



IMPACT ASSESSMENT OF APCNF

(ANDHRA PRADESH COMMUNITY MANAGED NATURAL FARMING)

Consolidated-2019-20 Report



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Acronyms

AHH	:	Agriculture Household
AP	:	Andhra Pradesh
APCNF	:	Andhra Pradesh Community Managed Natural Farming
AWC	:	Anganwadi Centre
CA	:	Cluster Assistant
CCE	:	Crop Cutting Experiment
CRP	:	Community Resource Person
CS	:	Case Study
CSPro	:	Census and Survey Processing System
DES	:	Directorate of Economics and Statistics
DPM	:	District Project Manager
FDG	:	Focussed Group Discussion
FPO	:	Farmer Producers Organization
GCA	:	Gross Cropped Area
GCC	:	Girijan Co-operative Corporation
HH	:	Household
IASRI	:	Indian Agricultural Statistical Research Institute
ICRP	:	Internal Community Resource Person
ICT	:	Information and Communication Technology
NGO	:	Non-Government Organization
NPN	:	Non-Pesticide Management
NSA	:	Net Sown Area
NSSO	:	National Sample Survey Organization
PDS	:	Public Distribution System
PNPIs	:	Plant Nutrients and Protection Inputs
RySS	:	Rythu Sadhikara Samastha
S2S	:	Seed to Seed
SDES	:	State Directorate of Economics and Statistics
SHG	:	Self Help Group
SI	:	Strategic Interview

Executive Summary

1. The mandate of the present study is to assess the impact of Andhra Pradesh Community Managed Natural Farming (APCNF) implemented by Rythu Sadhikara Samstha (RySS), a not-for-profit company of Government of Andhra Pradesh. It also provides insights for mid-course corrections and make available facts and figures for the advocacy.
2. Objectives of the study are:
 - a. To assess and measure the changes in expenditure on plant nutrients and protection inputs (PNPI), total cost of cultivation and gross and net returns from crop cultivation due to APCNF; and impact of these changes;
 - b. To estimate the changes in the crop yields due to APCNF;
 - c. To analyse the experience of the APCNF panel farmers;
 - d. To estimate the project level benefits realized by the participating farmers;
 - e. To estimate income and employment benefits, if the entire gross cropped area were put under APCNF and cropping intensity were raised to 200 per cent;
 - f. To estimate the changes in farmer households' incomes due to APCNF and compare with incomes of Non-APCNF farmers' incomes;
 - g. To learn the impact of the APCNF on soil quality and to know the qualitative changes in the crop output due to APCNF;
 - h. To understand the farmer's experience and perceptions about APCNF in terms of outlook towards farming and environmental and health benefits; and
 - i. To provide insights for mid-course corrections/improvements and recommendations for the policy changes.
3. The evaluation methodology adopted was "with and without" approach wherein the outcomes of a random sample of APCNF farmers cultivating a set of selected crops are compared with the outcomes of a random sample of farmers cultivating the same set of crops using chemical inputs.
4. Thirteen crops were covered in the kharif survey. But adequate sample was obtained for nine crops, viz. (1) Paddy, (2) Maize, (3) Bengal gram, (4) Groundnut, (5) Cotton, (6) Jowar, (7) Chillies, (8) Red gram, and (9) Sugarcane. In Kharif report, these crops were used for crop-wise detailed analysis and in the informed estimates with respect to potential state level benefits in terms of income and employment.

5. Similarly, 11 crops were covered during Rabi. But adequate sample was obtained for six crops, viz., (1) Paddy, (2) Maize, (3) Groundnut, (4) Sesamum, (5) Black Gram, and (6) Onion. These crops were covered in the crop wise detailed analysis in the Rabi report.
6. Crop wise analysis in the consolidated report used all crops covered in the Kharif and Rabi surveys, irrespective of their sample size. However, crops with adequate sample size are used in macro estimates and guestimates in chapters 5 and 6.
7. Sample villages were selected randomly from the list of project villages provided by the RySS. After conducting the household listing in the sample village, the Kharif sample households were drawn randomly. The Rabi sample has been drawn from the Kharif sample farmers, who were cultivating in the Rabi season. Control villages were selected from villages close to sample project village. Same process was followed for selection of sample households.
8. In total, household data was collected from 1,422 APCNF farmers and 628 non-APCNF farmers, during Kharif season. Similarly, data was collected from 902 APCNF farmers and 601 non-APCNF farmers during Rabi season. The APCNF sample also includes the panel and best farmers. Further, 99 Focused Group Discussions (FGDs) and 13 Strategic Interviews (SIs) with 13 District Project Managers (DPMs) were conducted.
9. Crop Cutting Experiments (CCEs) were conducted in both APCNF and Non-APCNF villages to get independent and precise estimates of crop yields. Total 1,762 CCEs were conducted; including 1,231 APCNF crops and 531 control crops in Kharif 2020. Due to Covid 19 related restrictions, CCEs could not be completed as per the plan during the Rabi. Total 433 CCEs were conducted including 299 for 11 APCNF crops and 134 for control 11 crops. For six select crops analysed in the Rabi report, 263 APCNF and 101 non-APCNF CCEs were used.
10. In the report unless stated otherwise, the yields obtained through CCEs were used in all tables and calculations such as gross and net returns.
11. Total seven research tools, viz. (1) Household listing schedules, (2) Village schedule (3) Questionnaire for APCNF HHs, (4) Questionnaire for Non-APCNF HHs, (5) Checklist of FDGs, (6) Checklist for Case Studies, and (7) Checklist for Strategic Interviews were used in the field work.
12. A mobile-based app was developed to collect CCE data.
13. One of the limitations of the study is CCEs could not be completed as per the plan due to Covid 19 related restrictions. To understand the severity of this limitation, the crop-wise yields obtained through CCEs and reported yields were compared in the Rabi report.

The variations observed in the CCEs yield and reported yields have same sign in five out of six crops; the only exception is Onion. It implies that despite smaller CCEs, the data gives a reasonably a good picture of the ground reality.

