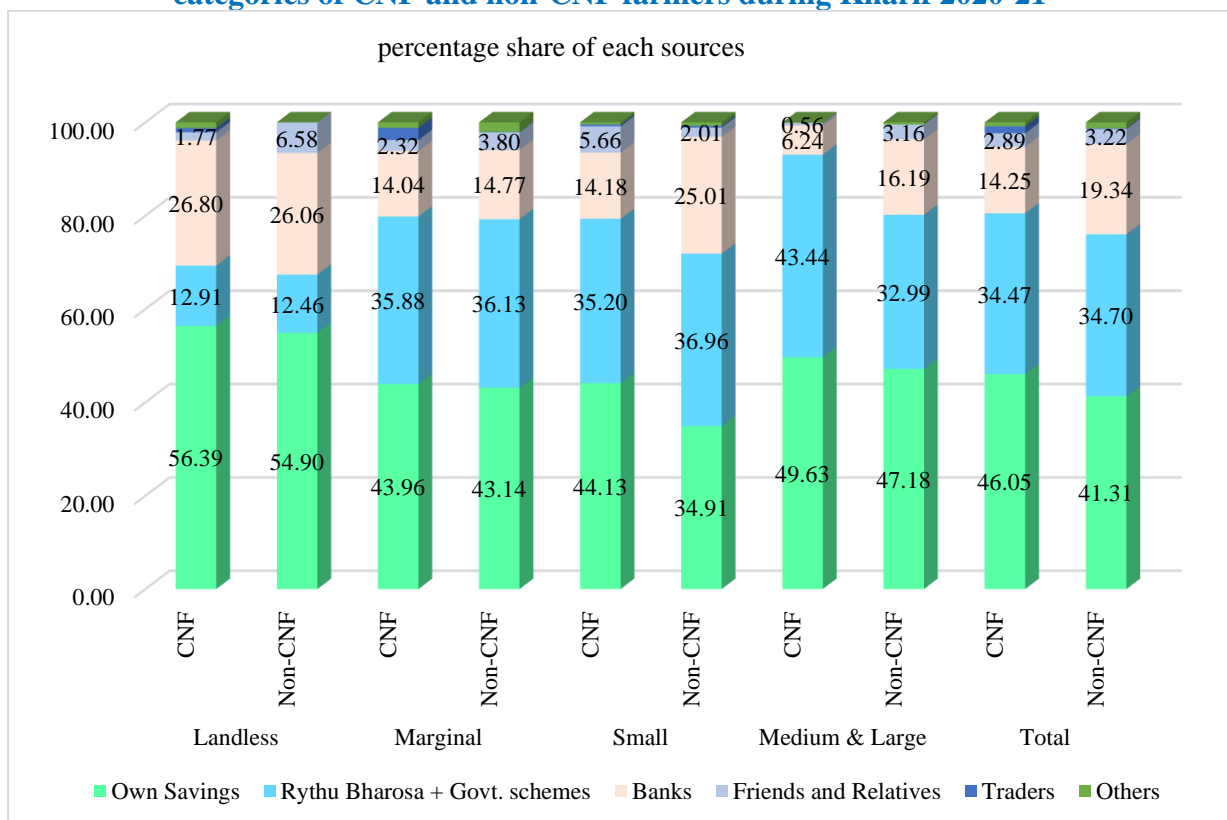


Note: Other irrigation sources include lift irrigation, other well, stream, and purchasing water.

Source: IDSAP Field Survey, 2021

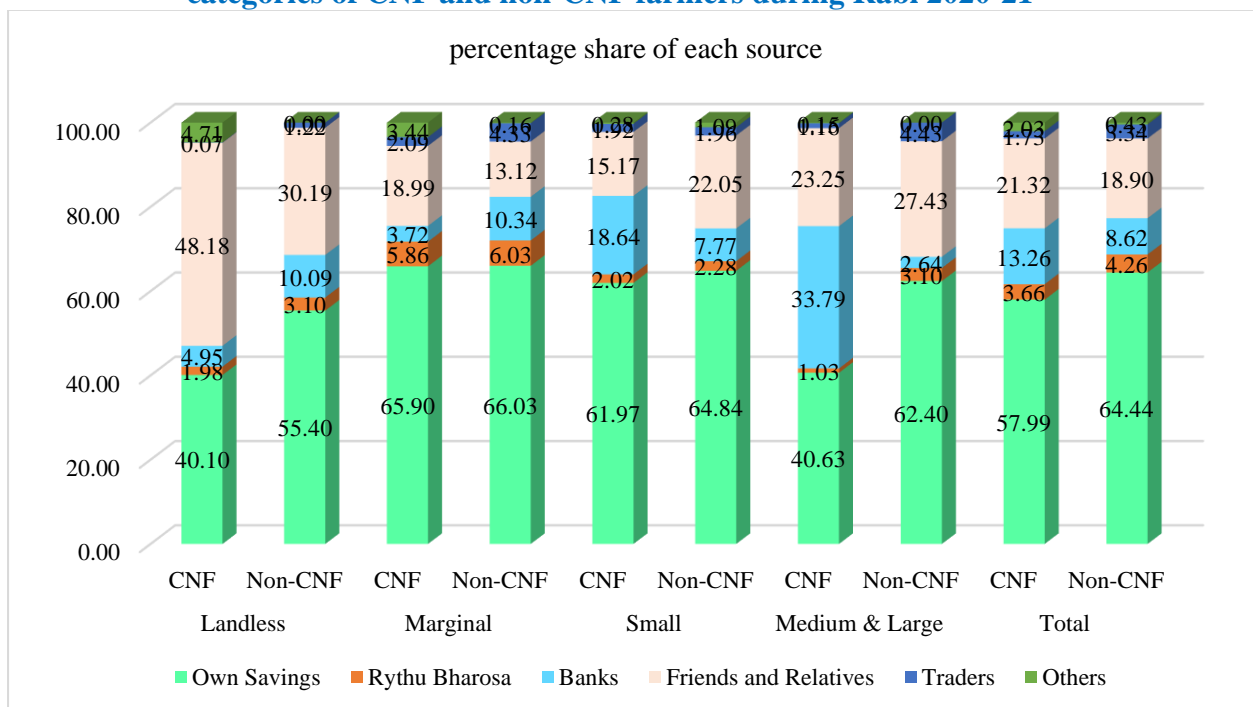
The sources of mobilization of funds for meeting the expenditure for carrying out agricultural operations for growing crops and also other purposes has implications for costs of cultivation. The dependency on informal institutions such as traders and money lenders to mobilize credit may increase cost of cultivation of crops. Hence there is need to assess the sources of mobilization funds for small landholders under CNF farmers in relation to non-CNF farmers. The dependency of all categories of landholders of CNF on own savings is relatively higher compared to non-CNF farmers. At the aggregate level, about five percentage points higher CNF farmers met their investment needs from own sources compared to non-CNF farmers during the Kharif season. The difference is about 10 percentage points for the small farmers. On the whole, the CNF farmers dependency on borrowings, especially from the friends and relatives and traders is less compared to non-CNF among all farm categories (Figure 5.8 and table 5.8). This implies that the cost of credit for small farmers will be lower to that extent compared to non-CNF farmers. On the other hand, CNF farmers dependency on borrowed funds, particularly from the friends and relatives is higher than that of non-CNF farmers, for all farm categories, during Rabi season (Figure 5.9 and Table 5.9). Possible reason could be that the CNF farmers might be getting advances from the friends and relatives for the supply CNF food items.

Figure 5.8: Source wise funds mobilized for farming and other purposes by farm size categories of CNF and non-CNF farmers during Kharif 2020-21



Source: IDSAP Field Survey, 2020-21

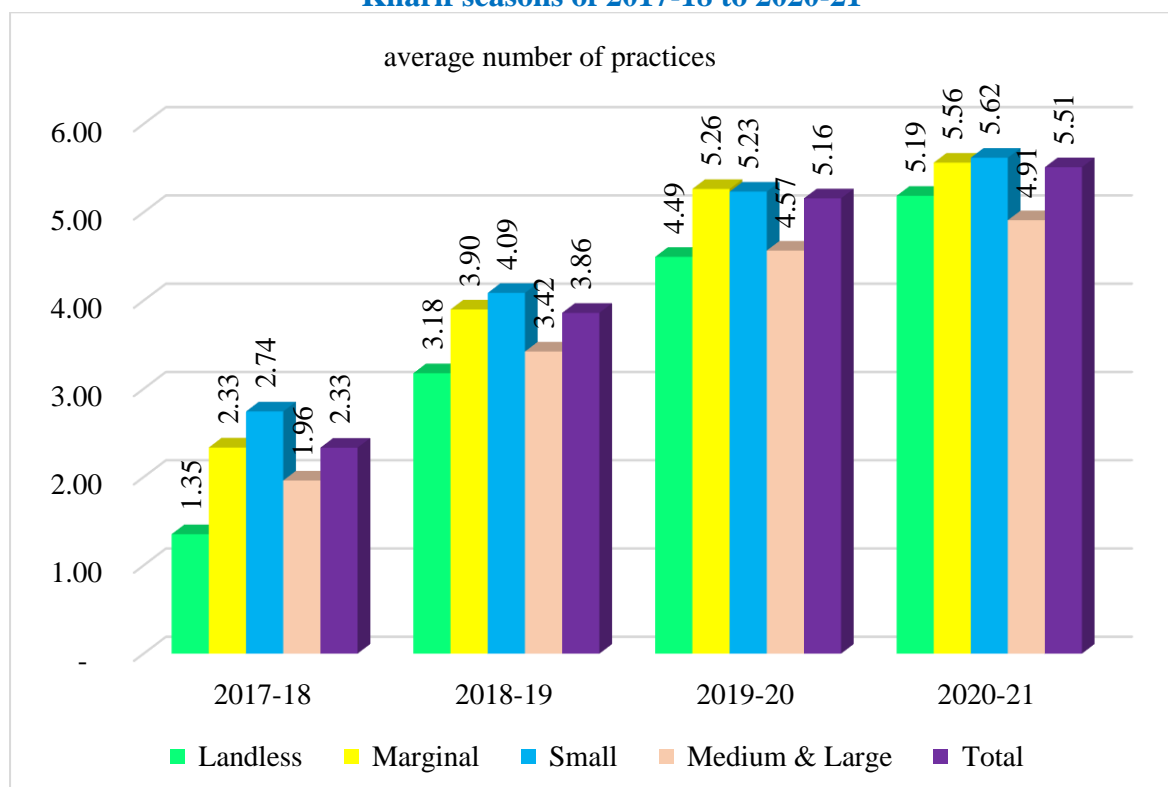
Figure 5.9: Source wise funds mobilized for farming and other purposes by farm size categories of CNF and non-CNF farmers during Rabi 2020-21



Source: IDSAP Field Survey, 2020-21

The adoption of practices of CNF has implications for costs of growing crops as well as yield of the crops. The increase in the number of practices of CNF may lower the cost of cultivation and improve yield of crops. The number of practices adopted is higher for the small landholders compared to large landholders in Kharif season (Figure 5.10 and Table 5.10). It is interesting to note that there is a gradual convergence among all farm categories in adopting the CNF inputs and practices. It is even more interesting to note that compared to the medium and large farmers, the pure tenant farmers have adopted a greater number of CNF practices and inputs in 2020-21

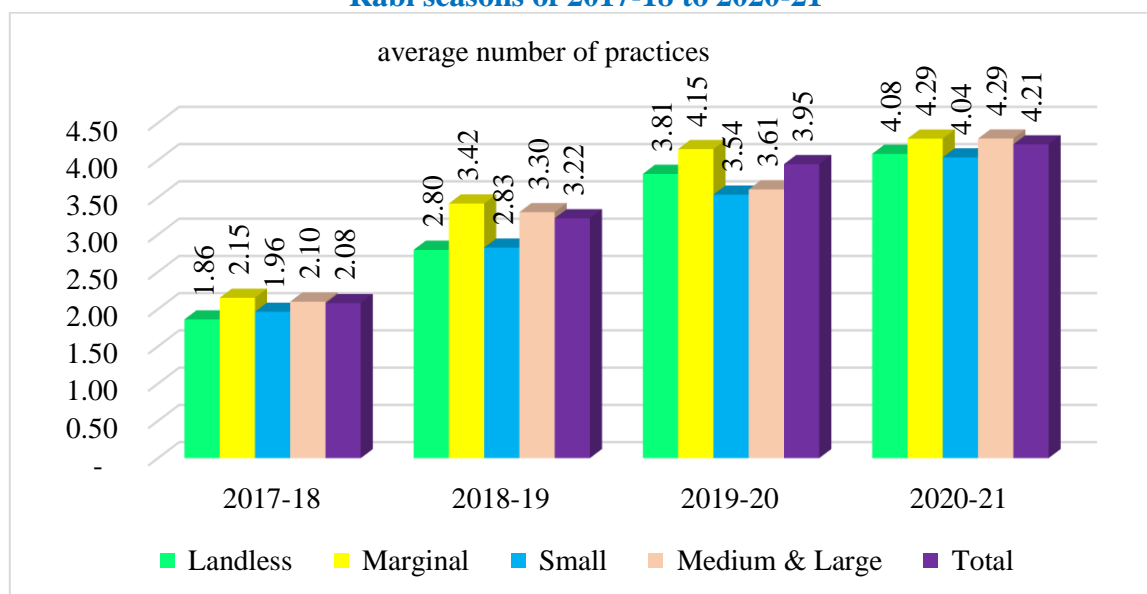
Figure 5.10: Average number of CNF practices adopted across farm categories during Kharif seasons of 2017-18 to 2020-21



Source: IDSAP Field Survey, 2020-21

A clear convergence among all farm categories in adoption of CNF practices and inputs can be seen in the Rabi season also. But the average number of CNF practices and inputs adopted in Rabi is less than that of Kharif (Figure 5.11 and table 5.11). The possible reason could be that many farmers do not cultivate crops during Rabi. This trend is conspicuous in the HAT and Scarce rainfall zones. As a smaller number of farmers cultivate during Rabi, the number CNF practices and inputs' adoption would be less in that season.

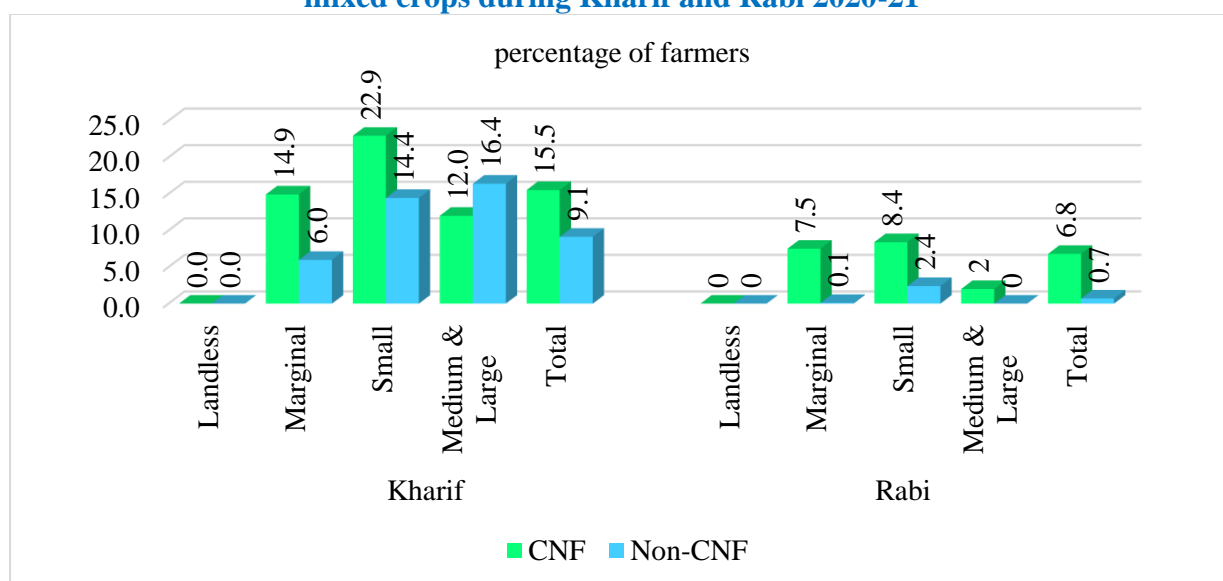
Figure 5.11: Average number of CNF practices adopted across farm categories during Rabi seasons of 2017-18 to 2020-21



Source: IDSAP Field Survey, 2020-21

Further, the incidence of growing mixed crops is higher among the small and marginal landholders of CNF compared to their counterparts in non-CNF in Kharif and Rabi seasons. It is higher for the small landholders compared to large landholders under CNF. This is true in Kharif as well as in Rabi Seasons (Figures 5.12, and Tables 5.12). One surprise result is that percentage of medium and large farmers cultivating the mixed crops is lower under CNF compared to their counterparts in non-CNF.

Figure 5.12: Farm category wise percentage of CNF and non-CNF farmers cultivating mixed crops during Kharif and Rabi 2020-21



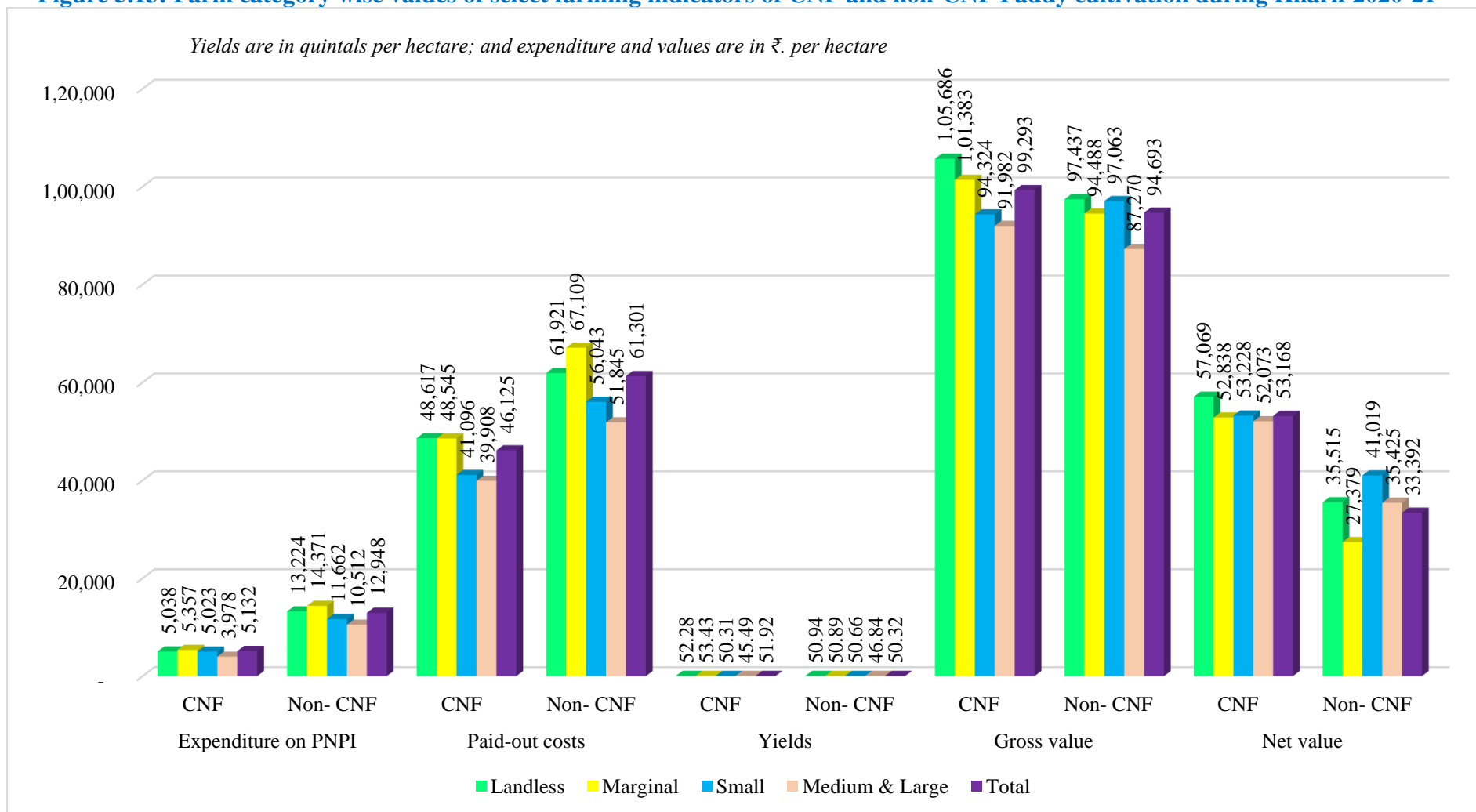
Source: IDSAP Field Survey, 2020-21

Thus, the resource use pattern and adoption of CNF practices analyzed above may results in lower costs of cultivation on one hand and higher yields on the other for small landholders due to CNF. These issues are analyzed in the next section

5.3. Costs and Returns of paddy crop

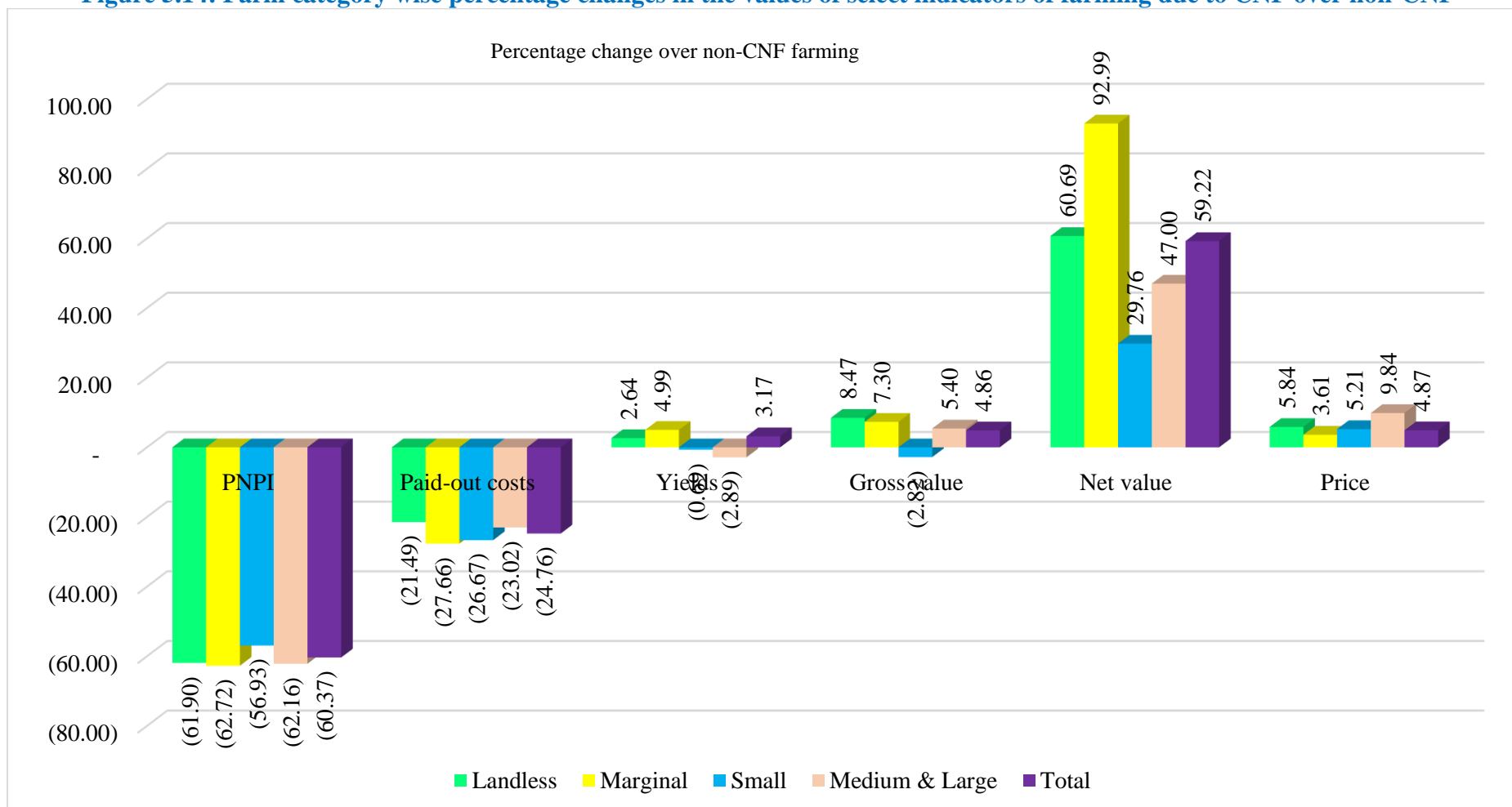
The substitution of biological inputs of CNF for the chemical inputs under non-CNF has contributed to higher reduction in plant nutrition and plant protection inputs (PNPIs) across all farm categories. Paid-out costs in growing Paddy for the CNF farmers belonging to all size classes of landholding in Kharif season were lower compared to non-CNF (Figure 5.13 and 5.14 and table 5.13 and 5.14). The yield of Paddy is higher for the tenant and marginal farmers of CNF over non-CNF in Kharif season. But it is less for the small and medium and large farmers in CNF vis-à-vis non-CNF farmers in Kharif season. On the whole, small landholders are better off compared to large landholders in yield gains from CNF in Kharif season. Among all farm categories, except small farmers, all others have obtained higher gross value of Paddy output under CNF. Net value of output per hectare was higher in all size classes of Paddy for CNF farmers compared to non-CNF. What is interesting about Kharif Paddy cultivation is that despite higher yields and scale economies for medium and large non-CNF Paddy growers, the net value per hectare is low due to high costs incurred on chemical plant nutrients and protection inputs. It is interesting to note that the medium and large farmers have got highest price of about 10 percent over their counterparts in non-CNF. Overall results have demonstrated that CNF is both environmentally benign and economically profitable for all farm categories in Kharif Paddy.