Profile of sample Households

14. The presence of SC, ST and women farmers is higher among APCNF sample than that in the control sample. Higher proportion of literates and educated farmers among the APCNF sample indicates that APCNF is gaining popularity among the educated or informed farmers.
15. The small and marginal farmers have allocated larger parts of their holdings to APCNF vis-à-vis other farmers. APCNF, being a low cost of cultivation model, is gaining acceptance among the poor. *APCNF proved to be the pro-poor orientated programme.*

Impact of APCNF on Farming conditions

16. The difference between APCNF and non-APCNF on important indicators are presented at Table 0.1. The expenditure on biological inputs under APCNF and chemical inputs under non-APCNF together are referred as the expenditure on Plant Nutrients and Protection Inputs (PNPIs) for comparative analysis. Broad trends from the data indicate that the scope for savings cost of cultivation is high in resource intensive crops such as Cotton, Chillies, Onion, Paddy, etc. Though the percentage of change in the expenditure on PNPI appears to be high, the expenditure on PNPI in absolute term is quite small for less resource intensive crops such as Sesamum and Ragi. On the other hand, the scope for increasing the yields in less resource intensive crops are high. Out of 24 crops and seasons wise cases presented in the Table 0.1, the net returns are positive for 21 crops. In some resource intensive crops like Cotton, the savings in the agri-chemicals alone make the net revenue positive even with marginal decline in yields and no difference in prices.

Table 0.1: Changes in select indicators due to APCNF during 2019-20

Crop	Season	Difference between APCNF and non-APCNF in: (Percentages)				
		Expenditure on PNPIs	Paid-out costs	Yields	Gross revenue	Net revenue
Paddy	Kharif	-64.86	-19.22	5.85	13.14	65.73
	Rabi	-40.31	-15.48	-7.02	2.05	14.60
Maize	Kharif	-56.72	-18.47	-4.73	-10.97	-5.26
	Rabi	-70.25	-17.41	8.94	4.39	21.31
Jowar	Kharif	-14.08	-1.89	10.42	11.28	23.51
	Rabi	-26.85	-18.78	1.88	-2.51	73.62
Ragi	Kharif	18.80	-41.93	23.26	18.08	49.36

	Rabi	-13.33	-13.04	-3.62	-11.23	-9.72
Bengal gram	Kharif	-62.39	-33.45	1.69	13.73	181.90
	Rabi	-55.54	-27.45	-9.47	-6.52	116.07
Black gram	Kharif	-48.08	-20.51	23.21	25.21	67.08
	Rabi	-3.54	21.12	2.45	2.43	-1.92
Red gram	Kharif	-58.83	-33.30	6.20	19.64	361.43
Green gram	Rabi	-10.31	29.17	14.62	31.15	31.52
Groundnut	Kharif	-12.59	-9.08	0.94	5.53	23.81
	Rabi	-53.32	-16.19	4.76	6.33	21.67
Sesamum	Rabi	91.02	23.68	32.78	28.44	32.57
Chillies	Kharif	-89.87	-25.77	8.98	11.77	39.58
	Rabi	-59.79	-28.87	-7.84	13.74	22.45
Onion	Kharif	-74.40	-39.07	9.36	24.67	43.06
	Rabi	-78.28	-42.41	-12.35	-18.54	13.27
Cotton	Kharif	-74.63	-35.97	-2.93	-3.11	165.65
Sugarcane	Kharif	-43.26	-3.32	-1.12	8.33	18.81
Turmeric	Kharif	-67.72	-31.27	9.70	10.26	26.20

Sources: IDSAP Field Survey, 2019-20

17. The farmers were able to save substantial amounts on plant nutrients and plant protection without any significant loss in the output of almost all crops. Another important benefit of APCNF is that it has resulted in a significant reduction in farmers' exposure to the input market. As the chemical inputs form the major component in the non-APCNF farming, the farmers' major worry always is timely procurement and application of agri-chemical inputs. To procure those inputs, the farmers often enter into credit agreements with the input suppliers with unfair terms or borrow money with exploitative terms and conditions. The scenario has been changing.

Experiences of panel farmers

18. IDSAP has conducted the panel study to assess the changes over the time due to APCNF. For this purpose, 260 sample farmers from 20 villages in all the districts at the rate of 20 households from two villages from each of the 13 districts were identified as the panel farmers and survey in 2018-19. The same farmers were re-surveyed during 2019-20 study.

19. The panel farmers have cultivated four common crops, viz., Paddy, groundnut, Bengal gram and Red gram during these two study years.

20. As this analysis is confined to APCNF farmers' experience in two years, one cannot expect a spectacular variation in the costs, yields and prices. One obvious expectation is an increase in the yields. As expected, and hoped, the yields of all four crops have increased. A couple of them have registered impressive growth rates of 25 per cent and 43 per cent. Improvement in gross and net returns in 2019-20 over previous year is very

good sign. It implies that the program is not only sustainable but is also improving over the time.

21. Compared to 2018-19, relatively higher percentage of farmers in 2019-20 indicated that APCNF grains are heavier, crop is more resistances to variances in the weather, yields are higher and the cost of cultivation is lower.
22. A significant decline in farmers' dependence on institutional and informal credit sources, in 2019-20 indicates that APCNF has freed the participating farmers from exploitations of the credit and input markets.
23. While the major problems of marketing and shortage of Desi cow become more severe in 2019-20, the panel farmers appeared to be overcoming and managing other problems such as knowhow to prepare the biological inputs, transplantation, nursery raising, procurement of inputs and shortage of family labour.

Best farmers

24. The study also reviewed and documented the experience of 130 identified best farmers. One of the purposes of these farmers is the action research. They experiment and perfect various practices and formulations of the biological inputs, particularly the Kashayams and Asthrams of APCNF.
25. Compared to their share in the total sample, the open categories (OCs), medium and large farmers, farmers with salary employment, and farmers with graduation and above education are overrepresented in the best farmers category. It indicates that APCNF has won over the trust of the influential sections in the agriculture.
26. Though the sample size is very small in 10 out of 11 crops considered in this chapter, the results have confirmed the well-established hypotheses about APCNF both with respect to resource intensive and less resource intensive crops. However, the results have exhibited wider variations.
27. A detailed analysis of Paddy crop, which has sufficient sample, suggests that that the best farmers are able to reduce their expenditure on machinery, implements, irrigation, and bullock labour. It confirms the hypothesis that APCNF needs less ploughing, less irrigation, etc. The only increase in expenditure is on hired labour. It again confirms that APCNF is labour intensive model. The best farmers have marginally higher paid-out cost and marginally lower yields. But they have obtained higher net returns of over 23%, due to better price realization. In a sense the best farmer is a 'known' or 'recognised' farmer,

who can sell their produce at premium price. It demonstrates the potential of the market for APCNF.

Project level benefits and state level potential benefits

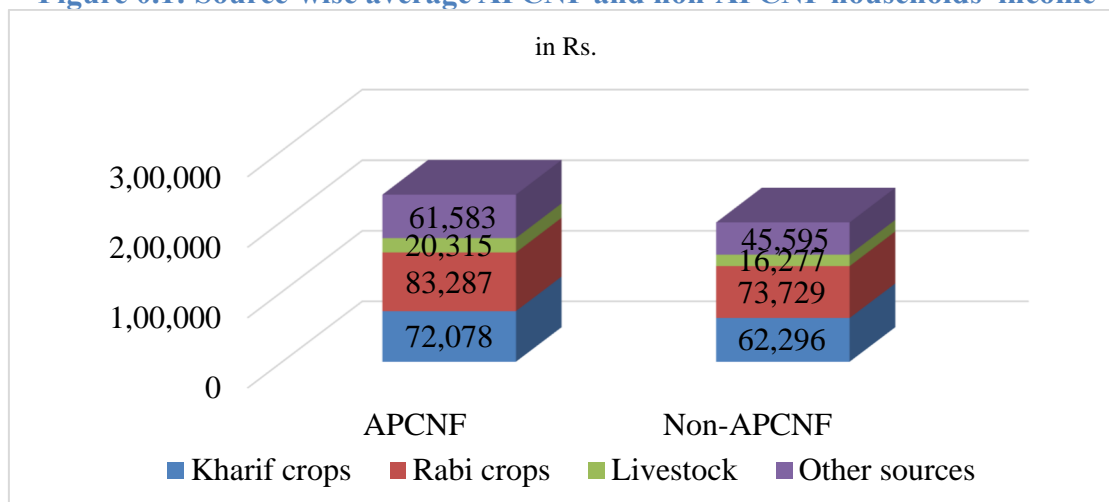
28. Because of APCNF interventions, the sample farmers have saved Rs.469.30 crore worth fertilisers and pesticides. This has larger environmental and health benefits. However, the farmers have spent Rs.164.98 crore on biological inputs. Still, they have saved over Rs. 300 crore (64.85 per cent) expenditure on PNPIs. This saving in turn has resulted in about Rs. 360 crore (21.47 per cent) savings in the paid-out costs. Even without application of agri-chemicals, which are considered as the critical inputs in the Green Revolution agriculture, the APCNF farmers have got Rs. 233 crore (8.26 per cent) higher gross revenue and Rs.593 crore (51.90 per cent) higher net returns.
29. If the entire GCA were converted into APCNF, the farmers in the state would have saved Rs. 8,038.5 crore (64.85 per cent) in the expenditure on PNPIs and Rs.9,504.27 crore (21.47 per cent) in the paid-out costs. They would have realized Rs. 6,170.38 (8.26 per cent) higher gross revenue and Rs.15,666.53 crore (51.90 per cent) higher net revenue.
30. Analysis of scenarios of increasing the cropping intensity to 200 per cent and bring about 40 per cent of fallow land under cultivation gives very interesting results.
31. Under non-APCNF, the per hectare net return of Rs.39,457 per one season would increase to Rs. 49,908 per hectare of Net Sown Area (NSA) per year, if the cropping intensity of 1.26 is considered. If the fallow lands of 9.53 lakh hectare are included with 1.26 cropping intensity, there won't be any change in the net returns of Rs.49,908 per hectare of NSA; however, the net returns from the crop sector in the state would increase from Rs. 30,184.25 crore to Rs. 34,940.47 crore. If the fallow lands are included and cropping intensity is increased to 200 per cent, the net revenue per hectare of NSA would increase to Rs.78,913; and the net revenue from the crops in the state would increase to Rs. 55,248.63 crore. The same, under APCNF, would increase to Rs. 1,19,871 per hectare of NSA and Rs.83.924.31 crore respectively.
32. ***It is important to note that a significant increase in cropping intensity is technically feasible and financially viable only under APCNF.***
33. Under APCNF, the average labour used per hectare is 119 days. It includes 50 days own labour and 69 days hired labour. Compared to non-APCNF crops, on average, 15 days additional labour is applied per hectare in APCNF crops. It mostly consists of own labour including exchange labour of 13 days and 2 days hired labour.

34. Under non-APCNF scenario, 104 labour days per hectare are required in one season. With 1.26 cropping intensity, labour requirement would be 132 days per hectare per year. If fallow lands are included with 1.26 cropping intensity, there won't be any change in the labour requirement per hectare per year. But, the total labour requirement in the crop sector would increase by 15.7 per cent, to 9.231.23 lakh days. If the cropping intensity increase to 200 per cent, the labour requirement would reach 209 days per hectare per year. If the entire area is put under APCNF, the labour requirement would be 239 per hectare per year.
35. At present the crop sector needs 26.60 lakh persons, if the entire area is under non-APCNF. The same would increase to 30.48 lakh persons, if the entire area is put under APCNF. Most of the additional employment of 3.88 lakh persons would accrue to own labour (3.28 lakh persons) and hired labour would get just 0.60 lakh persons employment.
36. If 40 per cent fallow lands are brought under cultivation and cropping intensity is raised to 200 per cent, the demand for employment would increase to 48.68 lakh persons under non-APCNF and 55.79 lakh persons under APCNF farming. Out of 7.11 lakh new jobs created with APCNF, 6.01 lakh jobs would be confined to the family labour and hired labour would get 1.1 lakh jobs.
37. New market channels are emerging for the APCNF farmers.