Figure 5.13: Farm category wise values of select farming indicators of CNF and non-CNF Paddy cultivation during Kharif 2020-21



Source: IDSAP Field Survey, 2020-21

Figure 5.14: Farm category wise percentage changes in the values of select indicators of farming due to CNF over non-CNF



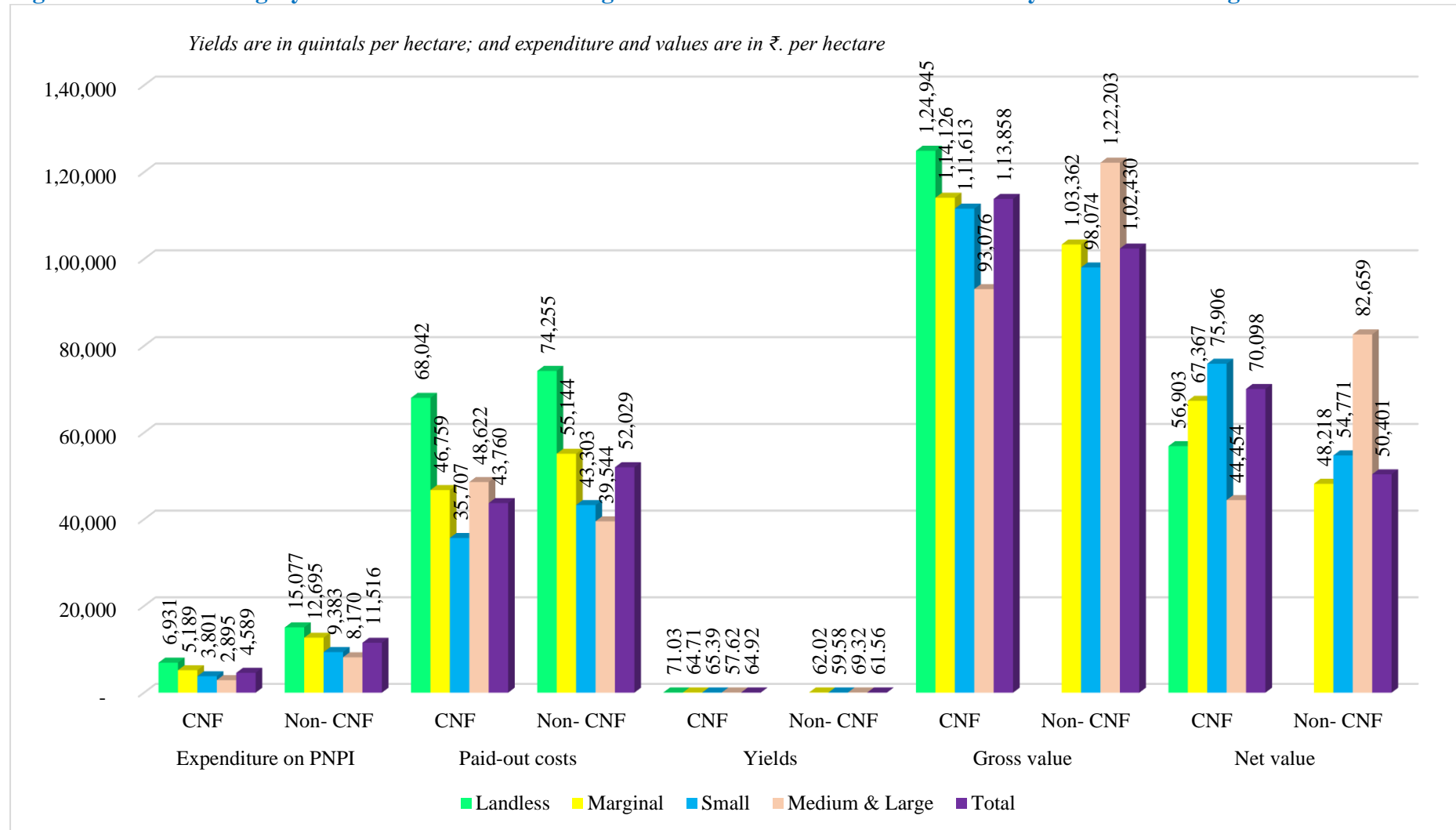
Source: IDSAP Field Survey, 2020-21

In Rabi season, the expenditure on PNPIs in growing Paddy is lower under CNF all for farm categories vis-à-vis their counterparts in non-CNF farming. The reduction varies from 54% for pure tenant farmers to 65% for medium and large farmers (Figure 5.15 and 5.16 and Tables 5.15 and 5.16). Surprisingly the medium and large farmers under CNF incurred about 23% higher paid-out costs, but got 17% lower Paddy yields and 24% lower gross value of output and 46% lower net value of Paddy output. This is an aberration needs further investigation.

In Rabi season small landholders have gained more over large landholders in the yield due to CNF. ***The is pointer to the fact that negative size-productivity relationship is being operated under CNF***, i.e., CNF is size neutral technology or model (Figure 5.15 and 5.16). In the Rabi season, marginal and small farmers got higher yields within CNF farmers and also got higher yields compared to marginal and small farmers cultivating non- CNF Paddy. Medium and large farmers of non-CNF paddy had higher yields in rabi season compared to all the other CNF paddy growers by about 5 quintals per hectare. This could be due to optimal levels of chemical fertilizer and irrigation applied to irrigated Rabi Paddy, which will ultimately degrade the soil. The paid-out costs also appear to be low for large and medium non-CNF Rabi Paddy growers despite high cost of chemical inputs due to lower hired labour costs. The lower hired labour cost again could be a result of saving with mechanization and economies of scale. Moreover, this is only due to larger area under Rabi Paddy in Godavari zone in which the Rabi yields of non-CNF farmers are high (see previous chapter). In all other regions CNF paddy in Rabi season gives better yields than non-CNF for all category of farmers. This also clearly points to the future possibility of large-scale land degradation due to large doses of chemical inputs and probably higher level of mechanization in the cultivation of Rabi Paddy in the Godavari Zone.

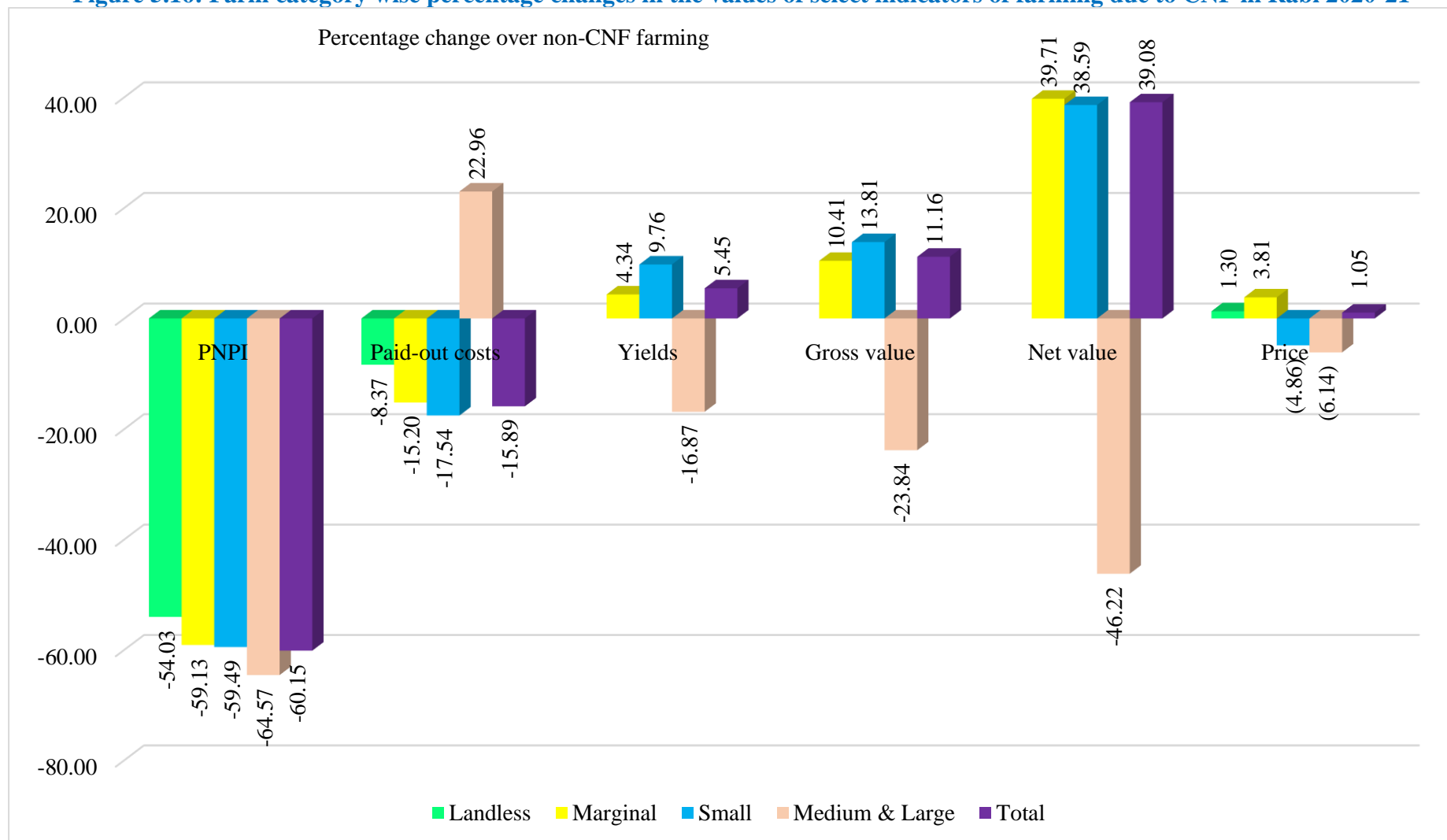
The gross value of output is higher for the marginal farmers among the small landholders under CNF over non-CNF in Rabi season. But it is clearly higher for small landholders compared to large landholders in Rabi season (Figure 5.16). The higher gains in gross value of output for the marginal and small farmer is due to higher yields due to CNF, compared to non-CNF (Figure 5.16). The gains in net returns also followed the same pattern (Figure 5.19,). The higher net returns for the small farmers of CNF are due to higher reduction in the paid-out costs and higher yields, rather than realized prices of Paddy crop output.

Figure 5.15: Farm category wise values of select farming indicators of CNF and non-CNF Paddy cultivation during Rabi 2020-21



Source: IDSAP Field Survey, 2020-21

Figure 5.16: Farm category wise percentage changes in the values of select indicators of farming due to CNF in Rabi 2020-21



Source: IDSAP Field Survey, 2020-21

5.4. Conclusions

The above analysis brought out clearly that the gains by way of lower costs and higher net returns for all the categories of landholders in Kharif Paddy cultivation are due to CNF. The gains in net returns are due to reduction in paid-out costs under CNF. It seems that the intensive use of land, the more engagement of family labour in agriculture and the controlled use of water for irrigation have contributed to the increase in yields due to CNF, especially for marginal farmers both in Kharif and Rabi season and small farmers in the Rabi season. The adoption of CNF practices might have contributed to the reduction in costs as well as improvements in yields. Had the realized price higher, the gains for the small landholders might have been much larger. On the whole, it is clear that CNF is environmentally sustainable due to organic inputs and economically viable due to lower costs incurred compared to non-CNF.

This chapter on CNF and non-CNF Paddy cultivation in Andhra Pradesh also clearly brings out the point that one should not just go by small yield per hectare gains of medium and large paddy cultivators who spend large amounts on chemical inputs that ultimately lead to soil degradation and widespread farmer distress but go by higher net returns per hectare and economic viability of Paddy cultivation in general. A small percentage of large Rabi Paddy cultivators of Godavari region are showing higher yield and returns by applying large amounts of chemical inputs which is essentially soil degrading, and hence more attention should be paid by the government to convert these Paddy farmers to CNF. The second important take away from the analysis is that yield gain in a single year in a particular region and season should not be taken as a deciding factor against CNF. The bigger picture is important.

Chapter 5 Tables

Table 5.1: Percentage of area allocated to CNF in the total cultivated area in Kharif according to the agricultural years for small and large landholders of CNF Farmers

Category of farmers	% of operational area under APNCF			
	2017-18	2018-19	2019-20	2020-21
Pure tenants	14.37	31.66	37.40	42.18
Marginal	29.10	45.24	62.79	68.27
Small	30.23	45.22	57.54	64.94
Medium & Large	18.12	27.08	40.73	52.76
Total	26.48	41.28	55.66	62.81

Source: IDSAP Field Survey, 2020-21

Table 5.2: CNF cultivated area as a % of total cultivated area in Rabi season for small and large landholders of CNF in 2017-21 (in %)

Category of farmers	2017-18	2018-19	2019-20	2020-21
Pure tenants	20.92	39.31	55.63	66.96
Marginal	33.87	52.87	67.24	71.76
Small	24.80	34.12	44.66	57.24
Medium & Large	19.28	29.08	41.26	53.16
Total	29.88	46.03	59.52	66.91

Source: IDSAP Field Survey, 2020-21

Table 5.3: Farm size category wise number of days of crop cover on PMDS+CNF and non-CNF fields and the differences between them during 2020-21

Farm category	Green covers days under		Differences between CNF & non-CNF	
	CNF + PMDS	Non-CNF	In days	in percentage
Marginal	241	231	10	4.49
Small	245	213	32	15.11
Medium & large	253	246	7	2.76
Total	244	229	15	6.49

Source: IDSAP Field Survey, 2020-21

Table 5.4: Farm category wise average labour use in the Paddy cultivation in Kharif 2020-21

number of person days per hectare

Category of farmers	Family Labour Days		Casual Labour Days		Total Labour days	
	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF
Landless	156	29	3	68	159	97
Marginal	46	43	66	62	112	105
Small	35	39	50	50	85	89
Medium & Large	104	29	56	43	160	72
Total	58	38	49	57	107	95

Source: IDSAP Field Survey, 2020-21

Table 5.5: Category of farmers wise average labour use in the Paddy by CNF and Non-CNF farmers during Rabi 2020-21

Number of person days per hectare

Category of farmers	Family Labour Days		Casual Labour Days		Total Labour days	
	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF
Landless	84	31	57	47	141	78
Marginal	64	39	43	42	108	81
Small	40	29	35	33	75	62
Medium & Large	82	27	64	25	146	52
Total	58	34	42	38	100	72

Source: IDSAP Field Survey, 2020-21

Table 5.6: Farm category wise and irrigation status wise total area under cultivation in Kharif 2020-21

Total area in hectares and sources in percentages

Farm categories	Rainfed		Canal		Tank		Borewell		Others		Total area cultivated	
	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF
Landless	16.11	6.08	50.35	83.79	0.64	3.55	29.45	4.56	3.46	2.03	63.16	39.95
Marginal	26.24	29.18	29.56	36.79	7.90	4.04	30.71	17.73	5.60	12.27	421.70	240.20
Small	41.39	39.89	15.57	16.39	4.10	2.91	34.97	34.39	3.96	6.42	307.44	221.64
Medium & Large	32.93	41.46	12.15	14.25	4.04	5.84	44.31	30.16	6.57	8.29	194.52	150.97
Total	31.63	34.24	23.10	27.52	5.49	4.04	34.64	25.45	5.14	8.74	986.83	652.76

Note: Other irrigation sources include lift irrigation, other well, stream, and purchasing water.

Source: IDSAP Field Survey, 2020-21

Table 5.7: Farm categories wise distribution of total area cultivated across different sources of irrigation during Rabi 2020-21

Farm category	% of total cultivated area under									
	Rainfed		Canal		Tank		Borewell		Others	
	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF
Landless	7.65	7.67	49.67	80.07	0.00	5.37	40.64	3.83	2.04	3.07
Marginal	17.99	23.38	24.57	39.46	9.56	4.98	43.71	24.43	4.17	7.74
Small	12.08	20.63	12.35	15.88	5.26	4.16	66.44	52.20	3.87	7.13
Medium & Large	7.28	31.71	19.75	17.62	0.00	11.70	55.51	38.36	17.46	0.61
Total	14.57	22.83	22.89	30.94	6.77	5.83	50.95	34.31	4.82	6.08

Note: Other irrigation sources include lift irrigation, other well, streams, and purchased water.

Source: IDSAP Field Survey, 2020-21

Table 5.8: Farm category wise and source wise share of funds mobilised for agriculture and other purposes in Kharif 2020-21

In percentages

Funds source	Landless		Marginal		Small		Medium & Large		Total	
	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF
Own Savings	56.39	54.90	43.96	43.14	44.13	34.91	49.63	47.18	46.05	41.31
Rythu Bharosa +Govt. schemes	12.91	12.46	35.88	36.13	35.20	36.96	43.44	32.99	34.47	34.70
Banks	26.80	26.06	14.04	14.77	14.18	25.01	6.24	16.19	14.25	19.34
Friends and Relatives	1.77	6.58	2.32	3.80	5.66	2.01	0.56	3.16	2.89	3.22
Traders	0.92	0.00	2.64	0.08	0.37	0.37	0.00	0.00	1.50	0.17
Others	1.21	0.00	1.17	2.07	0.47	0.75	0.13	0.47	0.84	1.27

Source: IDSAP Field Survey, 2020-21

Table 5.9: Farm category wise and source wise share of funds mobilised for agriculture and other purposes in Rabi 2020-21

In percentages

Funds source	Landless		Marginal		Small		Medium & Large		Total	
	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF
Own Savings	40.10	55.40	65.90	66.03	61.97	64.84	40.63	62.40	57.99	64.44
Rythu Bharosa+ Govt. schemes	1.98	3.10	5.86	6.03	2.02	2.28	1.03	3.10	3.66	4.26
Banks	4.95	10.09	3.72	10.34	18.64	7.77	33.79	2.64	13.26	8.62
Friends and Relatives	48.18	30.19	18.99	13.12	15.17	22.05	23.25	27.43	21.32	18.90
Traders	0.07	1.22	2.09	4.33	1.92	1.96	1.16	4.43	1.73	3.34
Others	4.71	0.00	3.44	0.16	0.28	1.09	0.15	0.00	2.03	0.43

Source: IDSAP Field Survey, 2020-21

Table 5.10: Farm category wise number of CNF Practices adopted by the CNF farmers during Kharif Seasons since 2017-18

Farm category	2017-18	2018-19	2019-20	2020-21
Landless	1.35	3.18	4.49	5.19
Marginal	2.33	3.90	5.26	5.56
Small	2.74	4.09	5.23	5.62
Medium & Large	1.96	3.42	4.57	4.91
Total	2.33	3.86	5.16	5.51

Source: IDSAP Field Survey, 2020-21

Table 5.11: Farm category wise number of CNF practices adopted during Rabi Seasons since 2017-18 by CNF farmers

Category of farmers	2017-18	2018-19	2019-20	2020-21
Landless	1.86	2.80	3.81	4.08
Marginal	2.15	3.42	4.15	4.29
Small	1.96	2.83	3.54	4.04
Medium & Large	2.10	3.30	3.61	4.29

Source: IDSAP Field Survey, 2021

Table 5.12: Farm category wise percentage of CNF and non-CNF farmers growing mixed crops during Kharif and Rabi seasons 2020-21

Farm category	Kharif		Rabi	
	CNF	Non-CNF	CNF	Non-CNF
Landless	0.0	0.0	0	0
Marginal	14.9	6.0	7.5	0.1
Small	22.9	14.4	8.4	2.4
Medium & Large	12.0	16.4	2	0
Total	15.5	9.1	6.8	0.7

Source: IDSAP Field Survey, 2021

Table 5.13: Farm category wise values of selected indicators of CNF and non-CNF Paddy farming in Kharif 2020-21

(Yields are in quintals per hectare; prices are in ₹. / quintal and expenditure and values are in ₹. / Hectare)

Farm category	Expenditure on PNPI		Paid-out costs		Yields		Gross value		Net value		Price realized	
	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF
Landless	5,038	13,224	48,617	61,921	52.28	50.94	1,05,686	97,437	57,069	35,515	1,868	1,765
Marginal	5,357	14,371	48,545	67,109	53.43	50.89	1,01,383	94,488	52,838	27,379	1,762	1,700
Small	5,023	11,662	41,096	56,043	50.31	50.66	94,324	97,063	53,228	41,019	1,753	1,666
Medium & Large	3,978	10,512	39,908	51,845	45.49	46.84	91,982	87,270	52,073	35,425	1,850	1,685
Total	5,132	12,948	46,125	61,301	51.92	50.32	99,293	94,693	53,168	33,392	1,775	1,693

Source: IDSAP Field Survey, 2020-21

Table 5.14: Farm category wise changes in selected agriculture in indicators due to CNF in Paddy farming during Kharif 2020-21

(Yields are in quintals per hectare; prices are in ₹. / quintal and expenditure and values are in ₹. / Hectare)

Farm category	Absolute change over non-CNF in:						Percentage change over non-CNF in:					
	PNPI	Paid-out costs	Yields	Gross value	Net value	Price realised	PNPI	Paid-out costs	Yields	Gross value	Net value	Price realised
Landless	-8,186	-13,304	1.35	8,250	21,554	103	-61.90	-21.49	2.64	8.47	60.69	5.84
Marginal	-9,014	-18,564	2.54	6,895	25,459	61	-62.72	-27.66	4.99	7.30	92.99	3.61
Small	-6,639	-14,947	-0.35	-2,739	12,208	87	-56.93	-26.67	-0.69	-2.82	29.76	5.21
Medium & Large	-6,535	-11,937	-1.35	4,712	16,649	166	-62.16	-23.02	-2.89	5.40	47.00	9.84
Total	-7,817	-15,176	1.60	4,599	19,776	83	-60.37	-24.76	3.17	4.86	59.22	4.87

Source: IDSAP Field Survey, 2020-21

Table 5.15: Farm category wise values of selected indicators under CNF and non-CNF Paddy farming in Rabi 2020-21

(Yields are in quintals per hectare; prices are in ₹. / quintal and expenditure and values are in ₹. / Hectare)

Farm category	Expenditure on PNPI		Paid-out costs		Yields		Gross value		Net value		Price realized	
	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non-CNF	CNF	Non- CNF	CNF	Non-CNF
Landless	6,931	15,077	68,042	74,255	71.03		1,24,945		56,903		1,667	1,645
Marginal	5,189	12,695	46,759	55,144	64.71	62.02	1,14,126	1,03,362	67,367	48,218	1,657	1,596
Small	3,801	9,383	35,707	43,303	65.39	59.58	1,11,613	98,074	75,906	54,771	1,604	1,686
Medium & Large	2,895	8,170	48,622	39,544	57.62	69.32	93,076	1,22,203	44,454	82,659	1,523	1,623
Total	4,589	11,516	43,760	52,029	64.92	61.56	1,13,858	1,02,430	70,098	50,401	1,638	1,621

Source: IDSAP Field Survey, 2020-21

Table 5.16: Farm category wise changes in selected agriculture in indicators due to CNF in Paddy farming during Rabi 2020-21

(Yields are in quintals per hectare; prices are in ₹. / quintal and expenditure and values are in ₹. / Hectare)

Farm category	Absolute change over non-CNF						Percentage change over non-CNF					
	PNPI	Paid-out costs	Yields	Gross value	Net value	Price	PNPI	Paid-out costs	Yields	Gross value	Net value	Price
Landless	-8,146	-6,213				21	-54.03	-8.37				1.30
Marginal	-7,506	-8,384	2.69	10,764	19,149	61	-59.13	-15.20	4.34	10.41	39.71	3.81
Small	-5,582	-7,597	5.81	13,539	21,135	-82	-59.49	-17.54	9.76	13.81	38.59	-4.86
Medium & Large	-5,275	9,078	-11.70	-29,127	-38,205	-100	-64.57	22.96	-16.87	-23.84	-46.22	-6.14
Total	-6,927	-8,270	3.36	11,429	19,698	17	-60.15	-15.89	5.45	11.16	39.08	1.05

Source: IDSAP Field Survey, 2020-21

Chapter 6: Household income of CNF and non-CNF farmers

6.1. Introduction

The analysis in the previous chapters has revealed that the cost of production of crops per hectare is found to be lower and the gross value and net value of crops per hectare are found to be higher for CNF farmers over non-CNF farmers. Further, cultivated land is more intensively used by the CNF farmers over non-CNF. This may result in higher agriculture annual income of CNF households, compared to that of non-CNF. A comparison across the agroclimatic zones has also revealed that the CNF farmers, compared to non-CNF experienced better scenario of costs and returns across the zones. Moreover, CNF farmers from the rainfall dependent zones such as north costal, southern and scarce rainfall zones have also fared well in regard to costs and returns, compared to non-CNF farmers. It is also further evident from the analysis that the small landholders of CNF have gained more crop incomes than those for non-CNF farmers. Hence the income from agriculture of small landholders of CNF is likely to be higher than that for the non-CNF small landholders. The income from livestock is also likely to be higher for the CNF farmers compared to that of non-CNF farmers, given the strong linkages between CNF and livestock compared to those between livestock and non-CNF farmers. In this backdrop, the chapter addresses to the following objectives.

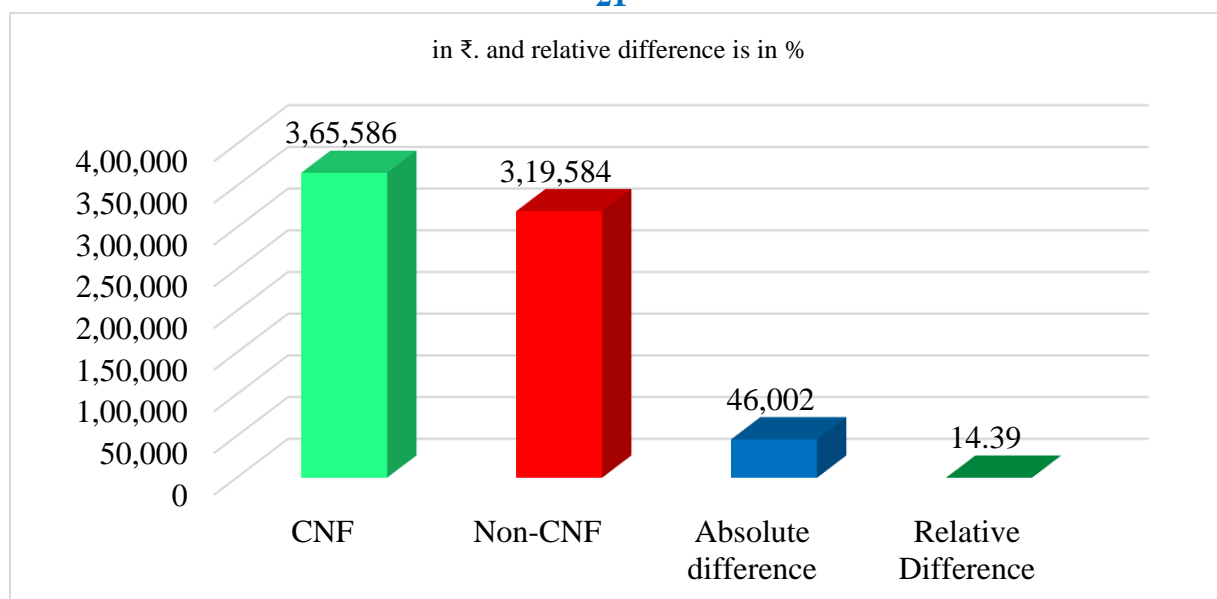
- a. Did the CNF farmer household on an average receive higher annual income than the non-CNF farmer households?
- b. Whether income from agriculture and livestock is higher for CNF farmers than that for non-CNF farmers in the state?
- c. How far has the improvement in annual income of CNF households is due to agricultural income from CNF?
- d. How did the household annual income, and income from agriculture and livestock vary between CNF and non-CNF farmers across agroclimatic zones?