Household income

38. The household incomes, have been derived from four sources, viz. (1) Crop income from Rabi season, (2) Crop income from Kharif season, (3) Income from livestock, and (4) Other income.
39. The per household income of APCNF farmers is ₹2,37,263 and the same for non-APCNF is ₹1,97,897.
40. The per household income of APCNF farmers is higher than that of non-APCNF by ₹39,365 in absolute terms and 19.89 per cent in percentages terms. Source wise income are shown at Figure 0.1. In each source, the average income of APCNF farmers is higher than that of non-APCNF. The highest gap is observed in other sources which may reflect on the composition of sample farmers in each category.

Figure 0.1: Source-wise average APCNF and non-APCNF households' income



Sources: IDSAP: Field Survey, 2019-20

41. The marginal and small farmers of APCNF got higher incomes than their non-APCNF counterparts. While marginal farmers of APCNF got ₹.46,125 (27.69 per cent) higher income, the small farmers of APCNF have obtained ₹.39,277 (19.78 per cent) higher income.

Environmental and health benefits,

42. Overwhelming majority of the farmers have reported that the quality of the soils and crops have improved due to APCNF. Soil improvements are not just the farmers' perceptions, they have manifested into higher and resilient crop yields and quality crop outputs which in turn resulted in higher gross and net returns.

43. Overwhelming majority of the farmers are consuming the APCNF natural food and have experienced an improvement in the health status of their family members and a reduction in their expenditure on health. Further, majority of members reported improvement in their financial position; their outlook towards agriculture and their happiness. The wider variations across the districts in some indicators need attention from the project staff.

Issues, challenges and policy options

44. The issues and challenges are identified in the study are put in the strengths, weaknesses, opportunities and threats, popularly known as SWOT framework. It is summarized at Box 0.1 below. More details are given in chapter 8.

Box 0.1: SWOT analysis of APCNF

<p style="text-align: center;"><u>Strengths</u></p> <ul style="list-style-type: none"> ➤ Providing wonderful solutions to the challenges of present agriculture in the state ➤ Potential to contribute to the global effort to overcome the challenges of climate change ➤ Improving profitability in agriculture ➤ Improving farmers' health ➤ Reducing farmers' stress 	<p style="text-align: center;"><u>Weaknesses</u></p> <ul style="list-style-type: none"> ➤ Not able to reach the needy ➤ Not able to command the commensurate prices ➤ Less awareness and inadequate extension services ➤ Non-availability of readymade Kashayams and Asthrams at the time of requirement. ➤ No improvement in Kashayams' and Asthrams' formulations
<p style="text-align: center;"><u>Opportunities</u></p> <ul style="list-style-type: none"> ➤ Growing demand for chemical free food ➤ International support for the mitigation and adaption of the climate change 	<p style="text-align: center;"><u>Threats</u></p> <ul style="list-style-type: none"> ➤ The programme is going against the powerful mainstream industries, institutions and policies

Recommendations

- a. To address the challenge of **low yields**, RySS has initiated, on a large scale, the pre-monsoon dry sowing (PMDS) to boost the soil quality and productivity. Other natural farming methods such as tree-based farming and System of Root Intensifications (SRI) may also be implemented at the appropriate places. The process of introducing the medicinal and cosmetic plants may be widened.
- b. To promote the marketing opportunities for APCNF produces, RySS may:
 - i. Facilitate the procurement of APCNF products for the Public Distribution System (PDS), School Mid-day Meal programme, Anganwadi programmes, etc.
 - ii. Rope in the Girijana Cooperative Corporation (GCC) in the marketing of the APCNF products, in the Tribal areas.
 - iii. Facilitate the tie ups between big malls and certain villages/ mandals. The SHG institutions may also be roped in for simple preparation of agri-products/ food processing such as cleaning, grading, grinding, deseeding, shelling, packing, etc.
 - iv. As and when the medicinal plants and cosmetic related plants are introduced in the farming systems, simultaneously, their processing and marketing interventions have to be initiated.

- c. To strengthen the extension services and awareness generation, APCNF may print and distribute the self-learning literatures, along with case studies, such as booklets, pamphlets, etc, extensively and frequently. All the television channels in the state may be encouraged and facilitated, under corporate social responsibility, to cover APCNF program, food quality, health issues, etc.
- d. Towards strengthening the institutions and influencing the Governments:
 - i. Facilitate a close coordination of all departments dealing with natural resources such as agriculture, rural development, animal husbandry, forestry, civil supplies, etc.
 - ii. Internal evaluations methods such as inter-district evaluation by the DPM staff for mutual learning may be facilitated and institutionalized.
 - iii. Persuade the Directorate of Economics and Statistics to incorporate the APCNF data in their annual publications/ data compilations.
 - iv. Encourage the mainstream research institutions to include APCNF in their regular research agenda.
 - v. RySS may take a lead role in revisiting and reviewing macro-policies, towards agriculture, of Government of India and the State Government.
- e. There are several funding opportunities with respect to climate change and afforestation. RySS may access those funds and use for the benefit of participating farmers

Chapter 1: Context, Objectives and Methodology

1.1. Introduction

It is well known that current agriculture (model) in India, including in Andhra Pradesh (AP), which is known as Green Revolution Model or Industrial Agriculture or Chemical Based Agriculture, is in crises and farmers are distressed. The annual farmers' suicides report and other official reports and many research studies have been confirming, one after other, the precarious situation of the Indian agriculture.

Almost all 1,000 farmers, interacted by the present study team, in about 60 Focussed Group Discussions (FGDs) have narrated the pathetic situation of the non-APCNF and farming communities in the state, which largely reflects the perilous condition of (non-APCNF) agriculture in India. The major challenges, under chemical-based agriculture, described in the FGDs are:

1. Crops are becoming more vulnerable to pests and diseases. Farmers are compelled to apply higher doses of pesticides year after year.
2. Another related issue is adulterated and spurious agriculture inputs, especially the agri-chemicals and seeds.
3. Application of higher doses of agri-chemicals, in turn, is resulting in higher costs of cultivation without any corresponding increase in the crop yields; leading to their severe indebtedness.
4. Crops are also becoming more vulnerable to the vagarious of the monsoon, leading to perpetual and increasing fluctuations in the crop yields and quality of output. It, in turn, is resulting in fluctuating and uncertain farm incomes.
5. Excess application of agri-chemicals is leading to deterioration of the soil quality and hardening of soils, which is not conducive for moisture absorption and retention, and round the year cultivation.
6. Excess application of agri-chemicals is leading to health hazards to the human beings and biodiversity, especially, to the benevolent birds, pollinating bees, and benign insects and bacteria. Domestic animals are also dying, albeit, in smaller numbers.