6.2. Household Income in the State

The household annual income from all the sources has been estimated for the agricultural year 2020-21. The sources include agriculture, animal husbandry, fishery, forestry, wages from

agriculture, self-employment in non-agriculture, wages from non-agricultural activities and salaries from non-agriculture, rent from assets, and other sources. The incomes of all the farmers who have grown crops in Kharif are estimated in Rabi season also and thereafter both the incomes in kharif and Rabi seasons are aggregated to arrive at household annual income from crops. The annual household income per household is higher for CNF farmers compared to non-CNF farmers in the state. The difference is ₹.46,002 and 14.36 % (Figure 6.1).²⁶

Figure 6.1: Household income of CNF and non-CNF farmers and the difference in 2020-21



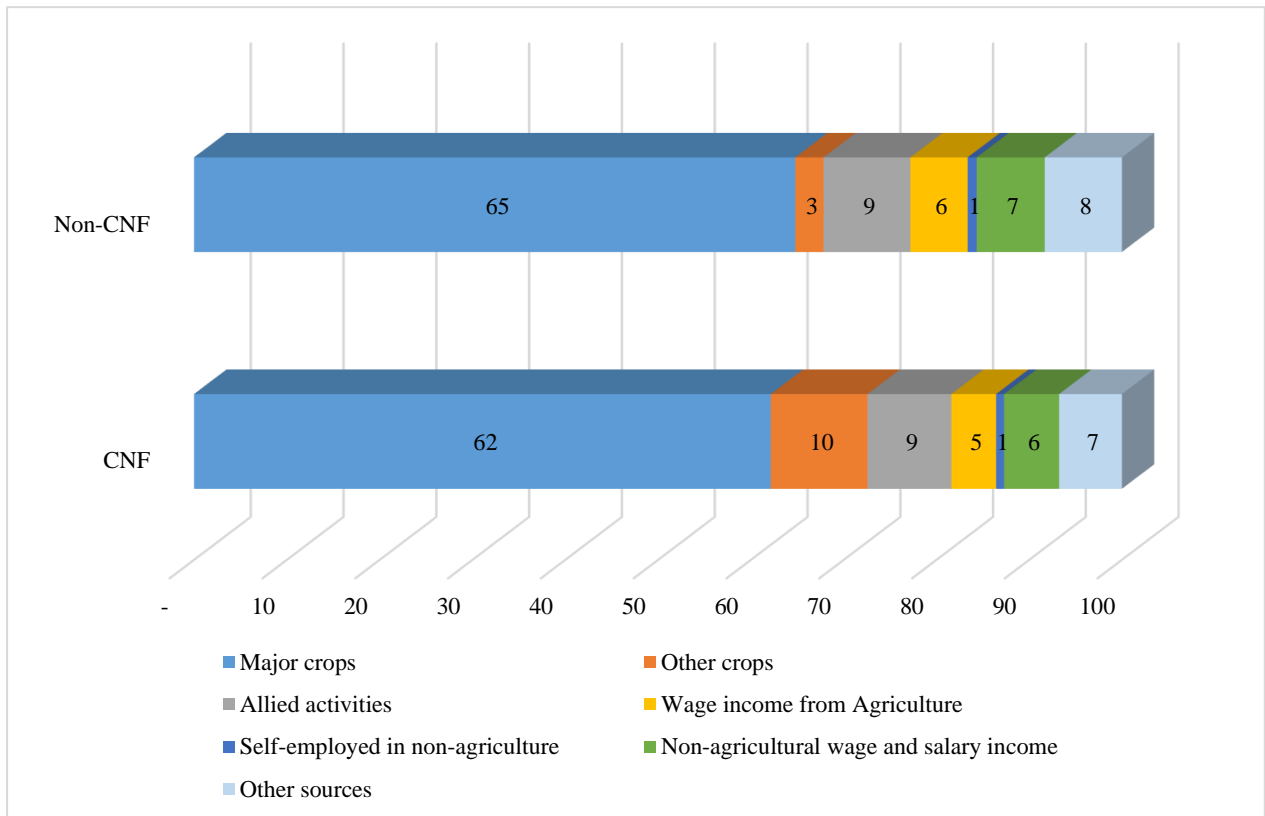
Source: IDSAP Field Survey, 2020-21

Compared to non-CNF farmers, CNF farmers have derived 4 percentage points higher household income from agriculture. On the other hand, non-CNF farmers got one percentage points higher income from each of the other sources, viz., agriculture wages, non-agriculture wages, salaries and other sources (Figure 6.2). Causal employment income share is lower for CNF households. CNF household derive a higher percent (10%) of their income from other crops, compared to non-CNF (3%). It indicates, a much needed, crop diversity in the CNF household income.²⁷

²⁶ All tables related to this chapter are given at the end of the chapter

²⁷ A part of the diversity may be due to cultivation of the same major crops by the CNF household under non-CNF farming. Still, it a diversity. Another reason is that CNF farmers are cultivating more diverse crops such as model crops, Navadhanyalu/ PMDS, border crops, bund crops, intercrops, etc.

Figure 6.2: Source wise percentage share in the total household income
(in percentages)

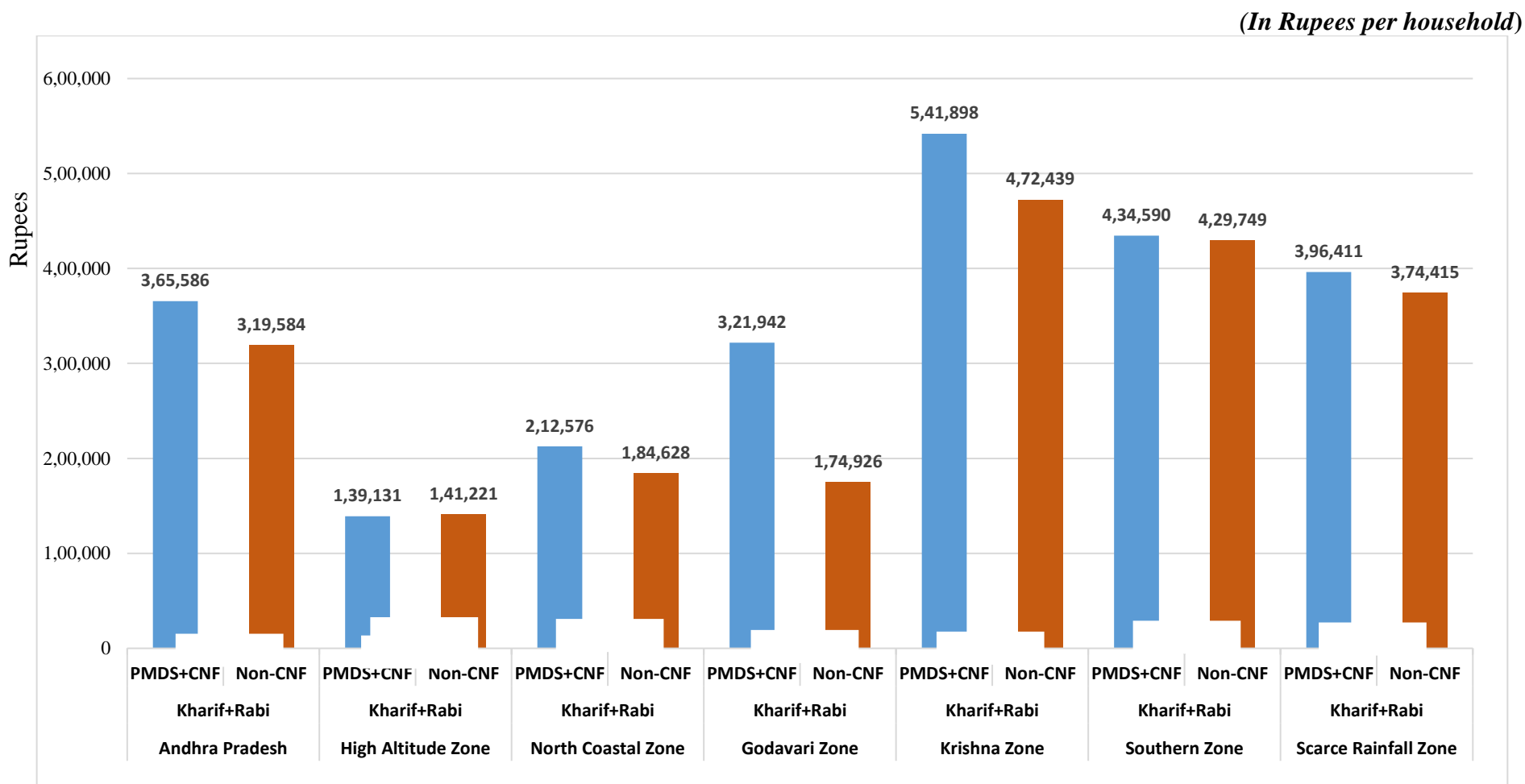


Source: IDSAP field survey 2020-21

6.3. Agroclimatic zone wise household income

Among the six zones in the state, Krishna, South and Scarce rainfall zones have higher than state average household income, and other three zones have lesser than the state average income (Figure 6.3). Surprisingly Godavari zone has less than state average household income. One of reasons is very high cost of cultivation. Its cost of cultivation is highest in the state. Because of its tradition, the farmers in the zone are also investing heavily in CNF cultivation. At the same time, it got highest difference between the household incomes of CNF and non-CNF farmers. Another important reason for the lower household income in the Godavari zone is the predominance of the Paddy cultivation in the zone. It can be seen in chapter 3 that the net value of Paddy crop output is quite less compared to crops like Chilies and Groundnut. The higher net values crops are mostly cultivated in the Krishna, Southern and Scarce rainfall zones.

Figure 6.3: Household annual income for CNF and Non-CNF farmers in the agricultural year 2020-21 in Andhra Pradesh and different agro-climatic zones

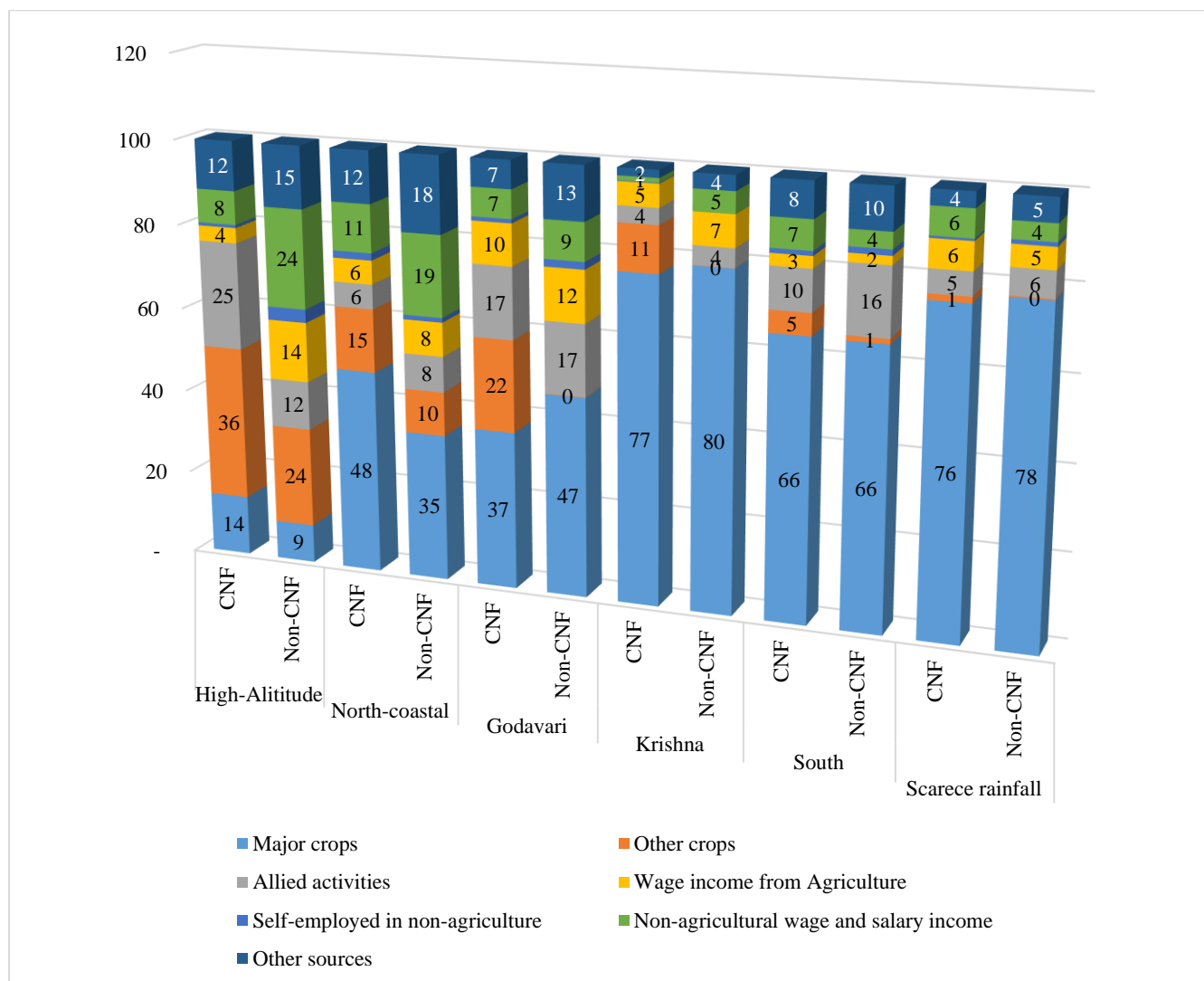


Source: IDSAP field survey 2020-21

In all zones, CNF farmers have higher diversity than non-CNF farmers (Figure 6.4). More diversity, based on the income sources other than the main crops²⁸, in the household income can be seen in the HAT zone, followed by, North coastal and Godavari zones.

Figure 6.4: Source wise composition of household income of CNF and non-CNF farmers in each agroclimatic zone

(in percentages)



It is striking to note that the contribution of CNF to the livelihood strategies of CNF farmers has varied across zones. The CNF farmers had lower dependency on wage employment compared to non-CNF in all zones except in Southern and Scarce rainfall zones. It seems that the contribution of CNF to the livelihood strategy for enhancing the household income depends on land and labour markets and the nature of linkages between these two. The nature of linkages

²⁸ It may be noted that the crops other than main considered in this report, include the same crops cultivated in non-CNF method by the CNF farmers. Still it gives some diversity and stability to the farmers' income.

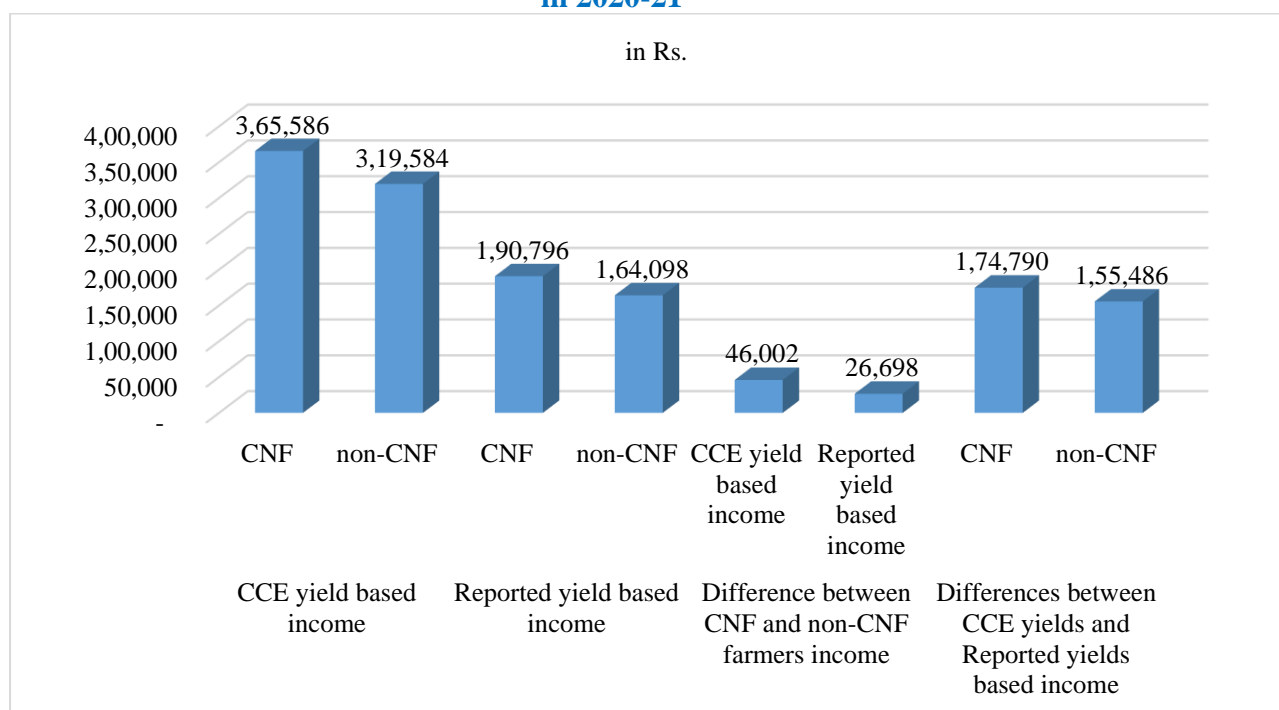
between land and labour market is of substitution in case of High altitude, North coastal and Krishna zone, while it is of supplementary in case of Godavari, Southern and Scarce rainfall zones.

6.4. Household income according to CCE yields and reported yields

The CCE yields data does not permit the estimation of farm category wise household income. Hence, farm category wise household income is estimated based income derived from the reported crop yields. Before analyzing the farm category wise household incomes, a comparison between household incomes derived from CCE yields and reported yields is in order.

Reported yield-based income is over 90 percent less than the CCE yield based income for both CNF farmers and non-CNF farmers. The difference between the CCE yields-based income and reported yield-based income is Rs.1,74,790 (91.61%) for CNF farmers and Rs.1,55,486 (94.75%) for non-CNF farmers. The difference in the household incomes of CNF and non-CNF farmers is Rs.46,002 (14.39%) if calculated on the basis of CCE yields and Rs.26,698 (16.27%), if calculated on the basis of the reported crop yields (Figure 6.5). The results have exhibited a consistency in the data. They have also indicated that non-CNF farmers have underreported their yields a little more compared to CNF farmers.

Figure 6.5: Household incomes based on CCE yields and reported yields and differences in 2020-21

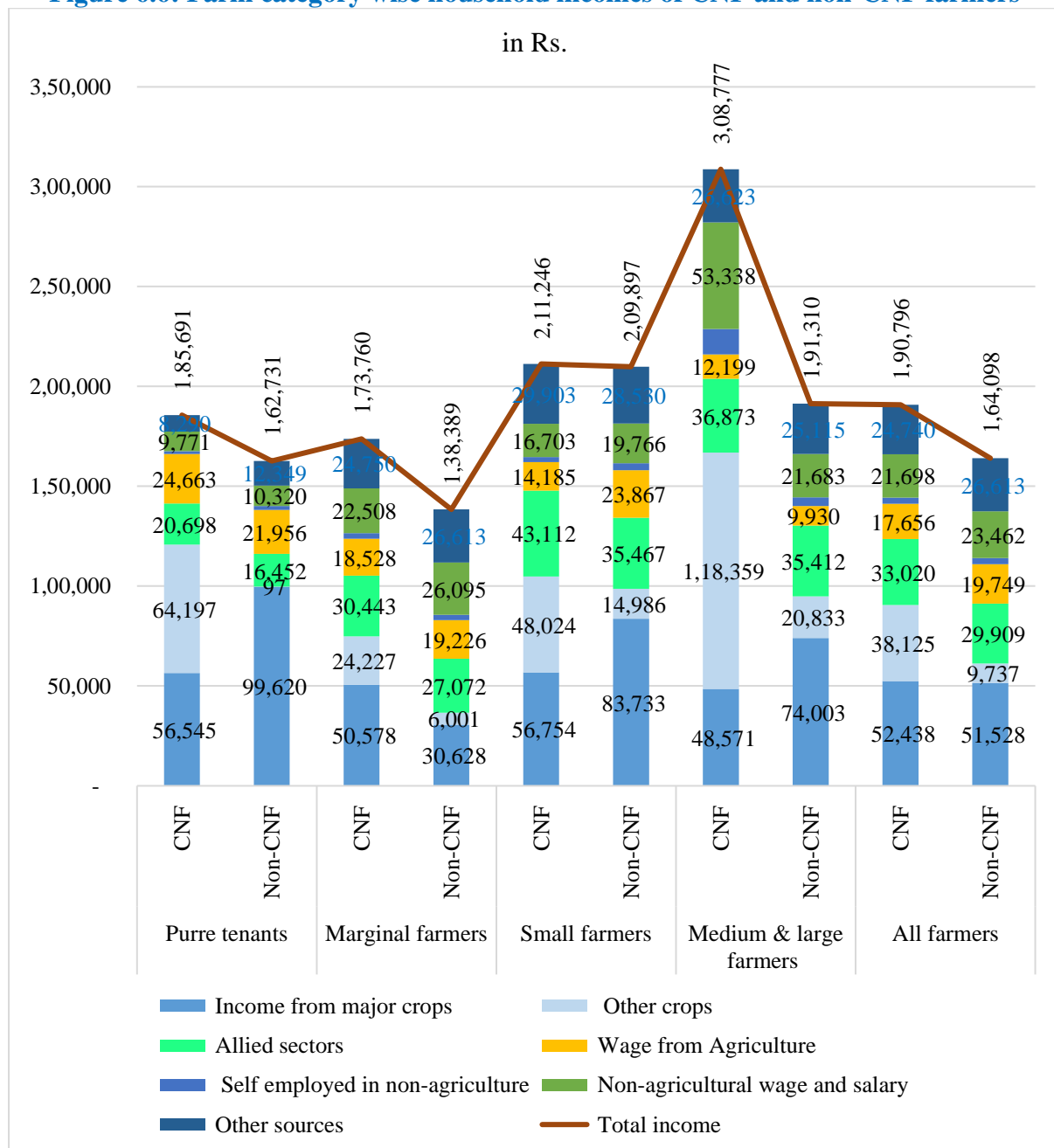


Source: IDSAP field survey 2020-21

6.5. Farm category wise household Income

Household income of CNF farmers is higher than that of non-CNF households for all farm categories (Figure 6.6). The difference between the incomes of CNF and non-CNF is highest for medium and large farmers, followed by the marginal farmers. It is the least for the small farmers. Income diversity is also high for CNF farmers.

Figure 6.6: Farm category wise household incomes of CNF and non-CNF farmers



Source: IDSAP Field Survey, 2020-21

The income in absolute value per household from allied sectors is higher for the CNF farmers over non-CNF farmers across all the categories of farmers. In High Altitude Zone and Godavari Zone allied sectors contribute more to the total household income of CNF farmers compared to non-CNF farmers (Annexure tables 6.2 to 6.7). This indicates that the linkages between agriculture and allied sectors is strengthened under CNF over non-CNF. It is striking to note that crop income constitutes about 47.5% of the total income for CNF, while it is about 37.3% for non-CNF farmers (Table 6.8) for CNF farmers constitute major share in the total increased income due to CNF. This is true across all the categories of farmers. But this is pronounced among the small landholders over large landholders.

The pattern of increased incomes of small landholders due to CNF has also revealed that the small landholders have higher dependency on agriculture and lower dependency on wage employment from agriculture to derive higher annual household income, while large landholders have increased dependency on agriculture as well as on wage employment from non-farm sector, may be mostly on salaried employment. Thus, the livelihood strategy of small landholders is different from that of large landholders for improving household income due to CNF. This also indicates that small landholders have more dependent on CNF to derive more agricultural income in the total household annual income.

6.6. Conclusions

The above analysis has brought out clearly that the CNF has contributed to the increase in annual income of farmer households. It also contributed to the diversity of the in the household income. The increased income is largely due to agricultural income from CNF. Linkages between agriculture and animal husbandry have been strengthened by CNF. Land and labour markets and the nature of linkages between them have facilitated the contribution of CNF to the livelihood strategies and thereby to the improvements in income across farm size categories.

Chapter 6 Tables

Table 6.1: Household annual income for CNF and Non-CNF farmers in the agricultural year 2020-21 in Andhra Pradesh

(In Rupees per household)

Source of Income	CNF	Non-CNF	Difference between CNF and non-CNF	
			In Rs.	in %
1.1. Major crops	2,27,139	2,07,014	20,125	9.72
1.2. Other crops including PMDS and model crops	38,150	9,737	28,413	291.80
2. Animal Husbandry and Fishery	31,599	29,074	2,525	8.68
3. Forestry	1,442	835	607	72.69
4. Wage income from Agriculture	17,667	19,749	-2,082	-10.54
5. Self-employed in non-agriculture	3,121	3,100	21	0.68
6. Non-agricultural wage and salary income	21,712	23,462	-1,750	-7.46
7. Rent	2,111	1,150	961	83.57
8. Other sources	22,645	25,463	-2,818	-11.07
Total income	3,65,586	3,19,584	46,002	14.39
<u>Percentage share of each source of income in the total household income</u>				
1.1. Major crops	62	65		
1.2. Other crops including PMDS and model crops	10	3		
2. Animal Husbandry and Fishery	9	9		
3. Forestry	0	0		
4. Wage income from Agriculture	5	6		
5. Self-employed in non-agriculture	1	1		
6. Non-agricultural wage and salary income	6	7		
7. Rent	1	0		
8. Other sources	6	8		
Total income	100	100		

Source: IDSAP field survey, 2020-21.

Table 6.2: Income from agriculture, animal husbandry and fisheries activities for agricultural year 2020-21 for CNF and non-CNF farmers in HAT zone.

(In Rupees per household)

Source of Income	Agriculture year 2020-21			
	CNF	Non-CNF	Absolute difference	Relative Difference
1.1. Major crops	19,693	12,860	6,833	53.13
1.2. Other crops including PMDS and model crops	50,683	33,338	17,345	52.03
2. Animal Husbandry and Fishery	21,850	11,899	9,951	83.63
3. Forestry	13,522	4,372	9,150	209.29
4. Wage income from Agriculture	5,063	20,137	-15,074	-74.86
5. Self-employed in non-agriculture	1,013	4,448	-3,435	-77.23
6. Non-agricultural wage and salary income	11,039	33,324	-22,285	-66.87
7. Rent	676	240	436	181.67
8. Other sources	15,593	20,604	-5,011	-24.32
Total Kharif season income	1,39,131	1,41,221	-2,090	-1.48
Monthly income	11,594	11,768	-174	-1.48

Source: IDSAP field survey, 2020-21.