7. Apart from the tenant farmers, the farmers with assigned-lands are also finding it difficult to get institutional credits and are forced to borrow from informal lenders at higher rates of interest.
8. Agriculture extension services, from the government agencies, are grossly inadequate and inappropriate.
9. Inputs supply, especially the seeds and fertilizers, by the government are inadequate. Farmers have to purchase those inputs at higher prices from the private traders, often in the black market.
10. Marketing support is grossly inadequate.
11. Because of these challenges:
 - a. Farmers dependency on other/ supplementary sources of income has increased.
 - b. Some farmers have left cultivation and either migrated out of the village or taken up another profession in the village.
 - c. Some land owners are leasing out a part of their lands.
 - d. Some land owners are leaving a part of their landholding fallow.
 - e. A few land owners are leasing out their lands for animal grazing for a nominal rent.

Most of the farmers, in the country and also in AP, are looking for alternative models of agriculture. Some farmers, in different pockets of the country, are fortunate to get alternative models such as organic farming, natural farming, tree-based farming, integrated pest management (IPM), integrated nutrition management (INM), integrated farming, multi-layer farming, etc., because of the efforts of non-government organizations (NGOs), local officials/ volunteers, progressive farmers, etc. However, these models, in all over India, are remained as isolated islands of success without any networking, integration, upscaling and replication by the state governments or Government of India. Almost all governments and government agencies, including research institution, are intended to continue with the chemical-based agriculture model, with one exception of Government of Andhra Pradesh. While the Government of United (erstwhile) AP initiated the Community Managed Sustainable Agriculture (CMSA) in the combined state, the reorganized State Government has launched the Andhra Pradesh Community Managed Natural Farming (APCNF) in 2016.

APCNF is an agri-ecological farming approach. It believes that the soil already has all the nutrients necessary for plant growth. 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.

APCNF facilitates this process. Thus, APCNF is contrary to the conventional chemical-based agriculture. Beejamrutham (treating of seeds with microbial), Jeevamrutham (incorporation of microorganism into soils), Achadana (mulching), and Waaphasa (aeration) are the four core APCNF farming practices. In order to protect crops from pests and insects, APCNF prescribes a number of natural fungicides and pesticides, known as Kashayams and Asthrams, made from locally available ingredients like neem leaves, chillies, garlic, tobacco, sour buttermilk, etc.

Diversification of cropping pattern is another key feature of APCNF. Under APCNF, different crops are intensively grown in a variety of ways. These include crop rotation, mixed cropping, internal 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 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 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.

1.2. Rythu Sadhikara Samstha

To implement the program effectively, an independent and dedicated organization, known as Rythu Sadhikara Samstha (RySS), a not-for-profit company, was established in 2016. The mandate of RySS is to cover all farmers and entire cropped area, in the state, under APCNF, which is diametrically opposite to the chemical-based farming model. As APCNF got the attention of many stakeholders, RySS has forged partnerships with the Rashtriya Krishi Vikas Yojana (RKVY) and Prime Minister Krishi Vikas Yojana (PKVY). RySS has also collaborations with Azim Premji Philanthropic Initiatives (APPI) and Sustainable India Finance Facility (SIFF) – an innovative partnership between UN Environment, BNP Paribas, the World Agro-Forestry Centre and KfW. Some international institutions such as the World Bank, the Food and Agriculture Organization (FAO), some state governments, NITI Aayog, etc., are interested in APCNF and are interacting with RySS. To get validate the impact of the APCNF on the farming and farming community in the state, through an independent agency, to get the hard data for its advocacy, and to get policy inputs, RySS has assigned this study to

Institute for Development Studies Andhra Pradesh (IDSAP). This yearlong learning and evaluation study is continuation of the previous year study and is being continued in 2020-21.

1.3. The Study

APCNF is expected to yield multiple benefits, in two streams of benefits, viz. economic and ecological benefits. The economic benefits include reduction in cost of cultivation, increase in net returns from cultivation, reduction in farmers' vulnerabilities from the weather extremes, input and credit market dependencies and exploitations, and output market fluctuations/slumps. The environmental benefits include improvement in the soil quality, environmental services, food quality, health issues related to application of poisonous pesticides and consumption of food with poisonous chemical residuals, etc. This study has used these benefits as the framework for the research.

The present report is a part of the larger monitoring and learning annual study of the Andhra Pradesh Community Managed Natural Farming (APCNF) and continuation of the APCNF Kharif Report 2019-20 and APCNF Rabi Report 2019-20. The details of the context, objectives, methodology, including sampling design, etc were discussed in details in the previous APCNF Kharif 2019-20 report and APCNF Rabi 2019-20 report (See IDSAP, 2020a and IDSAP, 2020b). In this chapter, the same are summarised.

The main objective of the APCNF is to make agriculture economically viable, agrarian livelihoods profitable and climate-resilient. APCNF aims at reduction in cost of cultivation, enhance yields, increase incomes, reduce risks, and protect the farming and farmers from uncertainties of climate change by promoting the adoption of an agri-ecology principles and practices. It is expected that APCNF would result in substantial reduction in the expenditure on plant nutrients and protection inputs (PNPIs)¹, due to replacement of the very expensive and harmful chemical inputs with the inexpensive and benevolent biological inputs. The reduction in PNPIs expenditure, in turn, is expected to reduce the total cost of cultivation; and result in the higher net returns from crop cultivation. Further, APCNF would likely to improve the yield

¹ The expenditure on chemical inputs under non-APCNF and biological inputs under APCNF, together referred as the expenditure on plant nutrients and protection items (PNPIs).

rates of crops and the quality of crop output and fetch better prices and lead to higher gross returns. APCNF is also expected to improve the quality of natural resources, especially the soil quality, and the quality of the environmental services. The mandate of the present study is to assess the impact, and to provide the insights for mid-course corrections, and to make available the facts and figures for the advocacy.

1.4. Objectives of the study

1. To assess and measure the changes in expenditure on PNPI, total cost of cultivation and gross and net returns from crop cultivation, due to APCNF; and impact of these changes.
2. To estimate independently and precisely the changes in the crop yields due to APCNF.
3. To analyse the experience of the APCNF panel farmers
4. To estimate the project level benefits realized farmers
5. To make an estimate with regarding to income and employment benefits, if the entire gross cropped area were put under APCNF and cropping intensity were raised to 200 per cent.
6. To estimate the changes in farmers household incomes due to APCNF
7. To learn the impact of the APCNF on soil quality and to know the qualitative changes in the crop output due to APCNF
8. To understand the farmer's experience and perceptions about APCNF, in terms of outlook towards farming; and environmental and health benefits,
9. To provide insights for mid-course corrections/ improvement and recommendations for the policy changes.

1.5. Methodology

The method “**with and without**”, was used in the study; i.e. the outcomes of APCNF farmers, cultivating a particular crop, are compared with the outcomes of the non-APCNF farmers cultivating the same crop, using chemical inputs. The field data was collected during Kharif 2019 and Rabi 2019-2020. The study has focussed on 13 major crops cultivated across the state, during Kharif. The crops include: (1) Paddy, (2) Maize, (3) Bengal gram, (4) Groundnut, (5) Cotton, (6) Jowar, (7) Chillies, (8) Red gram, (9) Sugarcane, (10) Black gram, (11) Ragi, (12) Onion and (13) Turmeric. Out of 13 crops listed above and covered in the data collection

during Kharif season, only first nine crops, which have 30 plus samples/ observations for both APCNF and non-APCNF, were used in the crop wise analysis in the Kharif report.

The Rabi data collection started at the end of February 2020 and continued to July 2020, due to Covid 19 related lockdown and travel restrictions. Though a number of crops are being cultivated under APCNF in the state, including many horticulture and floriculture crops, covering smaller areas, the study has planned to collect data of 11 crops, viz. 1. Paddy, 2. Maize, 3. Groundnut, 4. Sesamum, 5. Black gram, 6. Onion, 7. Ragi, 8. Bengal gram, 9. Green gram, 10. Jowar, and 11. Chillies. To get reliable estimates, crops with minimum of 30 records/ observations were used in the detailed analysis in the Rabi report. Out of 11 crops listed above and covered in the data collection, only first six crops, which have 30 plus samples/ observations for both APCNF and non-APCNF, were used in the crop wise estimates in the Rabi report. However, all crops are included in this report, to give, at least, an anecdotal evidence about all crops covered in the study. However, in estimations such as household income, project level benefits and state level benefits, only the select crops of nine in Kharif and six in Rabi were used.

It was planned to cover the entire state and all 13 districts in the study. The study has collected data during both Kharif and Rabi seasons. During Kharif season, it was planned to collect the household data from 1,430 APCNF farmers, which include 1,040 cross section, 260 panel and 130 best farmers. Further, it was planned to collect data from 650 non-APCNF farmers for the comparative analysis. During Rabi season, it was planned to collect the data from 910 APCNF farmers, including 520 cross section. 260 panel and 130 best farmers; and 520 control farmers. To get adequate number of observations for each of select sample non-APCNF crops, more than 80 additional non-APCNF farmers were covered during the season. The total planned and actual number of sample size, during Kharif and Rabi seasons, is shown at Table 1.1

Table 1.1: Quantitative sample frame of the entire study in numbers

Type of Sample	Sample Unit	KHARIF				RABI			
		APCNF		Non APCNF		APCNF		Non APCNF	
		No. of villages	Sample Size	No. of villages	Sample Size	No. of villages	Sample Size	No. of villages	Sample Size
Cross Section	Per District	8	80	5	50	4	40	4	40
	State Total	104	1040	65	650	52	520	52	520
Panel Sample	Per District	2	20	0	0	2	20	0	0
	State Total	26	260	0	0	26	260	0	0
Best Farmers	Per District	0	10	0	0	0	10	0	0
	State Total	0	130	0	0	0	130	0	0

Total	Planned	1430	650	910	520
	Actual	1,422	628	902	601

Sources: IDSAP: 2019: Project Inception Report and IDSAP Field survey 2019-20

Further, it was planned to conduct 130 case studies (CSs) at the rate of 10 per each of 13 districts, 13 strategic interviews (SIs) at the rate of one in each district with the District Project Manager (DPM) and 65 focus group discussions (FGDs) with APCNF farmers and 39 FGDS with non-APCNF villagers. Due to Covid 19 related travel restricts, the senior members could not travel to the fields and conduct the case studies, as per the plan. The qualitative data collection plan and actual accomplishment are summarized at Table 1.2.

Table 1.2: Qualitative data plan and actual collection in numbers

Tool	Planned number		Actual conducted number	
	APCNF	Mon-APCNF	APCNF	Mon-APCNF
Case studies	130	0	0	0
Strategic interviews	13	0	13	0
FGDs in the State	65	39	63	33

Sources: IDSAP: 2019: Project Inception Report and IDSAP Field survey 2019-20

All the data including APCNF cross section data, panel data, best farmers data and non-APCNF farmers data are used in the cross-section analysis in the previous two reports and also in the present report also. The panel data is separately analysed in this report.

Crop cutting experiments were conducted methodically to get independent and precise estimates of yields of crops under APCNF and Non-APCNF and the difference between them. For each of the selected farmer, a plot of the land where the farmer is growing the major crop, was identified. From this parcel of land, a plot of *size as required by the procedure* has been selected randomly for estimating the yield through crop cutting experiments (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 Andhra Pradesh for conducting CCEs. It was planned to conduct at least one CCE with each sample farmer. Total of 1,762 CCEs were conducted including 1,231 APCNF crops and 531 control crops in Kharif 2019. Due to Covid 19 related restrictions, CCEs could not be completed as per the plan during the Rabi. The work was severely affected. Total 433 CCEs were conducted including 299 for APCNF 11 crops and 134 for control 11

crops. For six select crops analyzed in the Rabi report, 263 APCNF and 101 non-APCNF CCEs were collected.