Table 6.3: Income from agriculture, animal husbandry and fisheries activities for agricultural year 2020-21 for CNF and non-CNF farmers in Kharif + Rabi in North-coastal zone.

(In Rupees per household)

Source of Income	Agriculture year 2020-21			
	CNF	Non-CNF	Absolute difference	Relative Difference
1.1. Major crops	1,02,422	64,142	38,280	59.68
1.2. Other crops including PMDS and model crops	31,827	19,165	12,662	66.07
2. Animal Husbandry and Fishery	12,588	15,224	-2,636	-17.31
3. Forestry	-193	325	-518	-159.38
4. Wage income from Agriculture	11,968	14,832	-2,864	-19.31

5. Self-employed in non-agriculture	3,557	1,979	1,578	79.74
6. Non-agricultural wage and salary income	24,164	35,427	-11,263	-31.79
7. Rent	551	544	7	1.29
8. Other sources	25,691	32,990	-7,299	-22.12
Total Kharif season income	2,12,576	1,84,628	27,948	15.14
Monthly income	17,715	15,386	2,329	15.14

Source: IDSAP field survey, 2020-21.

Table 6.4: Income from agriculture, animal husbandry and fisheries activities for agricultural year 2020-21 for CNF and non-CNF farmers in Kharif + Rabi in Godavari Zone.

(In Rupees per household)

Source of Income	Agriculture year 2020-21			
	CNF	Non-CNF	Absolute difference	Relative Difference
Income from				
1.1. Major crops	1,19,952	82,635	37,317	45.16
1.2. Other crops including PMDS and model crops	69,875	210	69,665	33,173.81
2. Animal Husbandry and Fishery	53,951	28,871	25,080	86.87
3. Forestry	613	643	-30	-4.67
4. Wage income from Agriculture	31,671	21,620	10,051	46.49
5. Self-employed in non-agriculture	3,035	3,013	22	0.73
6. Non-agricultural wage and salary income	21,650	15,740	5,910	37.55
7. Rent	4,194	3,222	972	30.17
8. Other sources	17,000	18,972	-1,972	-10.39
Total Kharif season income	3,21,942	1,74,926	1,47,016	84.04
Monthly income	26,829	14,577	12,252	84.05

Source: IDSAP field survey, 2020-21.

Table 6.5: Income from agriculture, animal husbandry and fisheries activities for agricultural year 2020-21 for CNF and non-CNF farmers in Kharif + Rabi in Krishna Zone.

(In Rupees per household)

Source of Income	Agriculture year 2020-21			
	CNF	Non-CNF	Absolute difference	Relative Difference
1.1. Major crops	4,16,857	3,75,925	40,932	10.89
1.2. Other crops including PM DS and model crops	59,133	270	58,863	21,801.11
2. Animal Husbandry and Fishery	20,476	20,916	-440	-2.10
3. Forestry	34	29	5	17.24
4. Wage income from Agriculture	29,007	35,103	-6,096	-17.37
5. Self-employed in non-agriculture	949	0	949	
6. Non-agricultural wage and salary income	5,774	23,626	-17,852	-75.56
7. Rent	1,829	1,340	489	36.49
8. Other sources	7,839	15,229	-7,390	-48.53
Total Kharif season income	5,41,898	4,72,439	69,459	14.70
Monthly income	45,158	39,370	5,788	14.70

Source: IDSAP field survey, 2020-21.

Table 6.6: Income from agriculture, animal husbandry and fisheries activities for agricultural year 2020-21 for CNF and non-CNF farmers in Kharif + Rabi in South Zone

(In Rupees per household)

Source of Income	Agriculture year 2020-21			
	CNF	Non-CNF	Absolute difference	Relative Difference
Income from				
1.1. Major crops	2,86,902	2,82,856	4,046	1.43
1.2. Other crops including PMDS and model crops	22,624	5,190	17,434	335.92
2. Animal Husbandry and Fishery	41,985	68,337	-26,352	-38.56
3. Forestry	97	323	-226	-69.97
4. Wage income from Agriculture	12,088	8,793	3,295	37.47
5. Self-employed in non-agriculture	4,695	5,847	-1,152	-19.70
6. Non-agricultural wage and salary income	29,843	16,291	13,552	83.19
7. Rent	2,811	1,763	1,048	59.44
8. Other sources	33,544	40,349	-6,805	-16.87

Total Kharif season income	4,34,590	4,29,749	4,841	1.13
Monthly income	36,216	35,812	404	1.13

Source: IDSAP field survey, 2020-21.

Table 6.7: Income from agriculture, animal husbandry and fisheries activities for agricultural year 2020-21 for CNF and non-CNF farmers in Kharif + Rabi in Scarce rainfall zone.

In ₹. Per household

Source of Income	Agriculture year 2020-21			
	CNF	Non-CNF	Absolute difference	Relative Difference
Income from				
1.1. Major crops	3,02,162	2,93,222	8,940	3.05
1.2. Other crops including PMDS and model crops	5,685	1,029	4,656	452.48
2. Animal Husbandry and Fishery	21,144	22,694	-1,550	-6.83
3. Forestry	207	0		
4. Wage income from Agriculture	25,652	18,485	7,167	38.77
5. Self-employed in non-agriculture	1,977	3,559	-1,582	-44.45
6. Non-agricultural wage and salary income	25,314	14,848	10,466	70.49
7. Rent	1,004	658	346	52.58
8. Other sources	13,266	19,921	-6,655	-33.41
Total Kharif season income	3,96,411	3,74,415	21,996	5.87
Monthly income	33,034	31,201	1,833	5.87

Source: IDSAP field survey, 2020-21.

Table 6.8: Farm category wise household income of CNF and non-CNF farmers during 2020-21

Income from	Kharif + Rabi									
	PMDS+CNF					Non-CNF				
	Pure Tenant	Marginal	Small	Medium & Large	Total	Pure Tenant	Marginal	Small	Medium & Large	Total
1.1 Income from major crops	56,545	50,578	56,754	48,571	52,438	99,620	30,628	83,733	74,003	51,528
1.2. Other crops	64,197	24,227	48,024	1,18,359	38,125	97	6,001	14,986	20,833	9,737
2. Animal Husbandry and Fishery	20,274	29,071	40,886	36,607	31,579	16,452	26,647	34,009	33,570	29,074
3. Forestry	424	1,372	2,226	266	1,441	0	425	1,458	1,842	835
4. Wage from Agriculture	24,663	18,528	14,185	12,199	17,656	21,956	19,226	23,867	9,930	19,749
5. Self-employed in non-agriculture	1,528	2,726	2,565	12,814	3,119	1,936	2,753	3,547	4,333	3,100
6. Non-agricultural wage and salary	9,771	22,508	16,703	53,338	21,698	10,320	26,095	19,766	21,683	23,462
7. Rent	115	1,525	4,007	3,532	2,109	2,798	700	794	4,635	1,150
8. Other sources	8,175	23,225	25,896	23,091	22,631	9,551	25,913	27,736	20,480	25,463
Total income	1,85,691	1,73,760	2,11,246	3,08,777	1,90,796	1,62,731	1,38,389	2,09,897	1,91,310	1,64,098
Percentage share of each source of income in the total household income										
1.1 Income from major crops	30	29	27	16	27	61	22	40	39	31
1.2. Other crops	35	14	23	38	20	0	4	7	11	6
2. Animal Husbandry and Fishery	11	17	19	12	17	10	19	16	18	18
3. Forestry	0	1	1	0	1	0	0	1	1	1
4. Wage from Agriculture	13	11	7	4	9	13	14	11	5	12
5. Self-employed in non-agriculture	1	2	1	4	2	1	2	2	2	2
6. Non-agricultural wage and salary	5	13	8	17	11	6	19	9	11	14
7. Rent	0	1	2	1	1	2	1	0	2	1
8. Other sources	4	13	12	7	12	6	19	13	11	16
Total income	100	100	100	100	100	100	100	100	100	100

Source : IDSAP Field Survey, 2020-21

Chapter 7: Actual and potential impact of CNF in Andhra Pradesh

7.1. Introduction

This chapter discusses the actual impact of CNF in the state in terms of reduction in the consumption or use of fertilizers and pesticides, savings/ changes in the cost of cultivation, increase/ changes in the crop outputs, gross and net values of crop output. This chapter provides an estimate of the project level and the potential benefits of CNF, if the entire cropped area were put under CNF. The specific research questions addressed in this chapter are:

1. What is the actual savings in the expenditure on fertilizers and pesticides in the state, due to CNF in 2020-21?
2. What is the of actual savings obtained by the CNF farmers in paid-out costs in the state in 2020-21?
3. What are the actual changes experienced in the gross and net values of crop outputs by the CNF farmers in 2020-21?
4. What would be the potential savings in the use of fertilizers and pesticides, if the entire cropped area were put under CNF in 2020-21?
5. What would be the potential savings in the cost of cultivation, if the entire cropped area were put under CNF in 2020-21?
6. What would be the potential change in the crop output in the state, if the entire cropped area were put under CNF in 2020-21?
7. What would be the potential change in gross and net values of the crop output, if the entire cropped area were put under CNF?

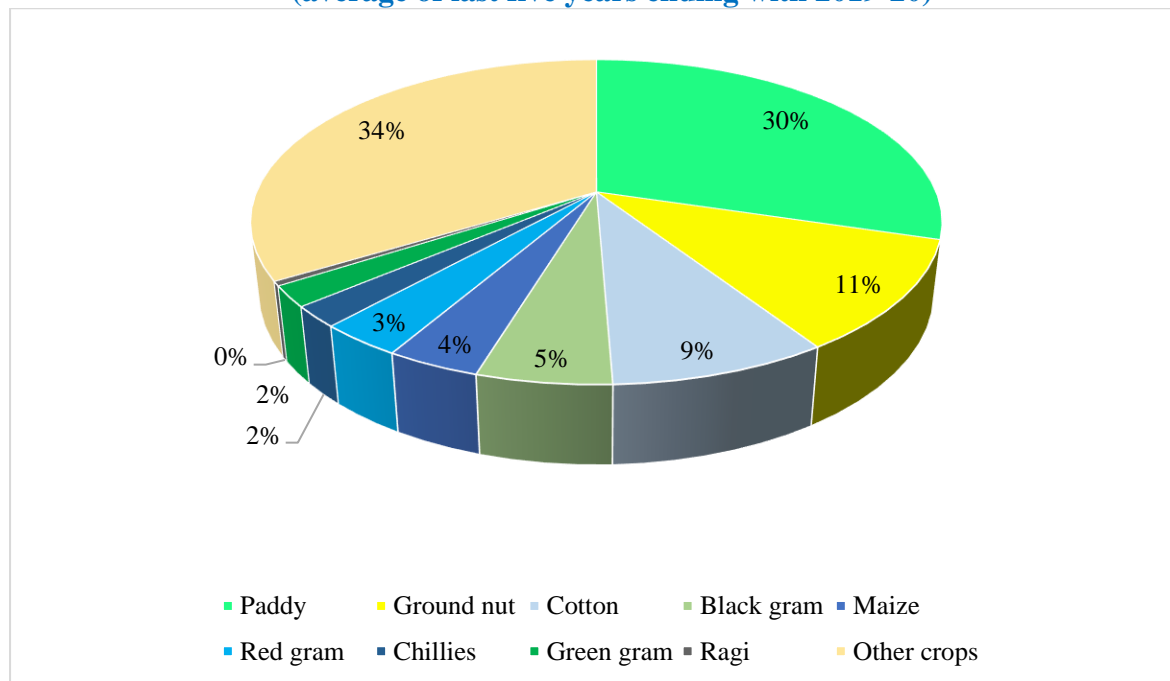
The crop wise details of nine crops discussed in chapter 3, the state cropping pattern data obtained from Directorate of Economics and Statistics (DES) of AP's publication, and the number of farmers participating in CNF project in 2020-21, provided by RySS are used in the estimations in this chapter.

7.2. Actual impact of CNF in the state in 2020-21

Chapter 3 discusses the crop wise costs, yields and returns of nine crops, viz., Paddy, Groundnut, Cotton, Black gram, Maize, Red gram, Chillies, Green gram and Ragi. The costs

and returns of these nine crops are used as the basis in the estimations of the project level actual benefits and state level potential benefits in this chapter. Out of total 74.75 lakh hectare of total gross cropped area (GCA) in the state²⁹, the select nine crops cover 66.36% of GCA; the range varies from less than 0.5% under Ragi to about 30% under Paddy (Figure 7.1).

Figure 7.1: Percentage of GCA under selected nine crops and remaining all other crops (average of last five years ending with 2019-20)

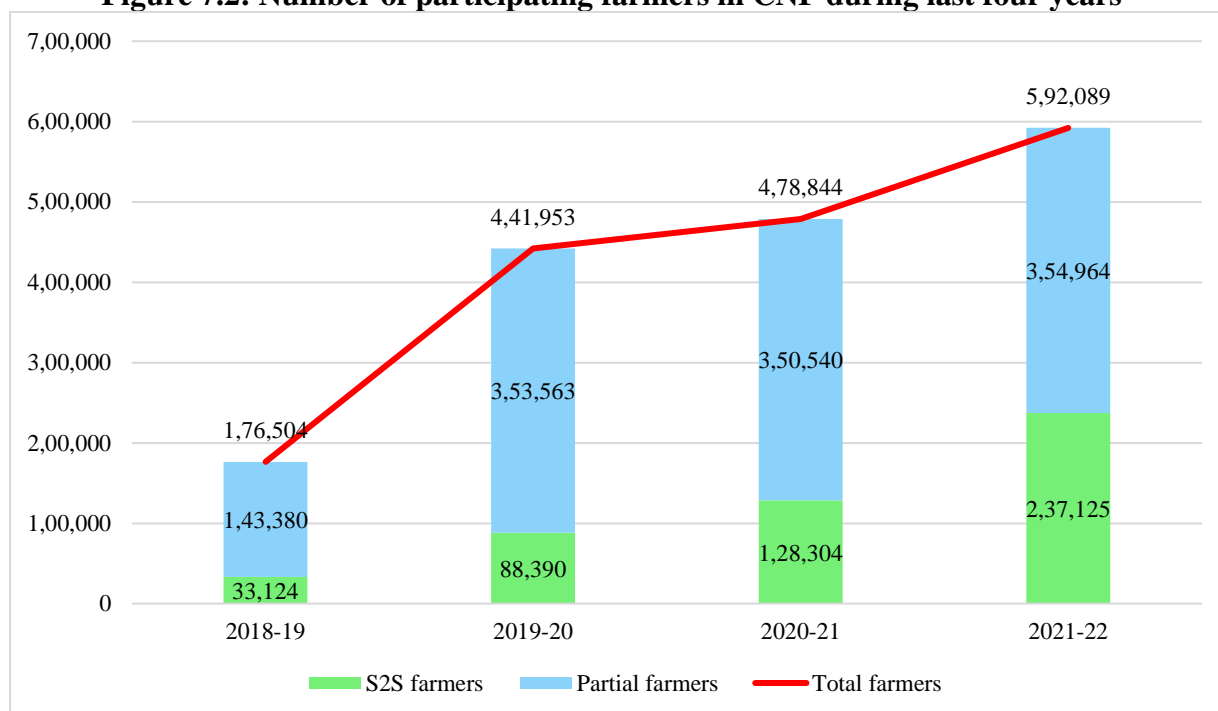


Sources: DES, (2021): Season and Crop Report 2019-20 Andhra Pradesh, Directorate of Economics and Statistics, Government of Andhra Pradesh, Vijayawada.

RySS registers the CNF project participants under two categories, viz., (1) Pure farmers or seed to seed (S2S) farmers, who do not apply any chemical inputs at all, at least on a part of their operational holdings and (2) Partial farmers, who apply both biological and chemical inputs in their fields. Number of farmers adopting CNF as the pure CNF/ S2S farmers and partial farmers are shown in the Figure 7.2. 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 and the number of partial farmers has stagnated during last three years. It may be noted and kept in mind that CNF sample was drawn from S2S or pure CNF farmers only.

²⁹ Average of previous five years ending with 2019-20

Figure 7.2: Number of participating farmers in CNF during last four years



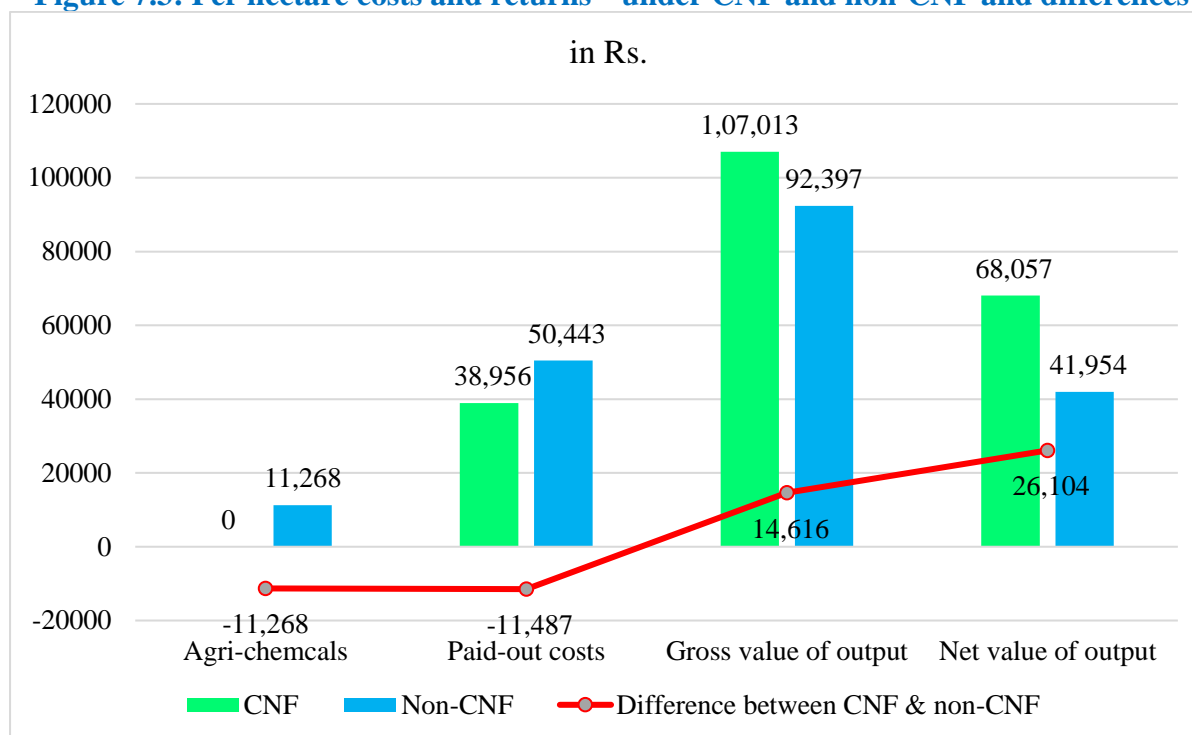
Sources: RySS

From the survey results of crop wise costs and returns, discussed in chapter 3 and the cropping pattern in the state, discussed above, the weighted average costs and returns of nine crops³⁰ are calculated and presented in Figure 7.3. On the average the non-CNF farmers have used ₹.11,268 worth of fertilizers and pesticides per ha. This amount is saved by the CNF farmers. Overall, the CNF farmers have spent ₹.11,487 less on paid-out costs per hectare; it is 22.77% less. At the same time, the CNF farmers got ₹.14,616 (15.82%) higher gross value of output per hectare and ₹.26,104 (62%) higher net value of output per ha. ***The observed, over 62%, higher net value of crop output under CNF over non-CNF is a result of four factors, viz., (1) Reduction in the cost of cultivation, (2) increase in crop yields, (3) better prices for CNF crops, and (4) good resistance to heavy rains.***³¹ Because of the last factor, the difference between the net value of CNF and non-CNF crop output, in 2020-21, is 3 percentage points higher than that of last year-2019-20.

³⁰ The crops are - Paddy, Groundnut, Cotton, Black gram, Maize, Red gram, Chillies, Green gram and Ragi

³¹ In a sense, the crop resistance is reflected in the yields. This year apart from the first three factors, which have been observed during last three years, CNF crops resistance to heavy rains is a notable factor. It has come out in the FGDs and also covered by the media.

Figure 7.3: Per hectare costs and returns³² under CNF and non-CNF and differences

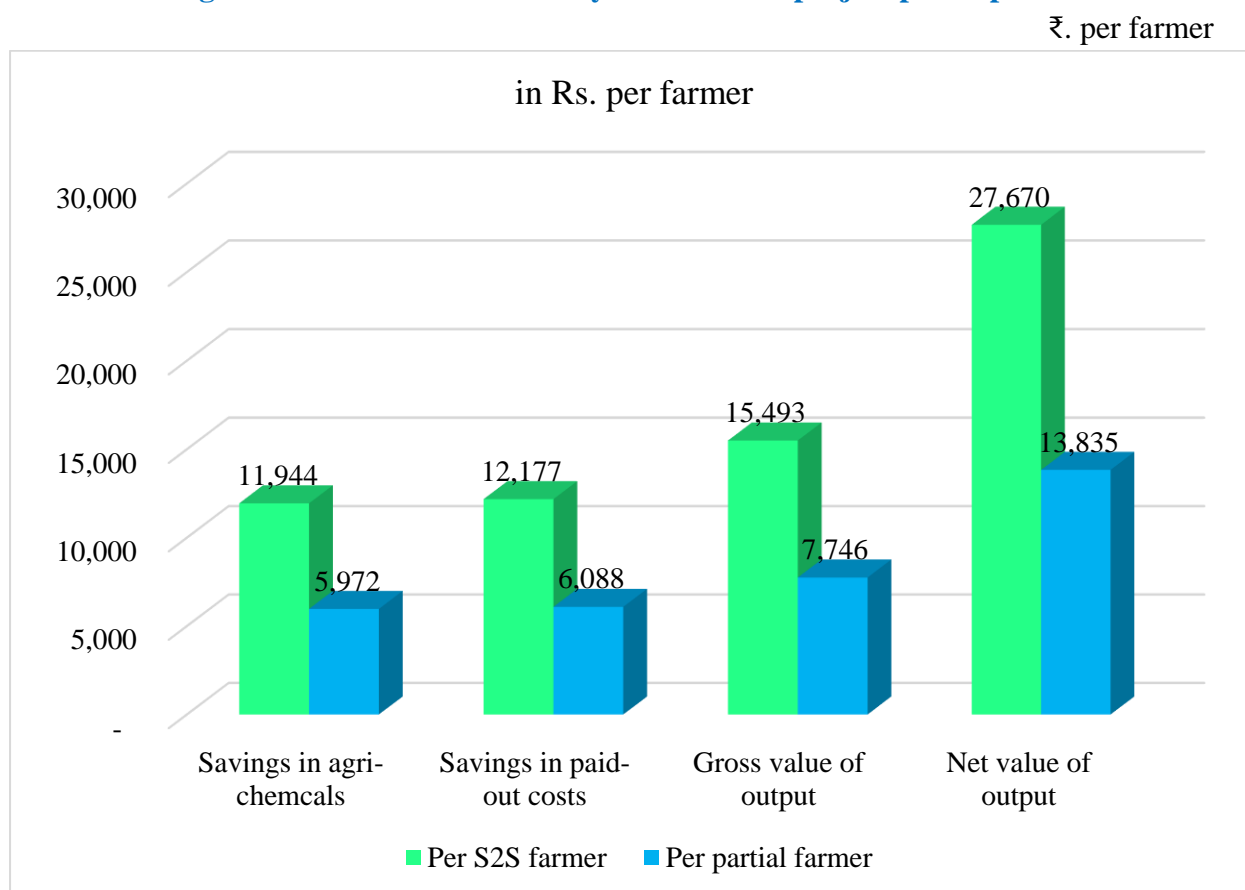


Sources: IDSAP, 2020-21 Field Survey

From the survey data, it was found that, on average, each sample farmer has allocated 1.06 hectare to CNF cultivation. It includes 0.69 hectare during Kharif and 0.37 hectare during Rabi. As the CNF sample was drawn only from CNF farmers in the data, the area allocated for CNF by the partial CNF farmers is not available. Therefore, it is assumed that each of partial CNF farmer gets 50% of the benefits obtained by the CNF farmers. Per farmer benefits from CNF project participation, for pure CNF and partial farmers, are estimated and shown at Figure 7.4. Each of CNF farmer has savings of ₹.11,944 in agrichemicals and ₹.12,177 in the paid-out costs. Each CNF farmer got additional gross value of output of ₹.15,493 and additional net values of output of ₹.27,670 due to their participation in CNF. Each of the partial participant/ farmers too got 50% of each of these benefits.

³² These values are the weighted averages of nine selected crops covered in this report. See chapter 3 for more details. Area under each crop in the state are used as the weights

Figure 7.4: Benefits obtained by each of CNF project participant



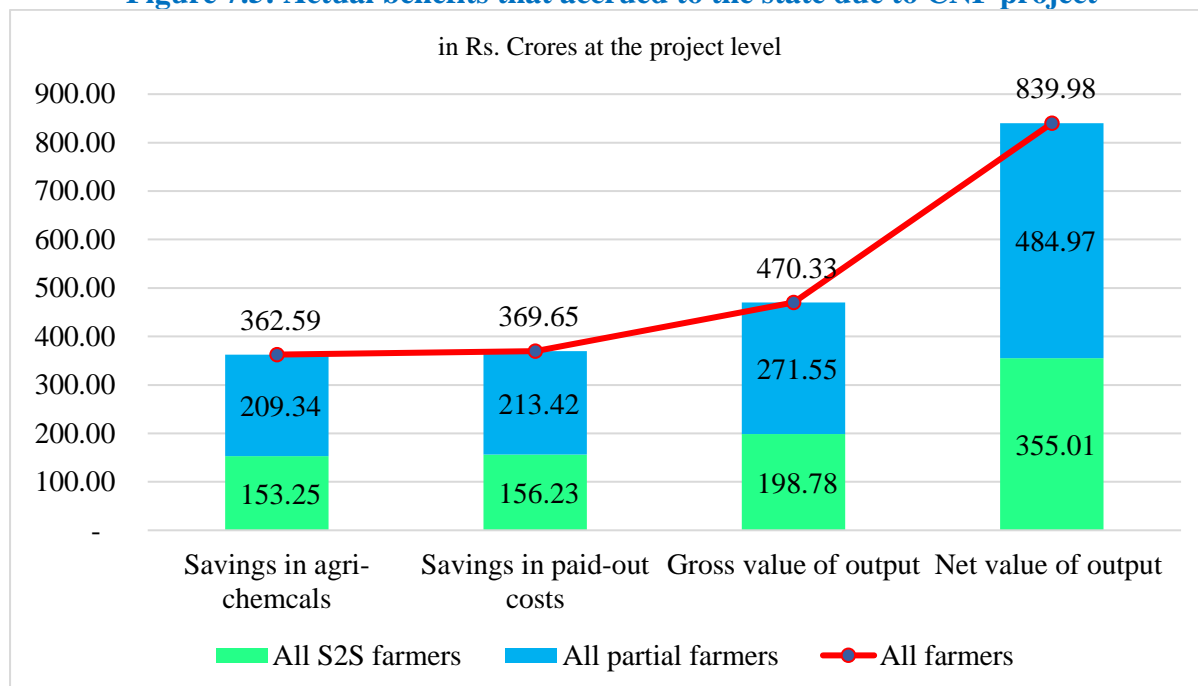
Sources: IDSAP, 2020-21 Field Survey

Using the total number of CNF project participating farmers of 4,78,844, including 1,28,304 CNF farmers and 3,50,540 partial farmers³³, the actual benefits, that accrued to the state due to CNF project, in 2020-21, are estimated and shown at Figure 7.5. CNF project has reduced the use of fertilizers and pesticides worth of ₹.362.59 crores in 2020-21, in the state. Needless to say, that it would be resulting in a large number of valuable environmental and health benefits. It would also result in the savings of about ₹.250 crore worth fertilizer subsidy. The state also experienced a savings worth of ₹.369.65 crores in the paid-out costs, ₹.470.32 crores additional gross value of crop output and ₹.839.98 crores of additional net value of crop output. One small issue of concern is that majority of the benefits came from the partial farmers³⁴, who are still large in numbers. However, the partial farmers number has stagnated during last three years, and the number of CNF farmers is growing at the fast pace, during last three years. In the future, as CNF spreads, the benefits would be larger.

³³ Data provided by RySS

³⁴ Though partial application of biological inputs and practices is far better than non-CNF, it does not allow detoxication of the soils, natural resources and food items. Further, it may affect adversely the life in subsoil.

Figure 7.5: Actual benefits that accrued to the state due to CNF project



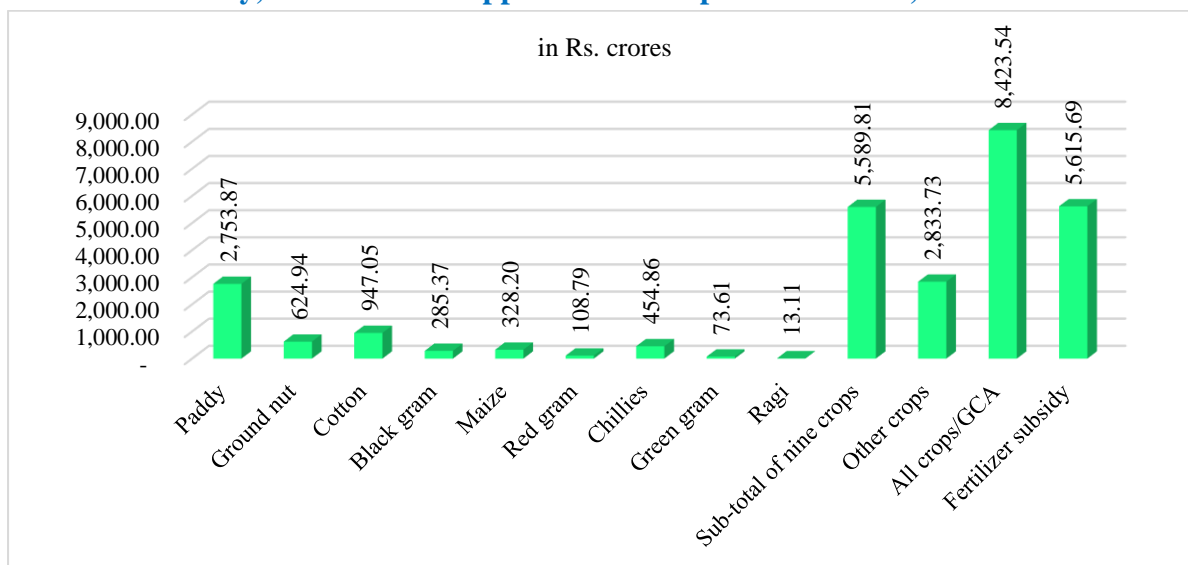
Sources: IDSAP, 2020-21 Field Survey

7.3. Potential benefits from CNF

Following the above calculations, one may be interested in knowing the potential benefits of CNF, if the entire cropped area is put under CNF. This issue is analysed in this section. Given the per hectare use of fertilizer and pesticides (discussed in chapter 3) and cropping pattern in the state (discussed above), the potential savings in the expenditure on agrichemicals, in nine selected crops, their sub-total, total cropped area and savings in the fertilizers' subsidy³⁵ are shown in figure 7.6. Savings in nine crops varies from ₹.13.11 crores in Ragi to ₹.2,753.87 crores in Paddy. Had the entire cropped area were put under CNF, the farmers would have saved ₹.8,423.54 crore by not using agrichemicals. The Government of India would have saved over ₹.5,600 crores in the fertilizer's subsidy (Figure 7.6). Further, there would be a number of invaluable health and environmental benefits. It may be noted that use of agrichemicals depends on many factors, especially the rainfall. This year, the state has received excess rainfall in many parts. In a few parts, the farmers have abandoned the crops. As a result, the agrichemical use, this year, might be less than that of last year or any normal rainfall year.

³⁵ From the survey data, it was estimated that the expenditure on fertilizers is about two-thirds of the expenditure on agrichemicals. As per the available literature, the fertilizer's subsidy is equal to farmers expenditure on fertilizers.

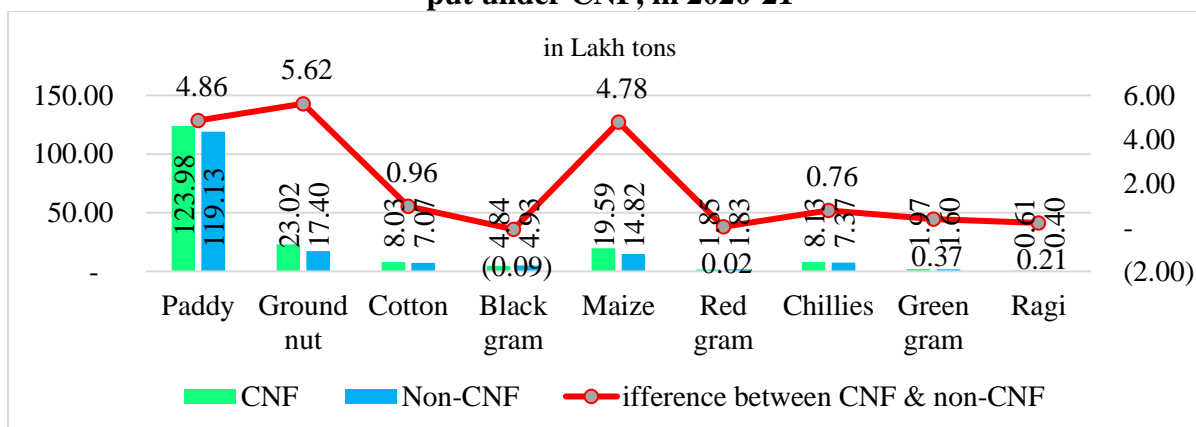
Figure 7.6: Potential savings in the expenditure on agrichemicals and fertilizers' subsidy, if the entire cropped area were put under CNF, in 2020-21



Source: IDSAP, 2020-21 Field Survey

Even without applying any agrichemicals, the state would have got higher crop output in eight out of nine selected crops. Only exception is Black gram, which might have declined by 0.09 lakh tons. In the remaining eight crops the increase would have varied from 0.02 lakh tons in Red gram to 5.62 lakh tons in Groundnut. Paddy output would have been increased by 4.86 lakh tons, followed by Maize output by 4.78 lakh tons. Cotton output would have been larger by 0.96 lakh tons and Chillies output would have been higher by 0.76 lakh tons (Figure 7.7). Following the above description, it is reasonable to assume that crop outputs would have been larger in 85% to 90% of remaining crops, if the entire cropped area were put under CNF in the state.

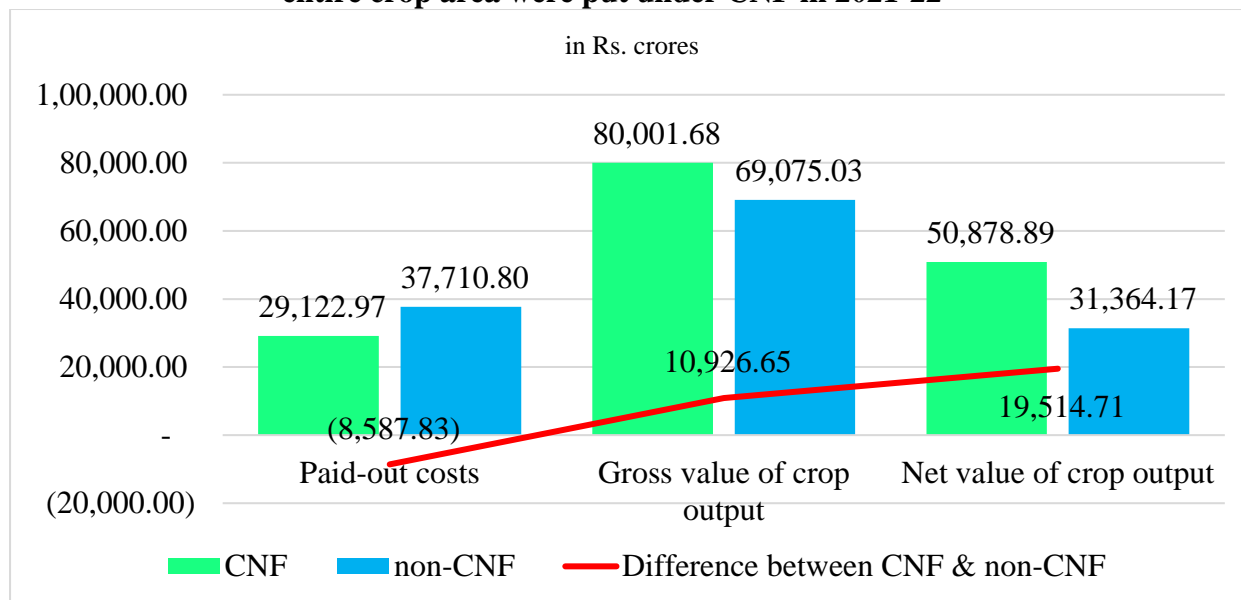
Figure 7.7: Potential changes in crop output in the state, if the entire cropped area were put under CNF, in 2020-21



Source: IDSAP Field Survey, 2020-21

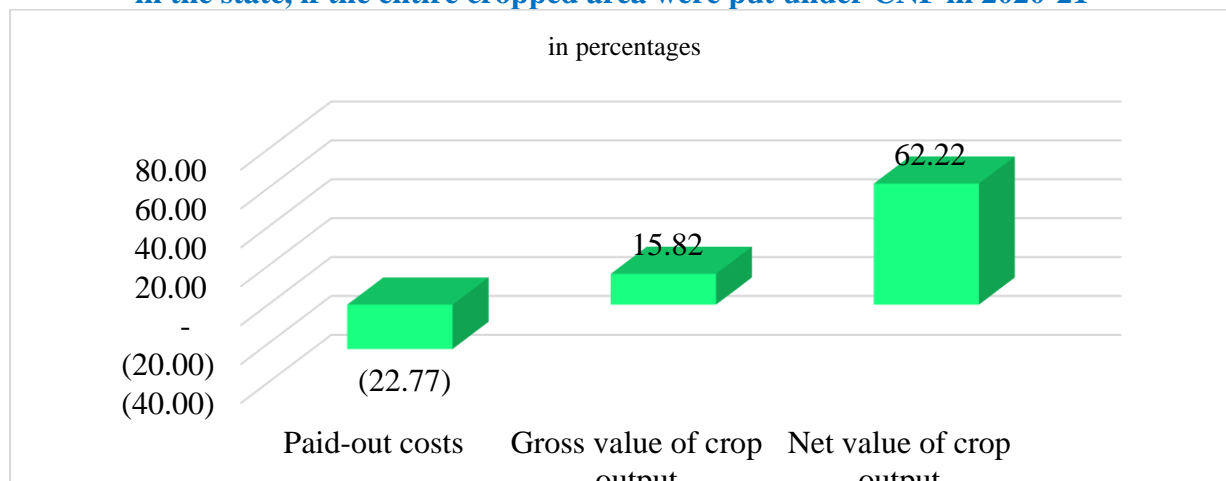
If the entire cropped area were put under CNF, the state would have saved ₹.8,587.83 crores in the paid-out costs; would have obtained ₹.10,927 crores additional gross values of crop output and ₹.19,515 crores higher net values of crop output (Figure 7.8).

Figure 7.8: Potential changes in paid-out costs and values of output in the state, if the entire crop area were put under CNF in 2021-22



In percentage terms the potential changes in the paid-out costs and values of crop output in the state are shown at the Figure 7.9. The paid-out costs would have been 23% lower, the gross value of crop output would have been 16% higher and the net value of crop out would be enlarged by whopping 62% (Figure 7.9). Apart from savings in cost of cultivations, increase in crop yields and better realized prices, CNF crops' resistance/ tolerance to heavy rains proved to be another contributory factor to the higher net value of CNF crops.

Figure 7.9: Potential changes in paid-out costs and gross and net values of crop output in the state, if the entire cropped area were put under CNF in 2020-21



Source: IDSAP Field Survey, 2020-21

7.4. Conclusions

In 2020-21, each CNF farmer has saved ₹.11,944 in agrichemicals and ₹.12,177 in paid-out costs; obtained ₹.15,493 additional gross value of output and ₹.27,670 higher net values of output due to their participation in CNF. Each of the partial participant/ farmers assumed to get 50% of each of these benefits. At the project level, the state has realized the savings of ₹.362.59 crores in the expenditure on fertilizers and pesticides³⁶ and ₹.369.65 crores in the paid-out costs. At the same time, the state has reaped ₹.470.33 crores and ₹.839.98 crores in the form of additional gross and net values of crops' output respectively.

If the entire GCA is put under CNF, it would have result in ₹.8,423.54 crores worth of savings in the use of fertilizers and pesticides, and ₹.5,600 crores savings in the fertilizers subsidies. The state would have reaped in higher crop outputs in eight out of nine selected crops. The increase in crop outputs includes 5.62 lakh tons of Groundnut, 4.86 lakh tons of Paddy, 4.78 lakh tons of Maize per annum and so on.

If the entire cropped area were put under CNF, the state would have saved ₹.8,587.83 crores in the paid-out costs; would have obtained ₹.10,927 crores additional gross values of crop output and ₹.19,515 crores higher net values of crop output. In percentage terms, the paid-out costs would be 22.77% lower, the gross value of crop output would be 15.82% higher and the net value of crop output would be enlarged by 62.22%. The potential gap between CNF and non-CNF net values in 2020-21 is about three percentage points larger than that of 2019-20. CNF crop tolerance to heavy rains could be one of the contributory factors.

³⁶ Though the projected reduction in fertilizer use, for partial farmers is based on some unverified assumptions, it gives a rough idea about the reduction in the use of fertilizer and pesticides.

Tables of Chapter 7

Table 7.1: Per hectare average³⁷ costs and returns under CNF and non-CNF farming (₹./ hectare)

Indicator	CNF	Non-CNF	Difference in ₹.	Difference in %
Agri-chemicals	0	11,268	-11,268	-100
Paid-out costs	38,956	50,443	-11,487	-23
Gross value of output	1,07,013	92,397	14,616	16
Net value of output	68,057	41,954	26,104	62

Source: IDSAP Field Survey, 2020-21

Table 7.2: Per hectare and per farmer benefits due to CNF in 2020-21

Indicator	Per hectare in ₹.	Per farmer in ₹.*
Savings in agrichemicals	-11,268	11,944
Savings in paid-out costs	-11,487	12,177
Gross value of output	14,616	15,493
Net value of output	26,104	27,670

* As each farmer on average cultivated 1.06 hectare under CNF in 2020-21, per farmer benefits are estimated by multiplying the per hectare benefits with 1.06.

Source: IDSAP, Field Survey 2020-21

Table 7.3: Number of farmers participating in CNF since 2018-19

Year	CNF farmers	Partial farmers	Total farmers
2018-19	33,124	1,43,380	1,76,504
2019-20	88,390	3,53,563	4,41,953
2020-21	1,28,304	3,50,540	4,78,844
2021-22	2,37,125	3,54,964	5,92,089

Sources: RySS

Table 7.4: Project level benefits, due to CNF in 2020-21

Indicator	Per CNF farmer in ₹.	Per partial farmer in ₹.	For all CNF farmers in ₹. crores	For all partial farmers ₹. crores	For all farmers ₹. crores
Savings in agrichemicals	11,944	5,972	153.25	209.34	362.59
Savings in paid-out costs	12,177	6,088	156.23	213.42	369.65
Gross value of output	15,493	7,746	198.78	271.55	470.33
Net value of output	27,670	13,835	355.01	484.97	839.98

Source: IDSAP Field Survey, 2020-21

³⁷ These values are the weighted averages of nine selected crops covered in this report. See chapter 3 for more details. Area under each crop in the state are used as the weights

Table 7.5: Potential savings in agrichemicals and fertilizers subsidy, if the entire cropped area in the state is put under CNF

S . No	Crop	Area under the crop in the state in hectares	Expenditure on Chemical inputs in Rs per ha	Savings from use of fertilisers and pesticides in ₹. Cr.
1	Paddy	22,17,255	12,420	2,753.87
2	Ground nut	8,28,831	7,540	624.94
3	Cotton	6,44,998	14,683	947.05
4	Black gram	3,98,439	7,162	285.37
5	Maize	2,77,804	11,814	328.20
6	Red gram	2,49,917	4,353	108.79
7	Chillies	1,55,608	29,231	454.86
8	Green gram	1,55,444	4,735	73.61
9	Ragi	32,651	4,016	13.11
10	Sub-total of nine crops	49,60,947	11,268*	5,589.81
11	Other crops	25,14,937	11,268@	2,833.73
12	Total cropped area	74,75,884	11,268	8,423.54
13	Fertilizer subsidy			5,615.69

* weighted averages of above nine crops. Area under each crop in the state are used as the weights

@ Assumed that the average values of remaining crops would be equal to the weighted averages of nine crops, which together account for over two-thirds of cropped area in the state

Source: IDSAP Field Survey, 2020-21

Table 7.6: Potential savings in the paid-out costs, if the entire cropped area were under CNF

Crop	State level paid-out costs in Rs. crores		Difference in paid-out costs due to CNF	
	CNF	Non-CNF	in ₹. Cr	in %
Paddy	10,107.14	12,833.92	-2,726.78	-21.25
Ground nut	3,637.82	4,183.61	-545.79	-13.05
Cotton	2,308.90	3,221.89	-912.99	-28.34
Black gram	721.25	1,016.54	-295.28	-29.05
Maize	1,020.21	1,173.97	-153.76	-13.10
Red gram	332.51	580.16	-247.64	-42.69
Chillies	819.98	1,479.01	-659.03	-44.56
Green gram	300.16	414.91	-114.75	-27.66
Ragi	77.84	120.64	-42.80	-35.48
Sub-total of nine crops	19,325.81	25,024.64	-5,698.83	-22.77
Other crops	9,797.16	12,686.16	-2,889.00	-22.77
Total cropped area	29,122.97	37,710.80	-8,587.83	-22.77

Source: IDSAP Field Survey, 2020-21

Table 7.7: Potential changes in crop output of selected nine crops in 2020-21

Crop	State level crop output in Lakh tons		Changes in crop output due to CNF	
	CNF	Non-CNF	in Lakh tons	in %
Paddy	123.98	119.13	4.86	4.08
Ground nut	23.02	17.40	5.62	32.29
Cotton	8.03	7.07	0.96	13.59
Black gram	4.84	4.93	-0.09	-1.81
Maize	19.59	14.82	4.78	32.25
Red gram	1.85	1.83	0.02	1.23
Chillies	8.13	7.37	0.76	10.35
Green gram	1.97	1.60	0.37	23.13
Ragi	0.61	0.40	0.21	51.26

Source: IDSAP Field Survey, 2020-21

Table 7.8: Potential changes in the gross value of crop output, if the entire cropped area is put under CNF in 2020-21

Crop	State level gross value of crop output in ₹. crores		Changes in gross value of crop output due to CNF	
	CNF	Non-CNF	in ₹. Cr	in %
Paddy	21,686.46	20,035.37	1,651.09	8.24
Ground nut	12,012.71	7,899.33	4,113.38	52.07
Cotton	3,314.88	3,321.10	-6.22	-0.19
Black gram	3,122.73	3,260.59	-137.86	-4.23
Maize	3,279.27	2,243.65	1,035.62	46.16
Red gram	951.67	925.65	26.02	2.81
Chillies	7,318.87	7,001.12	317.75	4.54
Green gram	1,207.84	1,007.90	199.94	19.84
Ragi	194.16	143.02	51.14	35.76
Sub-total of nine crops	53,088.59	45,837.73	7,250.85	15.82
Other crops	26,913.10	23,237.30	3,675.80	15.82
All crops	80,001.68	69,075.03	10,926.65	15.82

Source: IDSAP Field Survey, 2020-21

Table 7.9: Potential changes in the net value of crop output, if the entire cropped area is put under CNF in 2020-21

Crop	State level net value of crop output in ₹. Cr.		Changes in net value of crop output due to CNF	
	CNF	Non-CNF	in ₹. Cr	in %
Paddy	11,579.39	7,201.42	4,377.97	60.79
Ground nut	8,374.92	3,715.73	4,659.19	125.39
Cotton	1,006.00	99.20	906.80	914.11
Black gram	2,401.47	2,244.05	157.42	7.02
Maize	2,259.07	1,069.68	1,189.39	111.19
Red gram	619.14	345.49	273.66	79.21
Chillies	6,498.89	5,522.11	976.78	17.69

Green gram	907.67	592.99	314.68	53.07
Ragi	116.32	22.39	93.93	419.56
Sub-total of nine crops	33,762.89	20,813.06	12,949.83	62.22
Other crops	17,115.99	10,551.12	6,564.88	62.22
All crops	50,878.89	31,364.17	19,514.71	62.22

Source: IDSAP Field Survey, 2020-21

Chapter 8: Impact of CNF on environment and well-being of farmer

8.1. Introduction

The basic premise of this chapter is to assess the impact of CNF on environment and well-being of farmers. Qualitative data has been obtained from the farmers. The reported perceptions of farmers on the parameters considered have been converted in to percentages. It has to be noted that the perceptions are collected from CNF farmers only.

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

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

Conversation with the farmers continued with regard to impact of improved quality of crops on their well-being. The issues like improvement in family members' health; reduction in out-of-pocket expenditure on health; consumption of CNF food; taste of CNF food; improvement in family finances; reduction in tensions in pursuing agriculture and thereby increased happiness of shifting from non-CNF to CNF. These are the dimensions of farmers well-being considered for data collection from the farmers.

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

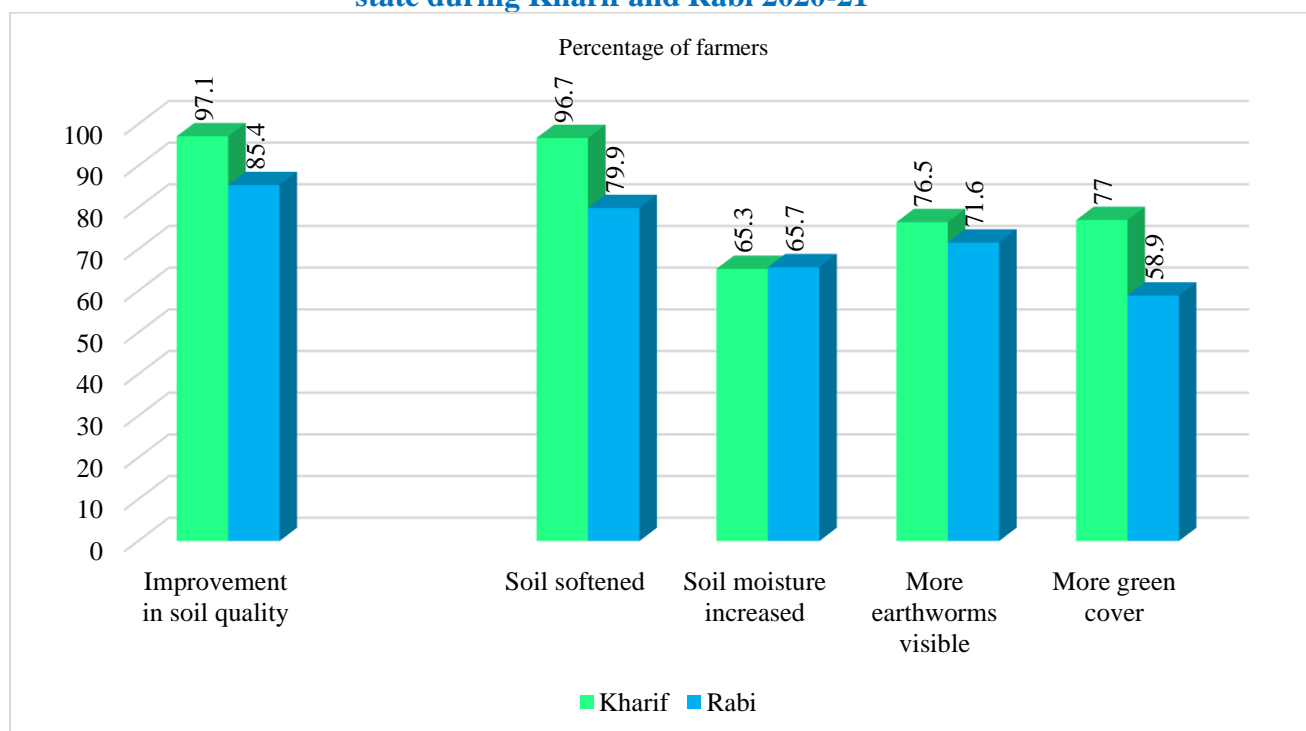
In the above backdrop, this chapter examines the following objectives:

- a. Whether CNF has improved soil health/quality?
- b. What is the cascading impact of improved soil health/quality on crop health?
- c. What is the impact of improved crop health on Well-being of CNF farmers?
- d. How far the above dimensions of environmental impact of CNF and its cascading effects vary across agroclimatic zones and category of farmers?
- e. What suggestions flow from the analysis to improve environmental and well-being impact of CNF?