In the report, unless stated otherwise, the yields obtained through CCEs were used in all tables and calculations such as gross and net returns.

1.6. Data Collection and the Management Process

Total seven research tools, viz. (1) Household listing schedules, (2) Village listing schedule (3) Questionnaire for APCNF HHs, (4) Questionnaire for Non-APCNF HHs, (5) Checklist of FDGs, (6) Checklist for Case Studies, and (7) Checklist for Strategic Interviews, were prepared. These instruments for all field-based evaluations 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 of training and field testing were carried out, to train the field investigators and supervisors during November 11 to 15 at the Nagarjuna University, Guntur. The actual field survey for Kharif season was commenced on 19th November 2019 and continued up to the end of February 2020. Senior core team members have visited the field regularly and supported the field team. Similarly, separate training for the Rabi survey for the staff was organized at CESS, Hyderabad during February 2020 and Rabi survey had begun by the end of February 2020. But, the survey, especially the CCEs, was adversely affected by Covid 19 related restrictions during the Rabi season.

A separate mobile-based app was developed/ generated to enter the CCEs' information; and training was given to all the supervisors, after duly installing the app in their mobiles. Senior team members visited the field and cross-checked the information filled. The data entry program was written in CSPro software and used for data entry and processing.

1.7. Limitations of the data

As the data collection was adversely affected by the Covid 19 related restrictions, the field teams have to go slow to completed data collection during Rabi. On average, 44 samples/

CCEs per each of six APCNF crop and 17 samples/ CCEs per each of six non-APCNF crop were collected. Among the six APCNF crops, the benchmark 30 plus CCEs/ observations, were obtained for four crops, viz. Paddy, Maize, Groundnut and Black gram. Only 15 CCEs were completed for each of remaining two crops, viz. Sesamum and Onion. Out of six select crops analyzed in the Rabi report, only Maize has more than 30 CCEs. The number of CCEs vary from 7 to 20 in the remaining five crops. This is the major limitation of this report. To understand the severity of this limitation, the crop wise yields obtained through CCEs and reported yields were compared. It is heartening to know that similar patterns were observed in almost all crops. The variations observed in the CCEs yield and reported yields have same sign in five out of six crops analyzed in the report; the only exception is Onion. It implies that despite smaller CCEs, the data gives reasonably a good picture of ground reality. Because of the smaller number of CCEs, the analyses – comparison of yields, gross and net returns were limited to state level only.

1.8. Structure of the Report

The context, objectives and methodology of the study have been presented in this Chapter 1. Chapter 2 describes the profile of sample households. Chapter 3 consists of the crop wise analyses of the impact of biological input on the production conditions of farmers. The changes obtained in the panel data is presented in Chapter 4. The project level benefits and the potential benefits of APCNF in terms farm revenues and employment generation and emerging marketing channels have been analyzed in chapter 5. The changes in household incomes, due to APCNF, in the Kharif and Rabi seasons, in the livestock sector and other sources are analyzed in Chapter 6. The environmental and health benefits of the APCNF are summarized in Chapter 7. Chapter 8 discusses the issues and challenges in the SWOT framework and gives policy suggestions.

Chapter 2: Adaptation of APCNF by Farmers: some Correlates

2.1. Introduction

The sample selection was completed during the Kharif survey. For the Rabi survey, the sample was selected from Kharif sample only. In a sense, Rabi sample is a sub-set of Kharif sample; and expected to have same characteristics. Rabi sample households were selected from those farmers, who were also cultivating during Rabi season. In many districts, there were not enough number of Kharif sample farmers, who were cultivating during Rabi season. Hence, some new sample farmers were selected from the village level household lists prepared during Kharif season, which were used for the selection of the sample at that time. As the Rabi sample is a subset of Kharif sample, therefore, the attributes of the Kharif sample, by and large, holds good for the Rabi sample also. The profiles of the sample households were analysed in detail in the Kharif Report 2019-20 (IDSAP, 2020a). The same is summarized below.

“The profile of the sample farmers clearly indicates that RySS has been focusing on the poor and vulnerable sections. The inclusion of SC, ST, women farmers and landless/ leased-in farmers has been higher among APCNF sample vis-à-vis the control sample. Higher incidence of literates and educated farmers, youth and professionals were present among the APCNF sample, indicates that APCNF is gaining popularity among the educated or informed farmers, youth and professionals. Contrary to the popular perceptions and deliberately propagated assertions that natural farming is a hobby of the rich, relatively higher presence of small and marginal farmers, including leased-in farmers among APCNF sample and the allocation of larger proportion of their holdings to APCNF vis-à-vis medium and large farmers, indicates the pro-poor nature of the project. The southern districts, especially Rayalaseema districts, have allocated larger portion of their operational holdings to APCNF. APCNF is gaining acceptance in the southern parts of the state as a low-cost cultivation model, where farmers usually adopt risk averse or low investment agriculture strategies.”

2.2. Profile of the Rabi sample farmers

As the Rabi sample is a subset of the Kharif sample; it is expected to have same characteristics of Kharif sample. To save the time and space, the detailed profile tables and graphs of the Rabi sample are not prepared. However, the salient features of the sample are described below.

1. Nearly one-fourth of APCNF sample farmers (24.94 per cent) are belong to SC and ST categories. The same is 13.64 per cent in non-APCNF farmers.
2. The APCNF farmers have better education level vis-à-vis non-APCNF farmers. Illiterate farmers constitute 25.72 per cent and 41.6 per cent among APCNF and non-APCNF sample farmers respectively. Graduates and above educated farmers constitute 9.42 per cent among the APCNF farmers. The same is only 3 per cent among the non-APCNF farmers.
3. The prevalence of women farmers is relatively high (8.31 per cent) in APCNF sample vis-à-vis 3.83 per cent in non-APCNF farmers.
4. By and large, the above trends are similar to that of Kharif. However, the proportion of landless among the APCNF (5.54 per cent) is less than that of non-APCNF (7.15 per cent). It is in contrast to the trends observed in Kharif.