8.2. Soil Health/Quality

Improvement in the soil health is widely reported by the farmers (97 per cent in Kharif and 85 per cent in Rabi) in the state. This is true across all the agroclimatic zones and category of farmers except those from Godavari and scarce rain fall zones in Rabi season. The percentage of farmers who reported softening of the soil was high and above 70% across all the zones and category of farmers. The percentage of farmers who reported increased moisture in the soil, visibility of more earthworms, and increased green cover in the fields was relatively lower in relation to those who reported the softening of the soil at the state level. Among the zones, Scarce rainfall zone has relatively lower percentage of farmers reporting increase in soil moisture (less than 40%), visibility of more earthworms (less than 50%) and increased green cover (less than 70%) in the Kharif season. In the Rabi season in scarce rainfall region less than 40% of the farmers reported improvement in the parameters of soil quality. Visibility of earth worms and increased green cover were reported by less than 20% of the farmers in Rabi season. Variation in the reported soil quality parameters was higher across agroclimatic zones than that of size classes of farmers (Figure 8.1 and Tables 8.1 and 8.2).

Figure 8.1: Percentage of CNF farmers' reported improvement in soil quality in the state during Kharif and Rabi 2020-21

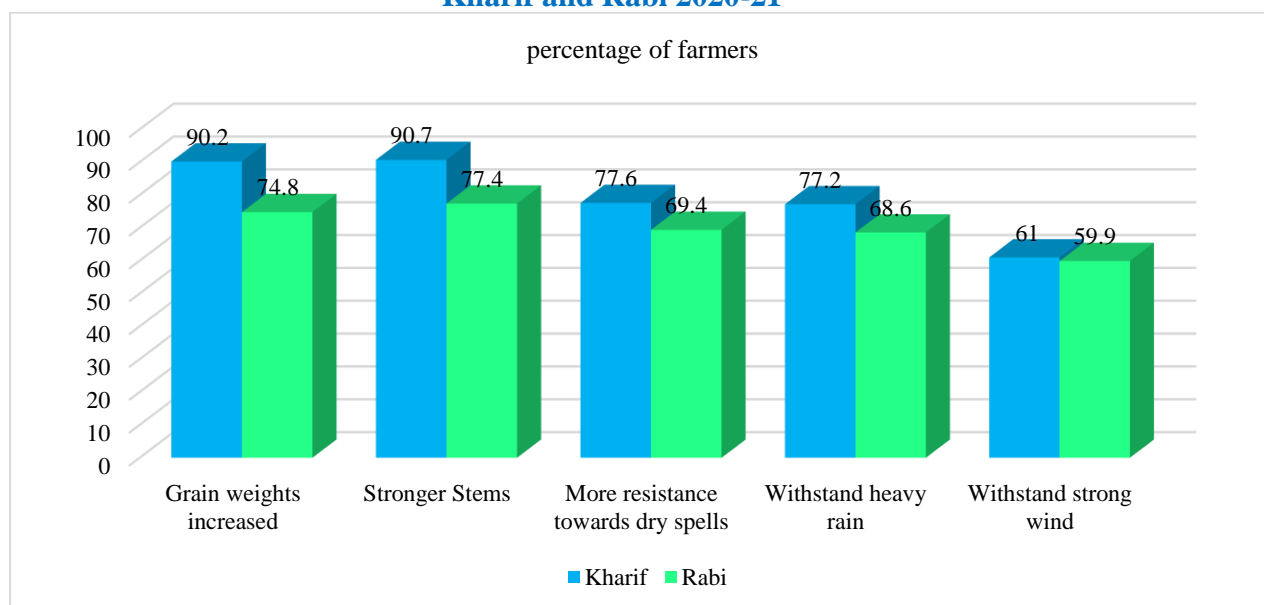


Source: IDSAP Field Survey, 2020-21

8.3. Crop Health

As noted earlier, cascading impact of improvement in soil health on crop health has been perceived by farmers in terms of 'increased Grain Weights'; 'Stronger Stems'; 'More Resistance towards 'Dry Spells'; Withstanding Heavy Rain'; and 'Withstanding Strong Winds'. The last three parameters are related to resilience of crops towards weather variability, and facilitated by stronger stems. Increased grain weights and Stems becoming stronger were reported by 90 per cent of all farmers in the state in Kharif season. But the corresponding percentage was around 75 in Rabi season. Fewer farmers (less than 30%) from the Scarce rainfall zone reported grain weight increase and stronger stems in the Rabi season. In the Kharif season more than 90% farmers from the same Scarce rainfall region reported grain weight and stronger stems. (Figure 8.2 and tables 8.4 and 8.5).

Figure 8.2: Percentage of CNF farmers, who reported crop quality improvement during Kharif and Rabi 2020-21



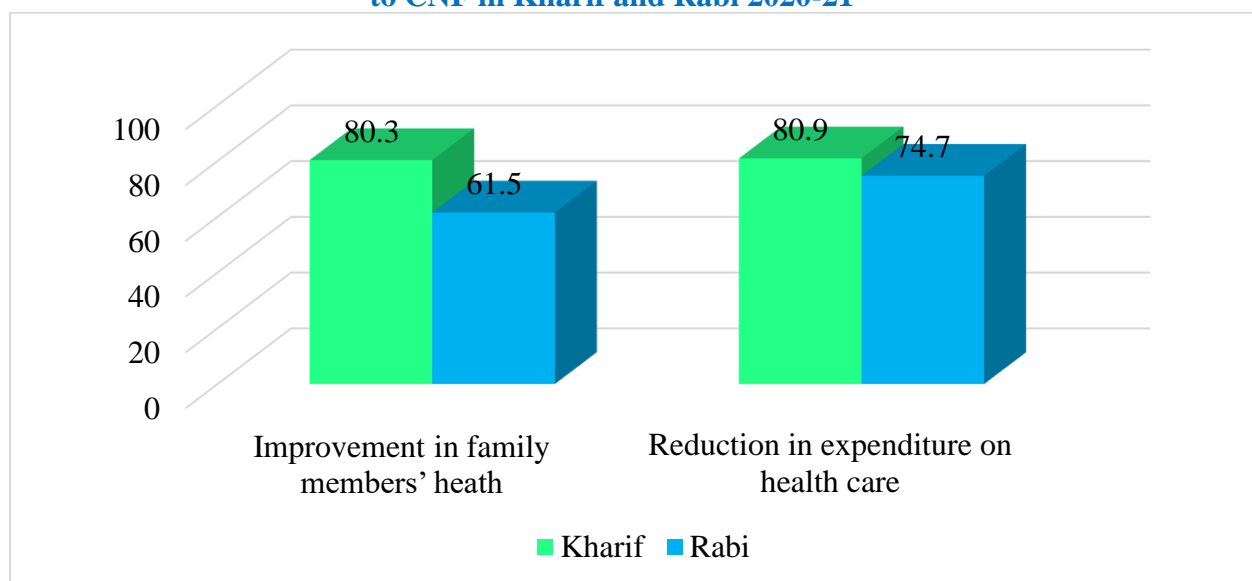
Source: IDSAP Field Survey, 2020-21

The percentage of farmers reported in case of other parameters of crop health such as ‘resistance to Dry Spells’; Withstanding Heavy Rain’; and ‘Withstanding Strong Winds’ were lower compared to those who reported increased grain weight and stems becoming stronger in Kharif and Rabi seasons at the state level. Thus, the resilience gains were reported by relatively lower percentage of farmers at the state level. Farmers from among the rainfall dependent zones southern and north scarce rainfall zones compared to those from other rainfall zones namely high altitude and north coastal zones have reported at lower percentages in regard to gains in resilience of crops in both the seasons. The small landholders reported similar weather resilience as the large landholders in both the seasons.

8.4. Farmers’ Well-being

About 80 percent of the farmers at the state level reported improvement in family members’ health and reduction in out-of-pocket expenditure towards health care in Kharif season. But the corresponding percentages are relatively lower in Rabi season. This is probably due to larger harvest and income from crops in the kharif season compared to rabi season in some regions. These gains are higher for the farmers in High altitude zone among the rainfall dependent zones in Kharif and Rabi seasons. Marginal, and medium and large farmers have reported health improvements and reduced expenditure on health care in higher percentages among the category of farmers in both the seasons (Figure 8.3 and Tables 8.6)

Figure 8.3: Percentage of CNF farmers reported improvement in health outcomes due to CNF in Kharif and Rabi 2020-21

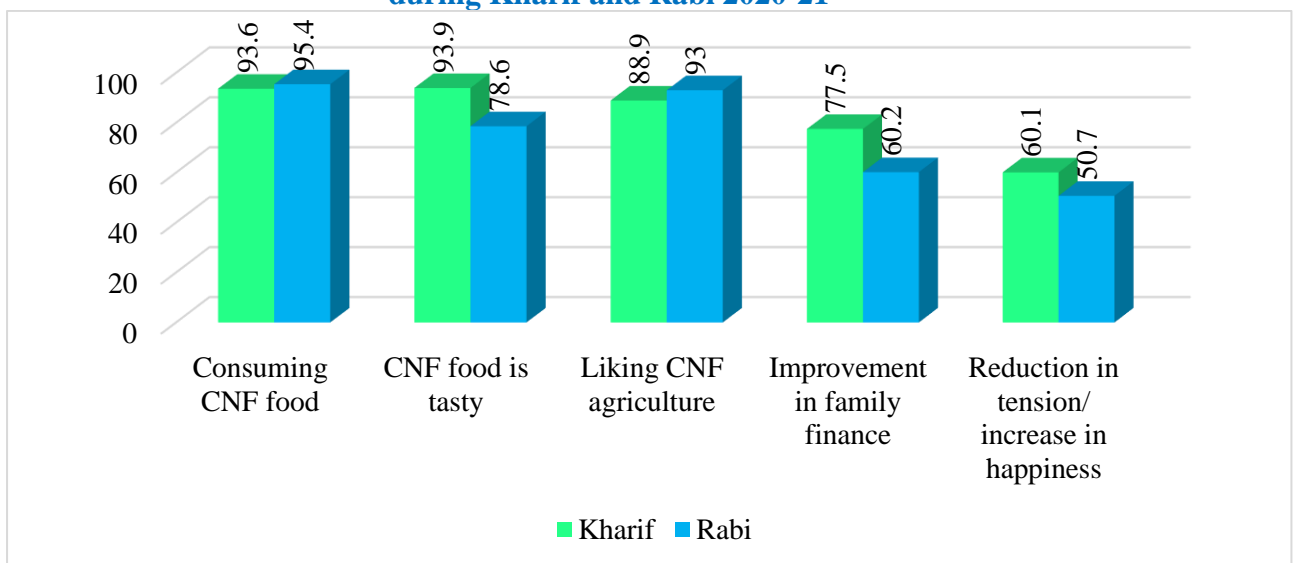


Source: IDSAP Field Survey, 2020-21

In addition to these, there are another five parameters considered for capturing perceptions on farmers' well-being. They are: Consuming CNF food; superior taste of CNF foods; Liking CNF agriculture; improvement in family finances; and reduction in tension and increase in happiness. Roughly more than 76% of the farmers across, agro-climatic regions, across size classes reported consuming CNF foods which were perceived as tasty and enjoyed natural farming. Thus, farmers from rainfall dependent zones on par with those from assured irrigation zones and small landholders on par with large landholders have reported consumption of CNF food. It is striking to note that the percentage of farmers reported that the CNF food is tasty and those who reported that they have consumed CNF food is the same and the percentage is at 94 per cent in Kharif season. But the corresponding figures are slightly lower in Rabi season. This is in line with the percentage of farmers reporting that the health of family members has improved. This means that the chemical free food produced under CNF through improvement in soil health and thereby improvement in crop health has improved the health of farmers and their family members. It is also striking to note that a large percentage of farmers (about 77%) reported improvement in their financial position and about 60% reported reduction in the tensions in pursuing agriculture and reported to be happy in Kharif season. But the corresponding figures are lower in Rabi season. The improvement in financial situation was reported only by less than 30% of the farmers of Godavari Zone and scarce rainfall zone in Rabi season, while 75% in Godavari zone and 98% in scarce rainfall region reported improved family finances in Kharif season. Further, the relatively high percentage of farmers reporting

that they like CNF agriculture indicates that farmers have converted to CNF agriculture due to the improvement in soil health, crop quality and well-being. It is evident that the small and marginal landholders are able to match with large landholders in regard to the perceptions of the parameters considered for measuring well-being. Similarly, health improvement of family members, reduction in stress in Rabi season was reported by less the 30% of the farmers of the Scarce rainfall zone. However, in the same zone, 98% of the farmers reported improved health and 65% reported lower tension in the Kharif season³⁸ (Figure 8.4, Tables 8.5 and 8.6).

Figure 8.4: Percentage of CNF farmers reported improvement in wellbeing indicators during Kharif and Rabi 2020-21



Source: IDSAP Field Survey, 2020-21

8.5. Conclusions

The analysis has brought out clearly that the CNF has improved soil health, crop health and well-being of farmer households at the state level. The performance of small and marginal landholders in this regard is on par with that of large landholders, by and large. But there are variations across the zones with respect to these parameters. The High altitude and North coastal zones compared to the other rainfall dependent zones namely Southern and Scarce rainfall zones have perceived CNF as enhancing their wellbeing. Thus, farmers gain in environmental resilience and wellbeing depends more on their location and the season and probably the financial gain and comfortable food intake.

³⁸ One major reason for such big variations between the Kharif and Rabi seasons in the Scarce rainfall zone is that only 21 percent of sample farmers in the zone have cultivated crops in the Rabi season.

Tables of Chapter 8

Table 8.1: Agroclimatic zone and Farm category wise percentage of CNF farmers reporting improvement in soil quality due to adoption of CNF in kharif

(In Percentages)

Agroclimatic zone/ Farm category/ District	Parameters of improvement in Soil quality				
	Improvement in soil quality	Soil softened	Soil moisture increased	More earthworms visible	More green cover
Agroclimatic zone					
High Altitude Zone	100.0	100.0	92.1	93.4	94.7
North Coastal Zone	98.9	94.3	78.5	73.8	82.8
Godavari Zone	99.1	99.6	54.9	87.6	64.2
Krishna Zone	95.0	98.8	57.6	91.0	78.6
Southern Zone	95.1	95.6	70.5	70.8	79.0
Scarce Rainfall Zone	97.1	95.9	36.5	46.5	63.5
Total	97.1	96.7	65.3	76.5	77.0
Farm category					
Pure Tenant	95.0	98.5	55.3	84.1	65.2
Marginal	97.3	97.8	70.0	79.4	78.4
Small	97.7	94.4	61.8	71.0	79.4
Medium & Large	95.9	95.0	55.0	67.9	71.4
Total	97.1	96.7	65.3	76.5	77.0

Source: IDSAP Field Survey, 2020-21

Table 8.2: Agroclimatic zone and Farm category wise percentage of CNF farmers reporting improvement of soil quality due to adoption of CNF in Rabi Season

(In Percentages)

Farm category/ agroclimatic zone	Percentage of farmers stated improves soil quality	Improves soil quality in terms of			
		Soil softened	Now see more earthworms	Increased green cover	Soil moisture increased
Agroclimatic zone					
High Altitude Zone	100.0	97.0	100.0	97.0	93.9
North Coastal Zone	100.0	97.2	79.9	90.0	78.4
Godavari Zone	60.4	59.5	60.3	54.6	44.4
Krishna Zone	88.2	88.1	85.8	81.3	50.5
Southern Zone	93.1	80.5	52.2	67.9	60.0
Scarce Rainfall Zone	29.2	29.2	14.2	17.6	0.9
Total	85.4	79.9	65.7	71.6	58.9
Farm category					
Pure Tenant	92.1	90.6	79.4	77.2	55.2

Marginal	86.7	81.3	70.0	74.3	64.1
Small	80.8	73.6	55.0	63.2	49.5
Medium & Large	80.8	76.1	41.3	68.0	45.7
Total	85.4	79.9	65.7	71.6	58.9

Source: IDSAP Field Survey, 2020-21

Table 8.3: Agroclimatic zone and Farm category wise percentage of CNF farmers reporting improvement in crop quality due to adoption of CNF in kharif season

(In Percentages)

Agroclimatic zone/ Farm category	Parameters of Crop Quality				
	Grain weights increased	Stronger Stems	More resistance towards dry spells	Withstand heavy rain	Withstand strong wind
Agroclimatic zone					
High Altitude Zone	100.0	100.0	100.0	100.0	98.7
North Coastal Zone	94.0	93.1	97.3	81.9	73.2
Godavari Zone	95.2	89.9	59.2	78.5	58.3
Krishna Zone	89.7	85.0	82.1	83.5	57.9
Southern Zone	80.8	90.6	59.2	68.6	55.3
Scarce Rainfall Zone	91.4	92.6	73.7	60.6	35.4
Total	90.2	90.7	77.6	77.2	61.0
Farm category					
Pure Tenant	85.6	81.3	59.0	75.5	55.4
Marginal	91.5	92.2	80.4	80.4	64.9
Small	89.7	90.6	78.5	72.5	56.5
Medium & Large	87.7	89.7	75.3	72.6	54.8
Total	90.2	90.7	77.6	77.2	61.0

Source: IDSAP Field Survey, 2020-21

Table 8.4: Agroclimatic zone and Farm category wise Percentage of CNF farmers reporting about benefits of CNF over non-CNF due to adoption of CNF in Rabi

(In Percentages)

Farm category/ agroclimatic zone	Grain weight has increased	Stronger Stems	More resistance towards dry spells	Withstand heavy rains	Withstand strong winds
Agroclimatic zone					
High Altitude Zone	97.0	100.0	97.0	87.9	87.9
North Coastal Zone	99.6	87.5	95.8	81.2	81.5
Godavari Zone	60.4	60.2	48.3	54.3	43.4
Krishna Zone	85.1	76.7	81.2	78.8	70.1
Southern Zone	66.2	82.2	61.3	70.2	54.4
Scarce Rainfall Zone	28.4	29.2	17.8	3.6	0.7

Total	74.8	77.4	69.4	68.6	59.9
Farm category					
Pure Tenant	81.9	81.2	73.8	68.9	52.3
Marginal	77.4	80.1	73.6	72.8	66.0
Small	66.6	70.4	61.6	58.6	49.6
Medium & Large	69.6	71.1	48.2	62.8	45.8
Total	74.8	77.4	69.4	68.6	59.9

Source: IDSAP Field Survey, 2020-21

Table 8.5: Agroclimatic zone and Farm category wise percentage of farmers reported improvement in health outcomes due to adoption of CNF in kharif season

(In Percentages)

Agroclimatic zone/ Farm category/ District	Kharif		Rabi	
	Improvement in family members' health	Reduction in expenditure on health care	Improvement in family members' health	Reduction in expenditure on health care
Agroclimatic zone				
High Altitude Zone	86.8	93.4	100.0	100.0
North Coastal Zone	51.0	71.6	62.9	66.7
Godavari Zone	94.7	100.0	59.8	100.0
Krishna Zone	98.8	80.3	87.8	93.5
Southern Zone	80.8	74.8	45.8	57.7
Scarce Rainfall Zone	96.6	89.1	26.8	92.2
Total	80.3	80.9	61.5	74.7
Farm size category				
Pure Tenant	91.4	79.1	83.0	84.8
Marginal	79.9	82.7	63.3	77.7
Small	77.8	76.7	50.1	64.6
Medium & Large	80.1	84.2	58.2	64.4
Total	80.3	80.9	61.5	74.7

Source: IDSAP Field Survey, 2020-21

Table 8.6: Agroclimatic zone and Farm category wise percentage of CNF farmers reporting improvement in well-being due to adoption of CNF in Kharif season

(In Percentages)

Agroclimatic zone/ Farm category/ District	Parameters of Well-being				
	Consuming CNF food	CNF food is tasty	Liking CNF agriculture	Improvement in family finance	Reduction in tension/increase in happiness
Agroclimatic zone					
High Altitude Zone	98.7	98.7	94.7	88.2	86.8
North Coastal Zone	79.0	97.1	72.7	55.3	46.5
Godavari Zone	100.0	92.1	99.6	75.0	93.4
Krishna Zone	100.0	93.5	99.4	88.5	65.3
Southern Zone	97.9	89.9	90.6	83.6	43.9
Scarce Rainfall Zone	98.9	95.4	89.7	98.3	65.7
Total	93.6	93.9	88.9	77.5	60.1
Farm size category					
Pure Tenant	98.6	89.9	95.7	84.2	81.3
Marginal	92.9	94.8	87.2	76.2	60.3
Small	92.9	94.3	89.2	79.9	54.0
Medium & Large	95.9	90.4	92.5	72.6	57.5
Total	93.6	93.9	88.9	77.5	60.1

Source: IDSAP Field Survey, 2020-21

Table 8.7: Agroclimatic zone and Farm category wise Percentage of CNF farmers reporting other well-being benefits of CNF farming due to adoption of CNF in Rabi

(In Percentages)

Farm category/ agroclimatic zone	Financial situation improved	Like CNF farming	Do you consume CNF produce?	Family happiness improved due to lower stress with CNF?
Agroclimatic zone				
High Altitude Zone	84.9	87.9	100.0	96.2
North Coastal Zone	60.1	80.8	76.2	49.2
Godavari Zone	28.6	94.7	99.2	60.2
Krishna Zone	52.9	97.5	100.0	74.1
Southern Zone	74.7	98.1	99.2	30.0
Scarce Rainfall Zone	28.4	100.0	100.0	24.2
Total	60.2	93.0	95.4	50.7
Farm category				
Pure Tenant	66.0	97.8	98.0	79.5
Marginal	61.9	94.9	94.2	53.8
Small	55.6	85.1	97.4	34.9
Medium & Large	52.3	95.4	97.3	41.2
Total	60.2	93.0	95.4	50.7

Source: IDSAP Field Survey, 2020-21

Table 8.8: Agroclimatic zone and Farm category wise Percentage of CNF farmers responded about tastiness of CNF products due to adoption of CNF in rabi

(In Percentages)

Farm category/ agroclimatic zone	Not aware of any difference	CNF product is tastier	Non-CNF product is tastier
Agroclimatic zone			
High Altitude Zone	0.7	99.3	0.0
North Coastal Zone	1.7	98.3	0.0
Godavari Zone	41.3	58.7	0.0
Krishna Zone	12.5	87.5	0.0
Southern Zone	23.5	76.5	0.0
Scarce Rainfall Zone	71.6	28.4	0.0
Total	21.4	78.6	0.0
Farm category			
Pure Tenant	14.1	85.9	0.0
Marginal	19.1	80.9	0.0
Small	27.7	72.3	0.0
Medium & Large	30.4	69.6	0.0
Total	21.4	78.6	0.0

Source: IDSAP Field Survey, 2020-21

Chapter 9: Issues, Challenges and Suggestions

9.1. Introduction

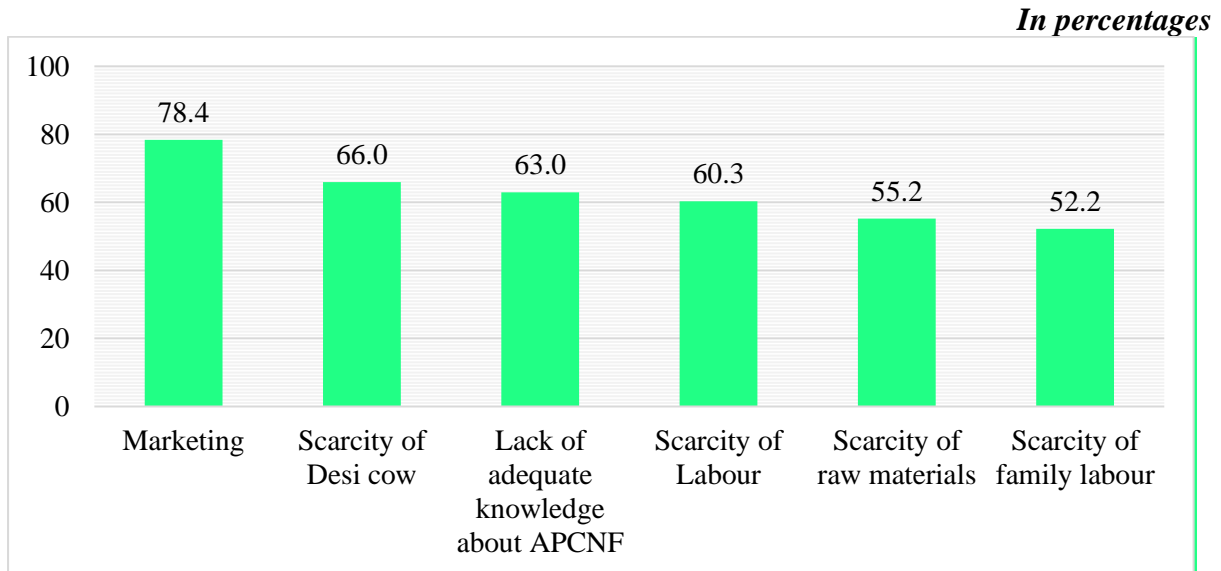
This chapter presents the issues and challenges faced by farmers, in adoption and expansion of CNF. In the earlier reports, these issues and challenges were derived from the farmers' responses in the individual interviews through household information and case studies and collective responses of the same, in the FGDs. The appropriate responses of the District Project Managers (DPMs) in the strategic interviews (SIs) were also integrated in the earlier reports. Along these methods, this year another new method is introduced. It is a comparison of top 10 percent best performing CNF farmers and the bottom 10 percent least performing CNF farmers with regards to Paddy crop yields. Such comparative analysis gives an idea about the potential benefits from CNF and issues and challenges faced by the top ten percent farmers (TTFs) and bottom ten percent farmers (BTFs). It may be noted that while BTFs face certain challenges, the TTFs also face a different set of issues and challenges. The data and information obtained in the household schedules, case studies, FGDs and SIs are utilised in this chapter.

9.2. Major challenges in the adoption of CNF

In CNF household schedule, each farmer is asked the challenges he or she is facing in the adoption of CNF. Their responses are presented in the Figure 9.1 and table 9.1.³⁹ Marketing of CNF crop output remained major problem, reported by 78.4 percent of CNF farmers. In fact, there is a growing consumer preference for non-chemical food. Some CNF farmers are selling their output in a few new market channels and realizing premium prices. But these channels are small in number and region specific. Scarcity of livestock dung and urine is second major challenge reported by 66 percent farmers. Though livestock holding is less, the market for cow dung and urine is developing in the villages. Inadequate knowledge about CNF, scarcity of labour, scarcity of raw material to prepare the biological inputs and scarcity of family labour are other major challenges reported by 50 plus percent of CNF farmers. In the previous surveys also, the farmers reported the same issues and challenges, almost in the same order and magnitude.

³⁹ All tables are given at the end of chapter

Figure 9.1: Percentage of CNF farmers, who reported different problems in the adoption of CNF



Source: IDSAP Field Survey, 2020-21

9.3. Inference from the qualitative studies

The unique issues (net of repetitions), that emerged in the FGDs, case studies and SIs have been listed in the Strengths, Weaknesses, Opportunities and Threats (SWOT) framework in the Box 1 below. The same is summarized below.

1. CNF is almost free from all the problems associated with the chemical-based agriculture, such as high cost of cultivation, low profitability, losses, vulnerable to weather anomalies, health issues related to the application of pesticides and consumption of chemical-based food, decline of soil quality, deterioration of local environment, etc.
2. It is generating new livelihood opportunities in the preparation of biological inputs, marketing of CNF output and improve agriculture practices for longer periods.
3. It is freeing the farmers from the clutches of input, credit and output markets oppressive practices.
4. It is unleashing the synergies between agriculture and allied sectors, particularly the livestock and horticulture sectors.
5. Less requirement of irrigation and power in agriculture.

6. Reduction in the intensity of sickness and related expenditure and farming related tensions, is enabling the farmers to focus on their children's education and their future.
7. But the program is expanding at slow pace.
8. Though the extension services by the project are far better compared to general government agriculture extension services, there is scope for further improvement.
9. Current marketing support for CNF output is inadequate.
10. Current supply of biological inputs is quite inadequate.
11. Lack of seed banks is one of the serious weaknesses
12. The concerns of tenant farmers are yet to be addressed⁴⁰
13. Expectations of higher prices
14. Potential fall in the output prices, if the program expands.
15. Expectations of subsidies in every activity of agriculture.

Box 1: Issues and challenges listed in the SWOT framework

<u>Strengths</u>
1. Agriculture became less risky and more profitable under CNF.
2. Improvement in the soil and local environmental quality
3. Reduction in the use of chemical inputs and irrigation water.
4. Improvement in the family health status and reduction in health care expenditure.
5. Reduction in the tensions of the farmers and their families.
6. Improvement in the social harmony in the village.
7. CNF farmers are getting premium prices for CNF food items
8. Availability of real-time support from RySS field staff.
9. Compared to "only CNF", "PMDS+CNF" proved to be more beneficial and effective.
10. Through CNF, the participants have overcome almost all problems associated with chemical-based farming, such as high cost of cultivation, low profitability, losses, vulnerable to weather anomalies, health issues related to the application of pesticides and consumption of chemical-based food, decline of soil quality, deterioration of local environment, etc.
11. Low cost of cultivation
12. Less dependence of credit or borrowings
13. Reduction in water need for irrigation. Soil is absorbing and retaining more water and crops are able to withstand prolonged dry spells.

⁴⁰ Majority of their concerns are common in both CNF and non-CNF farming

14. Crop diversity is occurring
15. Higher and stable farm income on the continues basis is being obtained.
16. Reduction in agrichemicals consumption by 20 to 40 percent
17. Market for Cow urine is developing.
18. CNF output are getting priority in the market yards/ places.
19. Credit worthiness improved
20. Came out of indebtedness
21. Selling CNF food items such as Paddy, pulses, vegetables, Groundnut, etc., locally at the premium prices.
22. Raising the Kitchen garden, obtaining additional income/ saving and getting quality food
23. Crop growing methods have changed ,mixed cropping bund crops.
24. The dreaded pest attacks are being controlled with local inexpensive ingredients/ solutions
25. Processing of paddy into rice and packing is fetching good price.
26. Reduction in sick days in the family and expenditure on health care. As a result, families are able to send their children to school for more days and admit them in the private/ quality schools.
27. Yields are improving gradually. Grain weight is increasing.
28. After CNF the Paddy yields have increased to 20-25 compared to 15-19 bags under non-CNF
29. Line sowing is being practiced in Paddy and Ragi.
30. Livestock number is increasing
31. Reduction in the cultivation costs and losses, has resulted in less tensions in the family.
32. Due to CNF cultivation, the linkage between agriculture and animal husbandry has become stronger.

Weakness

1. Lack of output marketing support.
2. No or inadequate NPM or input supply shops.
3. Inadequate awareness and extension services.
4. Non-availability of raw materials to prepare the biological inputs.
5. Tenant farmers are not interested in CNF.

6. Lack of model plots, for extension purposes in each village or GP, is another constraint in the expansion of CNF.
7. Preparation of own biological inputs is a big challenge, especially Kashayams and Asthrams.
8. As preparation of Kashayams and Asthrams needs some time, real-time application is a challenge.
9. Because of yield increase, and additional supply of vegetables, the prices are declining
10. Lack of seed banks
11. No minimum support prices for CNF products.
12. Not enough awareness about the benefits of CNF and CNF food items.
13. No support and subsidy to purchase the cows/ livestock and to build the cowsheds.
14. No identity cards were given to CNF farmers.
15. ICRP are not working as they are not paid salaries.

Opportunities

1. If CNF is expanded, it will result in larger improvement in the soil quality and environment.
2. CNF crops resistance to heavy rains is visible
3. Govt. Should procure CNF crop outputs through RRBs.
4. A few farmers have formed into a group and collectively processing and selling their agri.- products at the premium price. They are also marketing their products online.
5. Market for Cow urine is developing.
6. The villagers are getting some recognition to their CNF output. They are getting priority in the market yards/ places. But not getting the premium prices for their produce. They said the shelf life of CNF products is longer than that of non-CNF crop output.
7. The livestock has increased.
8. Use of water for irrigation has declined.
9. Local people are purchasing and consuming CNF food items.
10. Neighbourhood villagers, of CNF villages, are showing interest in CNF.
11. Apart from RySS, an NGO (like Jattu in Vizianagaram) is also promoting CNF.

Threats

1. Tenant farmers are not interested in CNF.
2. Partial farmers and use of both chemical and biological inputs in the same field.
3. Slow expansion of CNF
4. Expectation of higher prices for CNF products
5. Non-availability of readymade biological inputs
6. Affected and aggrieved agrichemical business
7. There are no changes in terms of lease for CNF practices. Tenant farmers prefer chemical farming.
8. The yields of Paddy and Sugarcane are marginally low. As a result, the returns are equal or marginally low under CNF.
9. CNF output needs premium prices.
10. Shortage of labour hampers the preparation of biological output.
11. NPM shops are required.
12. Expectations for subsidies – for drip irrigation, sinking of borewells, livestock purchase, cow-shed construction

Source: IDSAP Field Survey, 2020-21

9.4. TTFs and BTFs

For this analysis the CNF Paddy growing farmers ranked based on their average yield of Kharif and Rabi seasons.⁴¹ Top 10 percent farmers and bottom 10 percent farmers are made into two separate groups. A comparison of the average values of the top 10 per cent of CNF farmers (TTP) and the average values of the bottom 10 per cent of CNF farmers (BTP) enables us to assess the benefits to be achieved by the bottom 10 per cent CNF farmers and the constraints encountered there off.⁴² The average of each parameter of the top 10 per cent CNF farmers are compared with the average of the bottom 10 per cent CNF farmers to identify the constraints encountered by the bottom ten per cent of CNF farmers to reach the status of the top ten per cent of farmers.

⁴¹ This analysis is confined only to paddy in Kharif and Rabi seasons due to the availability of reasonable sample size. The other crops are not amenable for the planned analysis as they do not have adequate sample size.

⁴² The top 10 per cent farmers and the bottom ten per cent farmers are abbreviated as TTFs and BTFs respectively for brevity and for ensuring flow in reading.

The constraints encountered by farmers are in resource-use and adoption of CNF practices. This is because, the level and composition of resource-use and adoption of CNF practices influence the cost of production of crop on one hand and yield of the crop on the other. The constraints are also apparent in the realisation of remunerative prices by farmers for their crop outputs grown under CNF.

Land, labour, water (irrigation) and funds mobilised have been considered as resources in this analysis. Intensive use of crop land and labour especially family labour, use of less water for irrigation and mobilisation of funds for meeting the expenditure on agricultural operation from low-cost credit sources contribute to lower costs and higher returns of crops grown under CNF.

The expenditure on biological inputs under CNF and chemical inputs under non-CNF are commonly referred to as Plant Nutrients and Protection Inputs (PNPIs) in this study. Apart from expenditure on PNPIs, the survey has also collected the data on the costs of seeds, human labour, machine labour, bullock labour, implements, farmyard manure (FYM), and Irrigation. In almost all items, the values of purchased items and owned items are also collected. The values of all these purchased and own items used in the crop cultivation, together, are referred to as paid-out costs. The level of paid-out costs also represents the level of input use. The use of biological inputs and optimum use of other inputs reduce cost of production of crops under CNF.

The adoption of CNF practices leads to reduction in the cost of production of growing crops, compared to crops grown under non-CNF practices. Moreover, these practices are of labour-intensive type. Further, the biological inputs prepared have been based on the local low-cost raw materials. The adoption of these practices thus leads to cost reduction and revenue enhancement. Each additional adoption of CNF practice results in additional reduction in cost and thereby additional revenue enhancement. Hence, number of practices adopted by CNF farmer are considered for the analysis. Yield enhancement is achieved through the improvements in soil health/fertility due to the adoption of CNF practices.

The CNF farmers expect higher prices for their crop output compared to that of for non-CNF crop output. Thus, price realised for crop outputs by farmers has been considered for the analysis. The constraints are also in the realised yields, costs of production, and price realised

for unit of output by CNF farmers. Value of the crop and its by-products together determine the gross value of output. Yield and price realised by CNF farmer determine the gross value of output of crops grown under CNF. Gross value of output net of paid out costs of production provides the net value of output of the crop.

The comparison between the top 10 per cent CNF farmers and the bottom 10 per cent CNF farmers in this framework facilitates identification of constraints that have held back the bottom 10 per cent CNF farmers in reaching the top 10 per cent CNF farmers. In this context, this section addresses the following objectives:

- a. How did the level and composition of resource use, and adoption of CNF practices differ between the top 10 per cent CNF farmers and the bottom 10 per cent CNF farmers across crops grown? And how far they have contributed to the variations in cost of production and yields for the crops grown seasons between these two categories of farmers?
- b. How did realised price of crop outputs by farmers differ between these two categories of farmers?
- c. How did the gross and net value of output of crops differ between these two categories of farmers?
- d. What policy suggestions should be made to transform the bottom 10 per cent CNF farmers in to the top 10 per cent CNF farmers?

It may be noted that the TTF and BTF groups were derived from the Paddy yields⁴³ of all CNF cross section farmers. A comparison between the TTFs with the BTFs has revealed the following.

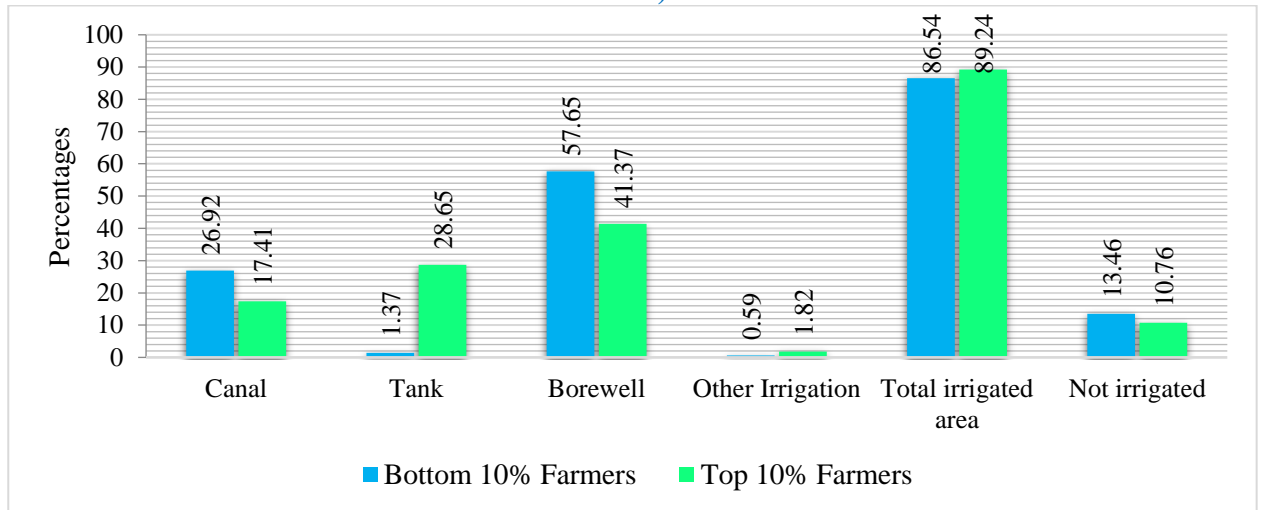
9.4.1. Profiles of TTFs and BTFs

The difference between TTFs and BTFs in irrigation is less than three percentage points. However, a higher percentage of BTFs have access to the high-quality irrigation; viz. Canal irrigation (9.51 percentage points) and Borewell irrigation (16.28 percentage points). On the other hand, a greater percentage of TTFs (27.28 percentage points) depended on tank irrigation (Figure 9.2 and table 9.3). This clearly shows that CNF does

⁴³ Weighted average of Kharif and Rabi; the area under the crop in each season being the weights.

not need assured or quality irrigation. It also implies that CNF needs relatively less water/ irrigation. But it should be kept in mind that the state has received very high rainfall, which may be beneficial to less assured irrigation regions/ fields and detrimental to assured irrigations regions and fields. This issue is elaborated a little more at the end of this section.

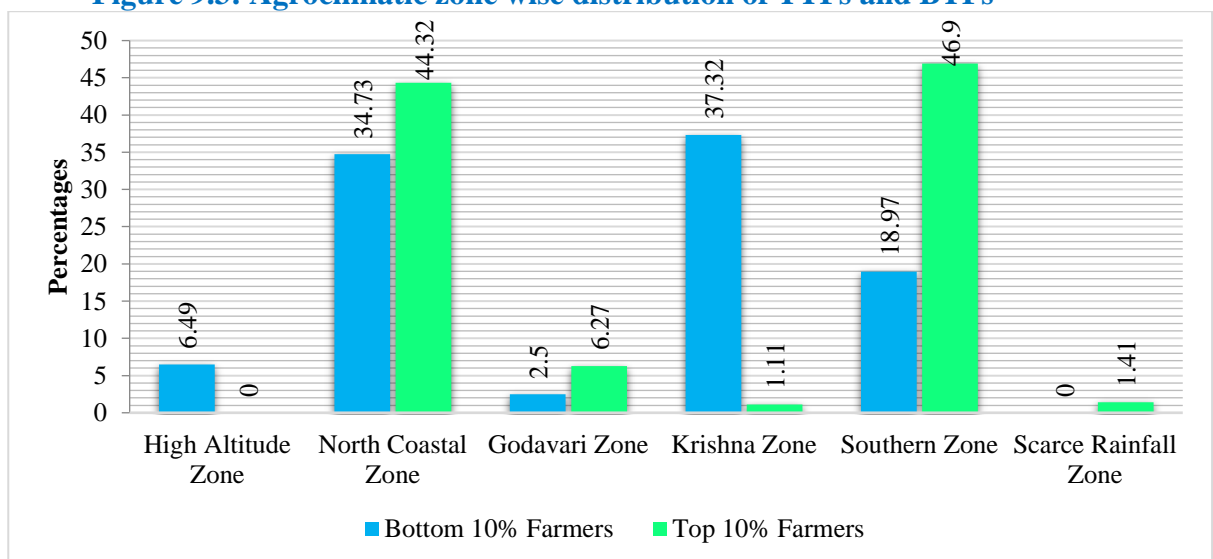
Figure 9.2: Irrigation source wise distribution of TTFs and BTFs (average of Kharif and Rabi 2020-21)



Source: IDSAP Field Survey, 2021.

This is due to the fact that a larger percentage of TTFs are located in highly rainfall dependent agroclimatic zones, North Coastal and Southern zones (Figure 9.3 and Table 9.4).

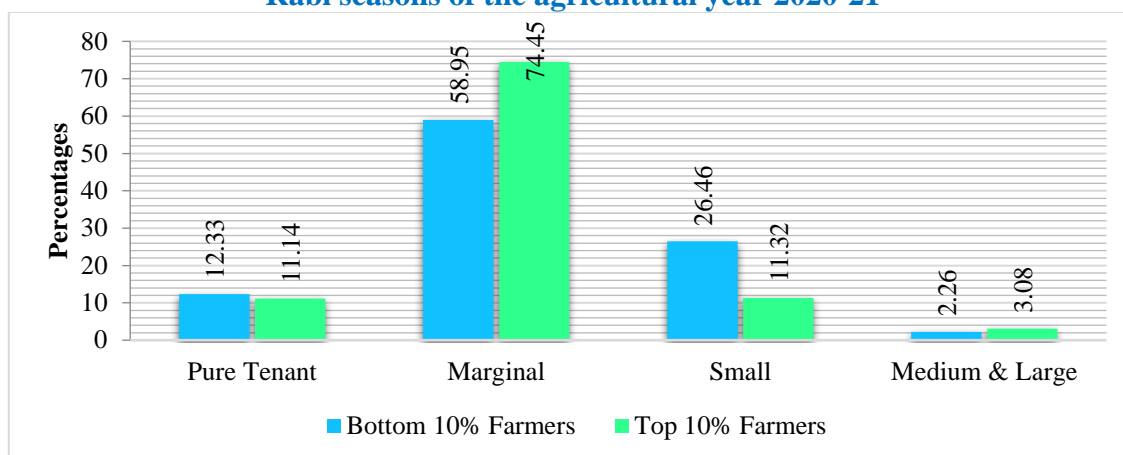
Figure 9.3: Agroclimatic zone wise distribution of TTFs and BTFs



Source: IDSAP Field Survey, 2021.

About three-fourths of TTFs are marginal farmers, which is over 15 percentage points higher than that of BTFs. At the same time over one fourth of BTFs are small farmers, which is over 15 percentage points higher than that of TTFs (Figure 9.4).

Figure 9.4: Distribution of TTFs and BTFs according to farm categories in Kharif and Rabi seasons of the agricultural year 2020-21

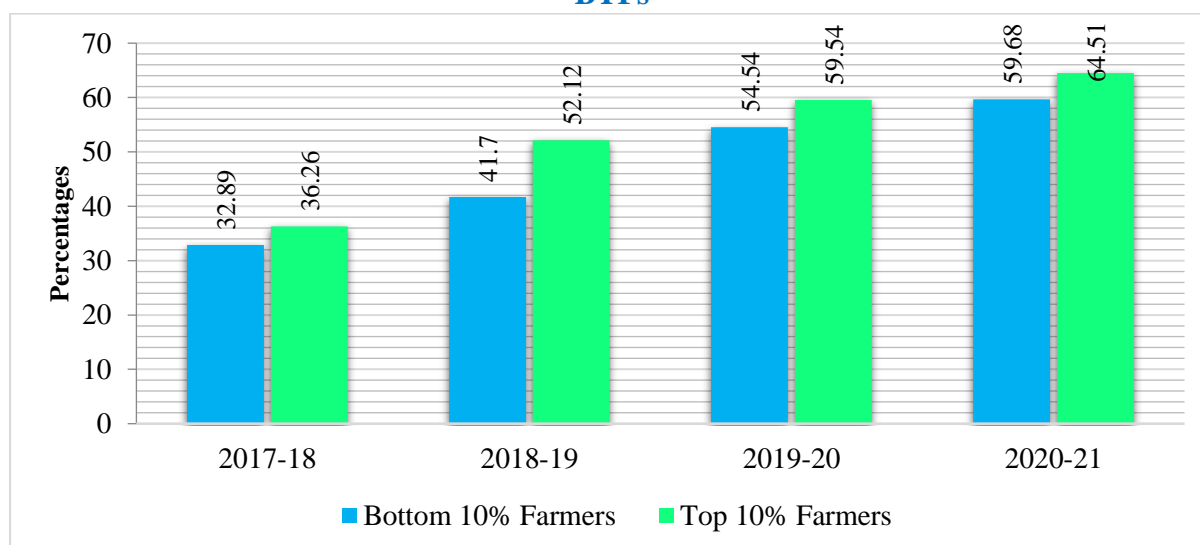


Source: IDSAP Field Survey, 2021.

9.4.2. Use of CNF inputs and practices by TTFs and BTFs

The TTFs, compared to BTFs, have brought in higher percentage of cultivated land under CNF in the agricultural year 2020-21 (average of both seasons). This is true for the agricultural years since 2017-18 (Figure 9.5 and Table 9.1)

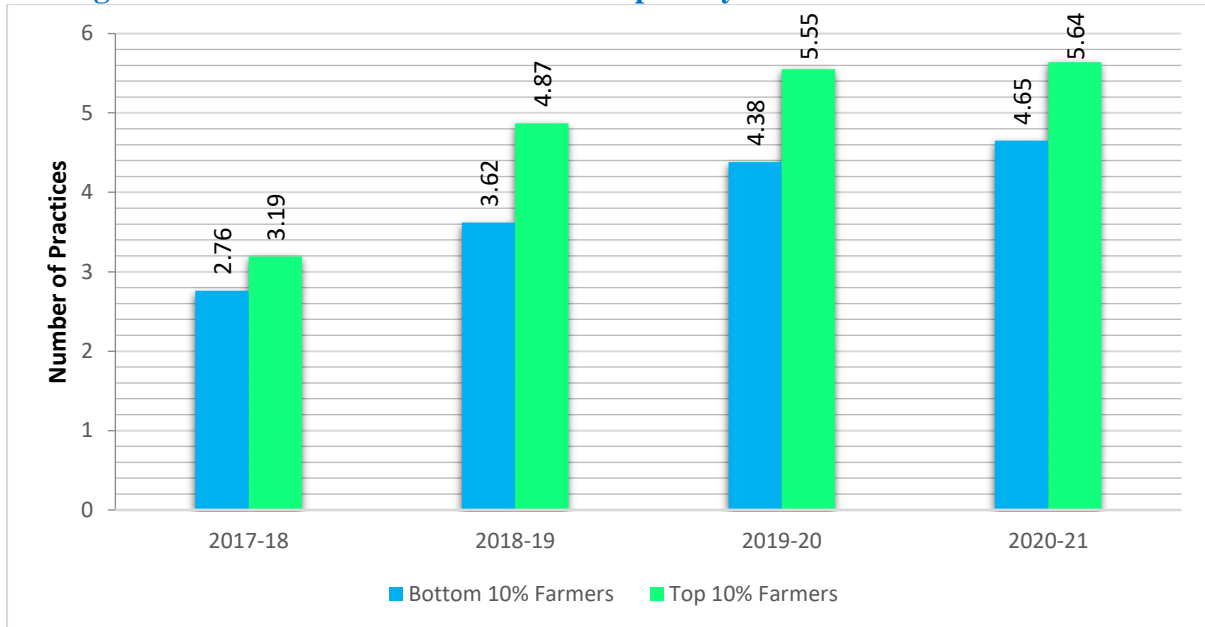
Figure 9.5: Percentage of area allocated to CNF during last four years by TTFs and BTFs



Source: IDSAP Field Survey, 2021.

The number of CNF practices has been on increase since the agricultural years 2017-18 for both the TTFs and BTFs. However, TTFs are consistently adopting a greater number of CNF practices since 2017-18 (Figure 9.6).

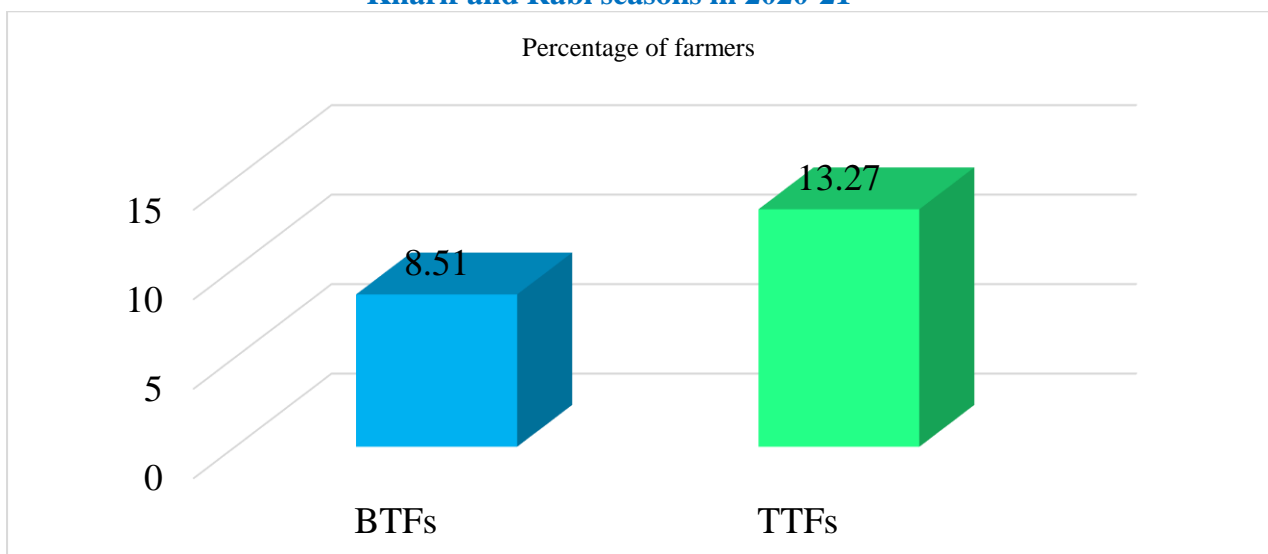
Figure 9.6: Number of CNF Practices adopted by TTFs and BTFs since 2017-18



Source: IDSAP Field Survey, 2021.

Moreover, the percentage of farmers who have mixed crops is higher for the TTFs over BTFs (Figure 9.7).

Figure 9.7: Percentage of TTFs and BTFs cultivating the mixed crops (average of Kharif and Rabi seasons in 2020-21)

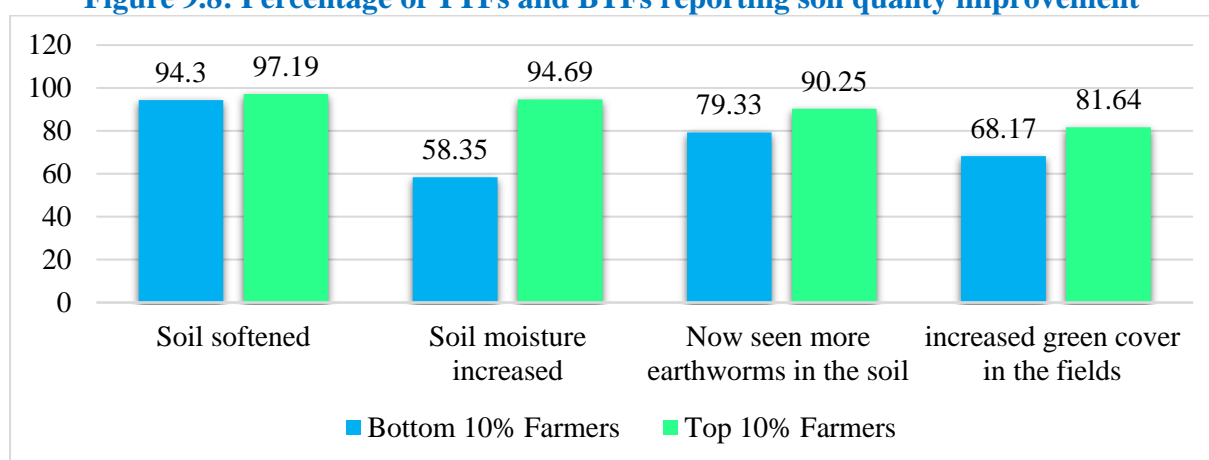


Source: IDSAP Field Survey, 2021.

These two may contribute to the lower costs of production and higher yield of paddy for the TTFs compared to BTFs. The higher level of adoption of CNF practices coupled with larger percentage of farmers adopting mixed cropping among the TTFs over BTFs contributed towards the improvements in soil health.

Softening of soil, increased soil moisture, visibility of more earthworms in soils, increased cover in the fields; and increased grain weight, stronger stems, more resistant to dry spells, withstanding capacity against heavy rain and strong winds have been reported in higher percentage by TTFs over BTFs (Figure 9.8).

Figure 9.8: Percentage of TTFs and BTFs reporting soil quality improvement



Source: IDSAP Field Survey, 2021

Thus, it is evident from these responses of the TTFs and BTFs that the adoption of CNF practices has contributed to the improvement in soil health among TTFs. This in turn might have contributed to increase crop quality (Figure 9.9) and yield of paddy crop.

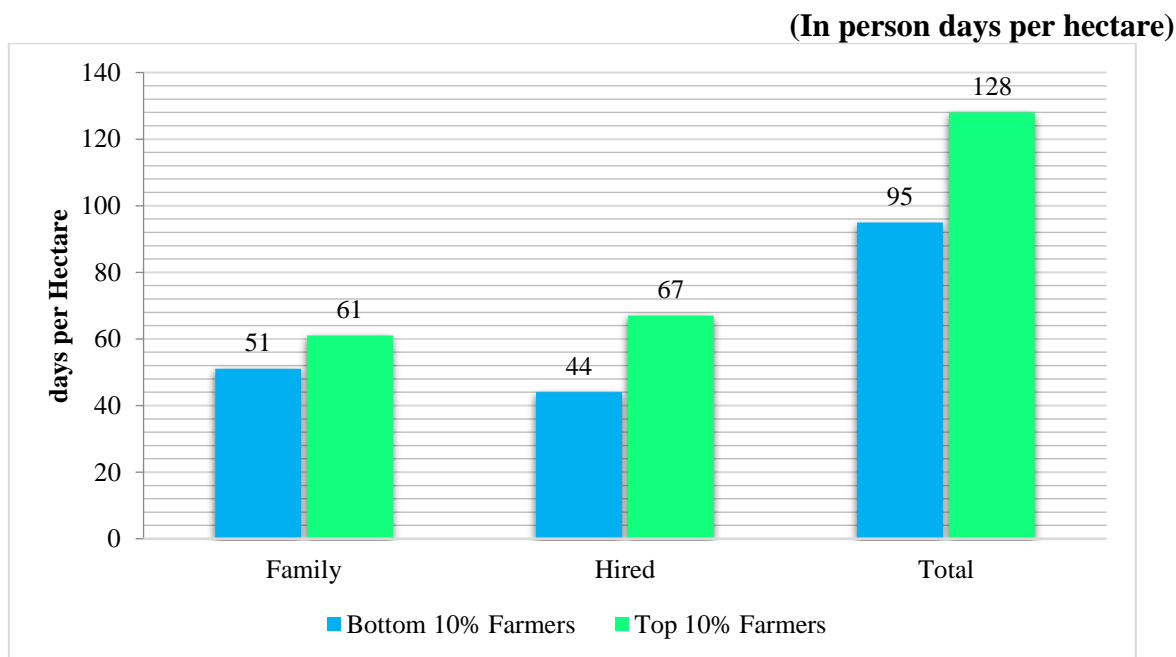
Figure 9.9: Percentage of TTFs and BTFs reporting improvement in crop quality



Source: IDSAP Field Survey, 2021.

Compared to BTFs, the TTFs used 33 days additional person days per hectare in the cultivation Paddy (average of Paddy and Rabi). This include 10 own person days and 23 hired person days (Figure 9.10). This may result in higher cost of cultivation.

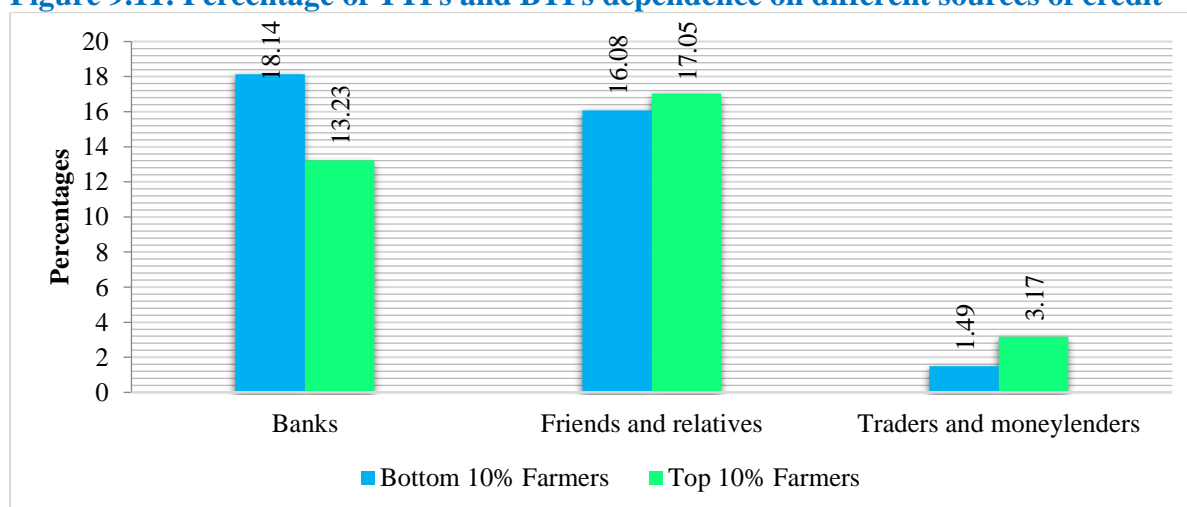
Figure 9.10: Labour use for Paddy Crop in the agricultural year 2020-21 for the Top ten percent and the Bottom ten percent farmers



Source: IDSAP Field Survey, 2021.

TTFs, compared to BTFs, have depended more on traders and money lenders for borrowings to meet the working capital requirements and family needs (Figure 9.11). This may result in higher cost of production for TTFs over BTF.

Figure 9.11: Percentage of TTFs and BTFs dependence on different sources of credit



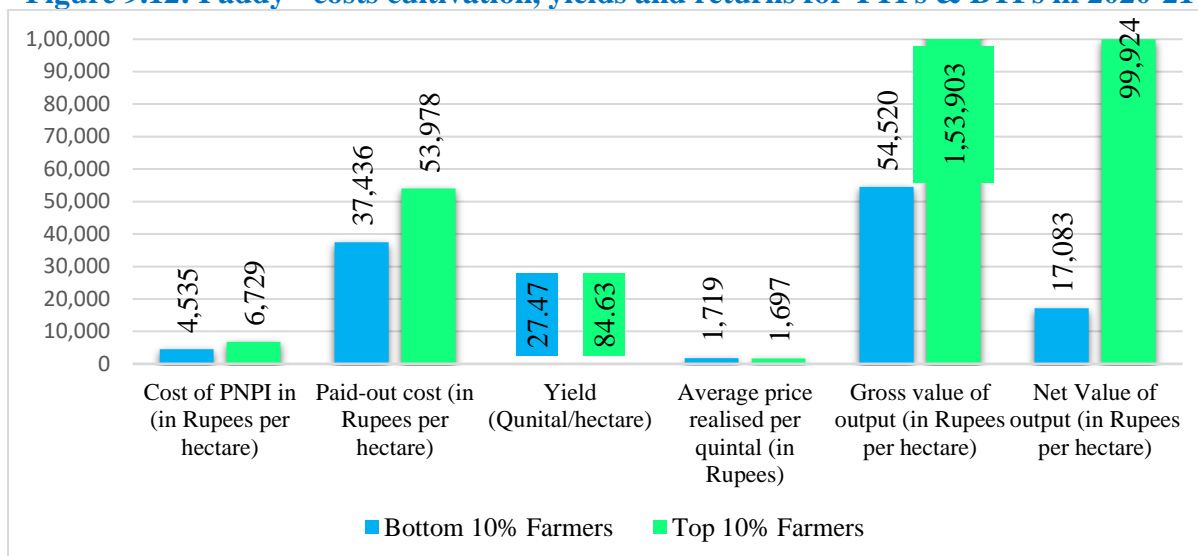
Source: IDSAP Field Survey, 2021.

9.4.3. Costs of cultivation, yields and returns from Paddy cultivations

Thus, TTFs compared BTFs, have used a greater percentage of land under CNF in the land cultivated, and more of labour, relatively lower flood irrigation and high-cost source of credit in both the seasons. The pattern of resource use of TTFs show higher cost of production but may have optimally used the inputs to fetch higher yield of paddy crop. BTFs have lower cost per hectare but may have used below the required level of inputs and hence had lower yields. This points to the need for extension services for CNF that gives advice to the farmers about the required levels of input application for obtaining maximum yields. This also means that the extension authorities should systematically collate information and instructions for best possible results from the best farmers and other demonstration plots and disseminate this information. It is also important to popularise natural varieties of rice which are flood resistant and drought resistant and multiply the seeds and distribute them, especially to wean away the farmers of the irrigated regions such as Godavari and Krishna Zones away from chemical farming.

The above analysis has brought out clearly that the pattern of utilisation of resources, and adoption of CNF practices do influence yield of paddy crop but may have increased the cost of cultivation. This calls for the analysis of costs and returns of paddy crop between TTFs and BTFs. The use of biological inputs is higher for the TTFs over BTFs. This is evident from the expenditure on PNPIs between TTFs and BTF. This is obviously related to the number of CNF practices adopted as the number of practices adopted is higher for the TTFs over BTFs, as noted earlier. Similarly, the paid-out costs are higher for the TTFs over the BTF. The higher level of input use resulted in higher yield of Paddy crop for TTFs over BTFs. This crop output per hectare of paddy resulted in higher gross value of output for TTFs over BTFs. Despite relatively higher paid out costs per hectare, the TTFs have experienced higher net value of output compared to BTFs due to their higher yield of paddy crop. The yield of the crop, rather than price of output, contributed to higher gross and net value of crop output for TTFs (Figure 9.12).

Figure 9.12: Paddy - costs cultivation, yields and returns for TTFs & BTFs in 2020-21

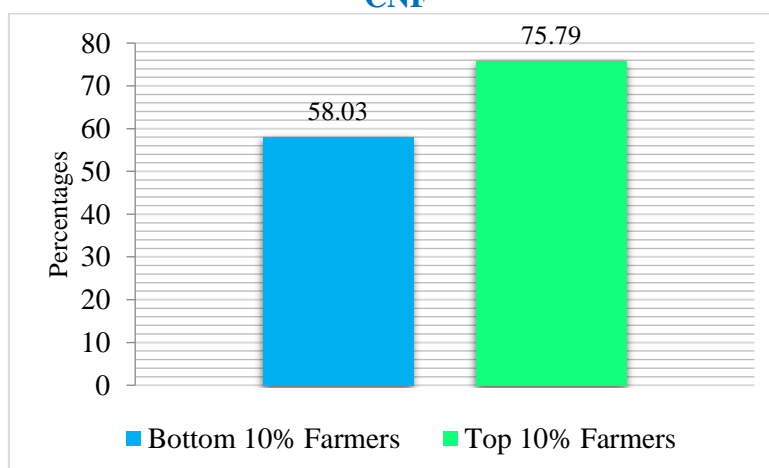


Source: IDSAP Field Survey, 2020-21.

9.4.4. Issues and challenges faced by TTFs and BTFs

The analysis has revealed that higher percentage of TTFs has experienced problems compared to BTFs, in adopting CNF practices and obtaining higher prices (Figure 9.13).

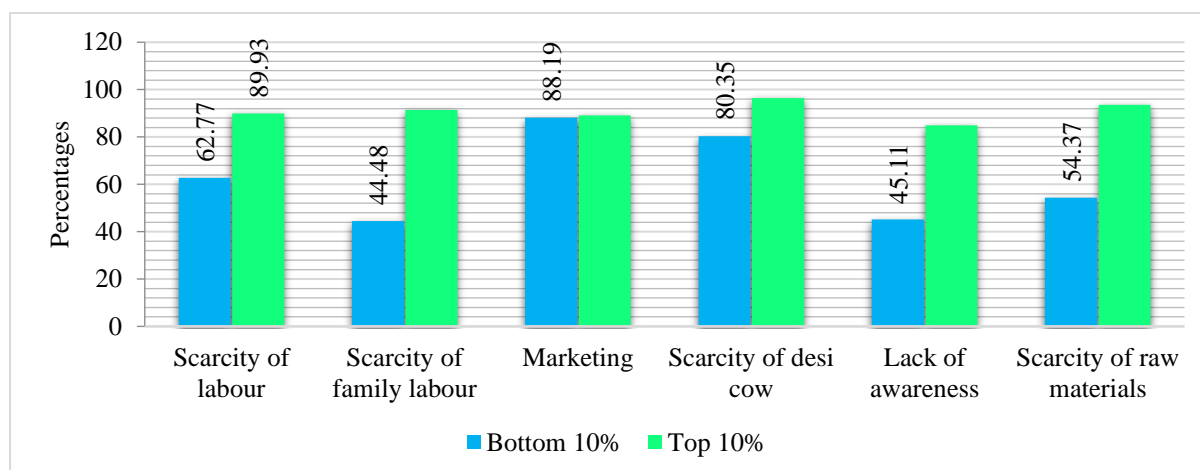
Figure 9.13: Percentage of TTFs and BTFs reported any problem in the adoption of CNF



Source: IDSAP Field Survey, 2020-21.

The TTFs who have experienced problems in majority, compared to BTFs, have reported that they encountered the problems of scarcity of labour, scarcity of family labour, marketing of output, scarcity of livestock and lack of awareness about the adoption of practices and scarcity of raw material in preparing CNF inputs (Figure 9.14).

Figure 9.14: TTFs and BTFs responses to different problems in the adoption of CNF
(In Percentages)



Source: IDSAP Field Survey, 2021.

Had these problems not been encountered, the TTFs might have obtained much higher yields, higher gross and net value of output compared to the present achievement. Moreover, the BTFs also might have achieved relatively higher benefits of CNF compared to the present scenario of achievements of CNF benefits, had they not experienced the same problems.

9.4.5. Inferences from TTFs and BTFs analysis

The Paddy yields of 84.63 quintals per hectare achieved by TTFs is equal to the best in world. At the same time the yield levels of 27.47 obtained by the BTFs needs an additional explanation. Firstly, the regional spread of BTFs is one reason. Relatively a higher percentage of BTFs are located in HAT zone, which is traditionally a low yields region and Krishna zone. On the other hand, relatively a greater percentage of TTFs are located in North-coastal, Godavari and Southern zone. Secondly in 2020-21, the state received heavy rains. The rains have adversely affected the Paddy crop especially in the Delta regions. These two reasons, at least partially, explain the low yields obtained by the BTFs. Apart from these two reasons, under investment by the BTFs is another reason for their low yields. *Yet another, perhaps more important, factor could be the promotion of a standard and uniform package of farming practices across all agroclimatic zones, districts and sub-districts, which have large variations in terms of soil type, rainfall, environmental and cultural factors, human resource development, agriculture infrastructure, etc. The analysis indicates, as CNF matures and expands, the problems of output marketing, availability biological inputs, shortage of labour own labour, raw material to prepare the inputs, extension services, etc., and knowledge gap would amplify.*

9.5. Suggestions

From the above three streams of analyses, the following major problems have been identified. Some suggestions are provided to each of the identified issues and challenges.

1. Slow progress of the program
2. Marketing
3. Productivity enhancement
4. Institutional issues

9.5.1. *Slow progress of the program*

This is an aggregation of many issues such as inadequate extension services, inadequate supply of the biological inputs, knowledge gap for the CNF farmers, marketing,⁴⁴ shortage of livestock, raw material shortage, etc. It is perplexing, while the benefits of CNF are clearly visible, still very small number of farmers, say less than 5% farmers, are adopting the CNF in many villages. Perhaps the expectation of subsidies in each and every activity may be one of the reasons.⁴⁵ The following suggestions are made to overcome most of, if not all, above mentioned problems.

1. Massive publicity should be given to the CNF using all kinds of publicity channels ranging from TV to wall writings. Booklets and pamphlets about the benefits, success stories, self-learning, etc., may be printed in a large number and distributed frequently. Once the farmers are convinced of the benefits of CNF, they themselves will resolve many of the issues and challenges.
2. At the moment RySS is directly contacting individual or groups of farmers and involving them in the program. Along with this strategy, RySS may think of involving institutions, who can implement, expand, replicate and own the programs. The possible institutions are Sarpanches, NGOs, who have independent agenda and resources, like Rural Development Trust (RDT) in Anantapuramu, and CSR institutions. At the moment, there are about 30 thousand Sarpanches, overwhelming majority of them are

⁴⁴If there is good market for CNF output, the farmers, on their own, adopt the CNF and overcome all the challenges.

⁴⁵ In one FGD, the farmers asked for the free supply of drums, which cost about Rs.500 to Rs.1,000, to prepare biological inputs

women and from SC and ST communities. The Sarpanches have real and larger stakes in the development of their villages and welfare of their people.

3. At least these institutions may be involved and facilitated to develop, manage and own the model plots, for demonstration and repositories of knowledge products.
4. The issues of landless tenant farmers need to be resolved. Awareness generation is of one of the important solutions.
5. Further, as per the available evidence, CNF, including PMDS, consisting of leguminous crops, captures the nitrogen from the atmosphere and fixes in the soil. As the green cover over soils is being maintained throughout the year, it captures the carbon-dioxide from the atmosphere, through prolonged photosynthesis, and stores in the soil. There are anecdotal evidences about the elevated carbon levels in the CNF fields. RySS may get confirmed this; and facilitate the Carbon Credits to the CNF farmers.

9.5.2. Marketing

Though marketing is a serious problem for non-CNF farming also, CNF farmers are expecting some premium prices for their output. Further, some villages are, already, experiencing a slump in the prices⁴⁶ of CNF food items, especially, in the perishable items, because of the glut in the local markets.⁴⁷ *The farmers, themselves, have suggested and demanded, in the FGDs, the following:*

1. The Government should announce the minimum support prices (MSPs) for CNF crops.
2. The Government should procure the CNF food items instead of non-CNF food items.
3. A dedicated place should be allocated to CNF crops in all marketing places such as Rythu Bazars, Market Yards, Shandies, Exhibitions, etc.
4. CNF farmers should be given identity cards
5. Apart from above, RySS may think of introducing the forest species or promotion of agro-forestry, to save the CNF farmers from the wider fluctuations in seasonal and horticulture crops' production and prices.

⁴⁶ Kosuru Appala Raju, Visakhapatnam case study stated this example

⁴⁷ In economics, this phenomenon is known as the fallacy of composition. Many an economics textbook speaks of the farmer who is better off because he has a bumper crop but may not be better off if every farmer has one.

9.5.3. Productivity enhancement

1. Past two-three years survey results show that the yields of CNF crops were higher than that of non-CNF in most of the crops; but it is less than non-CNF crops in one or two crops, in each year.
2. This year data clearly indicates that the PMDS is an effective tool in enhancing the crop yields and resistance to weather anomalies.
3. Further, RySS may develop and propagate the region, irrigation status and crop specific packages of farm practices.

9.5.4. Institutional issues

A couple of issues observed in the field and obtained in the FGDs are:

1. While RySS is promoting CNF zealously, its parent organization the Agriculture Department, is promoting the non-CNF with same level of zeal.⁴⁸
2. While Community Resource Persons (CRPs) were appointed from the poorer communities, the well-off farmers were appointed as the internal community resources persons (ICRPs) in many places. Instead of supporting the CRPs, some of these ICRPs are commanding the CRPs.
3. There are issues of staff strength and their postings in their villages.

⁴⁸ Rythu Bharosa Kendra are given steep targets to distribute agrochemicals.

Tables of Chapter 9

Table 9.1: Cultivated area under CNF in the total cultivated area in different agricultural years for the Top ten percent and Bottom ten percent farmers.

(In Percentages)

S. No	Agricultural Year	Bottom 10% Farmers	Top 10% Farmers
1	2017-18	32.89	36.26
2	2018-19	41.70	52.12
3	2019-20	54.54	59.54
4	2020-21	59.68	64.51

Source: IDSAP Field Survey 2020-21

Table 9.2: Labour use for Paddy crop in the agricultural year 2020-21 for the TTFs & BTFs

(In man days per hectare)

S. No	Description of Labour	Bottom 10% Farmers	Top 10% Farmers
1	Family	51	61
2	Hired	44	67
3	Total	95	128

Source: IDSAP Field Survey, 2021.

Table 9.3: Distribution of farmers according to the source of irrigation in Kharif and Rabi seasons in the agricultural year 2020-21 for the TTFs BTFs

(In Percentages)

S. No	Source	Bottom 10% Farmers	Top 10% Farmers
1	Canal	26.92	17.41
2	Tank	1.37	28.65
3	Borewell	57.65	41.37
4	Other Irrigation	0.59	1.82
5	Total irrigated area	86.54	89.24
6	Not irrigated	13.46	10.76

Source: IDSAP Field Survey, 2021.

Table 9.4: Distribution of farmers according to different agroclimatic zones in the agricultural year 2020-21

(In Percentages)

S. No	Description of Zone	Bottom 10% Farmers	Top 10% Farmers
		1	High Altitude Zone
2	North Coastal Zone	34.73	44.32
3	Godavari Zone	2.50	6.27
4	Krishna Zone	37.32	1.11
5	Southern Zone	18.97	46.90
6	Scarce Rainfall Zone	0.00	1.41

Source: IDSAP field Survey 2021.

Table 9.5: Farmer borrowings according to sources in the agricultural year 2021-21

(In Percentages)

Source of Borrowings	Bottom 10% Farmers	Top 10% Farmers
Banks	18.14	13.23
Friends and relatives	16.08	17.05
Traders and moneylenders	1.49	3.17

Source: IDSAP field Survey 2021.

Table 9.6: Number of CNF Practices adopted by framers in different agricultural Years for the Top ten percent and the Bottom ten percent farmers

(In Percentages)

S. No	Agricultural Year	Bottom 10% Farmers	Top 10% Farmers
1	2017-18	2.76	3.19
2	2018-19	3.62	4.87
3	2019-20	4.38	5.55
4	2020-21	4.65	5.64

Source: IDSAP Field Survey, 2021.

Table 9.7: Area under Cultivation and farmers growing mixed crops during the agricultural year 2020-21 for the top ten percent and the bottom ten percent farmers

(In percentages)

S.No	Description	Bottom 10% Farmers	Top 10% Farmers
1	No. of Observations	113	100
2	Area under cultivation per farmer (in Hectare)	0.40	0.34
3	Farmer growing mixed Crop(in percentage)	8.51	13.27

Source: IDSAP Field Survey, 2021.

Table 9.8: Percentage of farmers reporting impact of CNF on Soil and crop quality in the agricultural year 2020-21 for the Top ten percent and the Bottom Ten percent. (In percentage)

S. No	Description of Indicators	Bottom 10% Farmers	Top 10% Farmers	
1	Indicators of soil quality	Soil softened	94.30	97.19
		Soil moisture increased	58.35	94.69
		Now seen more earthworms in the soil	79.33	90.25
		increased green cover in the fields	68.17	81.64
2	Indicators of crop quality	Grain weights increased	94.67	94.17
		Stronger stems	79.48	96.41
		More resistant to dry spells	69.38	82.20
		Withstand heavy rain	52.55	83.76
		Withstand strong winds		

Source: IDSAP Field Survey, 2021.

Table 9.9: Costs and returns of Paddy Crop in the agricultural year 2020-21 for the Top ten percent and Bottom ten percent farmers

S. No	Description	Bottom 10% Farmers	Top 10% Farmers
1	Cost of PNPI in (in Rupees per hectare)	4,535	6,729
2	Paid-out cost (in Rupees per hectare)	37,436	53,978
3	Yield (Quintal/hectare)	27.47	84.63
4	Average price realised per quintal (in Rupees)	1,719	1,697
5	Gross value of output (in Rupees per hectare)	54,520	1,53,903
6	Net Value of output (in Rupees per hectare)	17,083	99,924

*Here PNPI refers to biological inputs of natural farming.

Source: IDSAP Field Survey, 2021.

Table 9.10: Problems encountered by the Framers in adopting CNF practices and in obtaining benefits from CNF in Kharif and Rabi seasons of 2020-21

In Percentages

S. No	Description of Indicators	Bottom 10% Farmers	Top 10% Farmers
1	Households facing problems in adopting CNF Practices and obtaining benefits from CNF	94.30	97.19

Source: IDSAP Field Survey, 2021.

Table 9.11: Types of problems encountered by farmers in adopting CNF practices and in obtaining benefits on CNF in the agricultural year 2020-21

(In Percentages)

S. No	Description of Indicators	Bottom 10% Farmers	Top 10% Farmers
1	Scarcity of labour	62.77	89.93
2	Scarcity of family labour	44.48	91.37
3	Marketing	88.19	89.08
4	Scarcity of desi cow	80.35	96.33
5	Lack of awareness	45.11	84.94
6	Scarcity of raw materials	54.37	93.55

Source: IDSAP Field Survey, 2021.

Table 9.12: Distribution of farmers according to category in Kharif and Rabi seasons of the agricultural year 2020-21

(In Percentages)

S. No	Category of Farmers	Bottom 10% Farmers	Top 10% Farmers
1	Pure Tenant	12.33	11.14
2	Marginal	58.95	74.45
3	Small	26.46	11.32
4	Medium & Large	2.26	3.08

Source: IDSAP field Survey, 2021

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