2.3. Area allocated for APCNF crops

All the APCNF Kharif sample farmers together own 1,944.44 hectare of land and have cultivated 2,044.98 hectare during the season. Out of the total cultivated area, the APCNF farmers have devoted nearly 55 percent of area to APCNF method of farming. One interesting point to be noted is that landless or pure lease-in farmers have put over 71 percent of their operational area under APCNF. The same is 67.95 percent for marginal farmers, 58.96 percent for small farmers and 40.21 percent for other farmers (medium and large farmers). On average, while the APCNF farmers own a little more area (1.37 hectare) vis-à-vis non-APCNF farmers (1.31 hectare), they cultivate relatively less area (1.44 hectare) compare to non-APCNF farmers (1.53 hectare). More details can be seen in IDSAP, (2020a).

During Rabi, out of 902 APCNF farmers, 50 are landless, 399 are marginal, 305 are small and 148 are other farmers. On an average, each APCNF farmer owns 1.46 hectare. It varies from 0.64 hectare for marginal farmers to 3.95 hectare for other farmers. On an, average each APCNF farmer has cultivated 1.07 hectare during the Rabi season. It varies from 0.72 hectare for marginal farmers and 0.86 hectare for landless farmers to 1.99 hectare for other farmers.

On average, each APCNF farmer has put 0.61 hectare under APCNF. It varies from 0.44 hectare for landless and marginal farmers to 1.04 hectare for other farmers. All APCNF farmers, together, put 56.58 per cent of their cultivated area under APCNF during the study period/season. Surprisingly the marginal farmers have assigned highest percentage (61.03 per cent) of their cultivated area to APCNF, followed by small farmers (57.34 per cent). Even the landless farmers have allocated 51.22 per cent of their cultivated area to APCNF. It is just less than that of other farmers (52.15 per cent) by one percentage points (IDSAP, 2020b). ***It indicates the pro-poor orientation of the programme.***

2.4. Crop cutting experiments

One of the major activities of this study is to collect yield data through crop cutting experiments (CCEs) independently and precisely. Total 1,732 crop cutting experiments were conducted during the Kharif season. These include 1,232 APCNF crops and 531 non-APCNF crops. More details can be seen at IDSAP, (2020a). Total 433 CCEs covering 11 crops including 299 APCNF and 134 Non-APCNF farmers were conducted during the Rabi survey. For six select crops analyzed in the Rabi report, 263 APCNF and 101 non-APCNF CCEs were collected. More details can be seen in IDSAP, (2020b). In the report, unless stated otherwise, the yields obtained through CCEs were used in all tables and calculations such as yields, gross returns and net returns.

2.5. Conclusion

The profile of the sample farmers clearly indicates that RySS has been focusing on the poor and vulnerable sections. The presence of SC, ST, and women farmers is higher among APCNF sample than that of the control sample. Higher proportion of literates and educated farmers among the project-APCNF sample indicates that APCNF is gaining popularity among the educated or informed farmers. Contrary to the popular perceptions that “natural farming is a hobby of the rich”, the small and marginal farmers have allocated larger parts of their holdings to APCNF vis-à-vis other farmers. APCNF, being the low cost of cultivation model, apparently, is gaining acceptance among the poor. ***APCNF proved to be a pro-poor orientated programme.***

Chapter 3: Impact of APCNF on Farming Conditions

3.1. Introduction

This chapter covers the impact of the APCNF on the expenditures on the plant nutrient and protection inputs (PNPIs), the paid-out costs of cultivation, crops' yields, gross and net returns from cultivation. In the Kharif and Rabi reports, the analysis was carried out, item wise, i.e., expenditure on PNPIs, the paid-out costs of cultivation, crops' yields, gross and net returns across all crops. In other words, all crops were analysed together, item wise. For example, yields of all crops were put in one table and analysed. In this report, the analysis is carried out crop wise; i.e., all costs, yields and returns of a crop are put in one table. In other words, crop wise tables are prepared. The impact of APCNF on each item of cost – seed, fertilizers, pesticides, biological inputs, hired labour, farm yard manure (FYM), bullock labour, machine labour, agriculture implements, irrigation expenditure, yields, value of output, value of by-products, total paid-out costs, gross returns and net returns are analysed separately for each crop.

3.2. Crop wise analyses

Out of 13 crops covered in the data collection, during Kharif season, nine crops with 30+ APCNF and non-APCNF records/ observations were analysed in the Kharif report. Similarly, out of total 11 sample crops for which data was collected in Rabi, crop wise cost of cultivation and returns were estimated for only six crops, who have a minimum of 30 APCNF and non-APCNF sample-observations/ records. But in this chapter all 13 Kharif crops and 11 Rabi crops are analysed. Out of these Kharif and Rabi crops, nine crops, viz., Paddy, Maize, Jowar, Ragi, Bengal gram, Black gram, Groundnut, Chillies and Onion are common in both seasons. Sugarcane, Cotton, Red gram and Turmeric are Kharif season crops and Green gram and Sesamum are Rabi crops.² These crops are analysed below.

² Normally Sugarcane and Bengal gram are considered as the Rabi crop. As the Kharif data collection was extended up to end of February 2020, many farmers have reported Sugarcane and Bengal gram as Kharif crops. Most importantly, the field team got several Sugarcane and Bengal gram plots for CCEs during Kharif and very less during Rabi season.

3.2.1. Paddy

Paddy is the principal crop in the state, being cultivated on about 23 lakh hectare (30 per cent) of gross cropped area (GCA). It is predominantly an irrigated crop. Majority of paddy is cultivated under flood irrigation model. Paddy yields under APCNF were less than that of non-APCNF during last year- Kharif and Rabi seasons of 2018-19 (CESS, 2020). This year, the APCNF yields, during Kharif, were higher than that of non-APCNF by three quintals per hectare; but fell short by five quintals during Rabi. ***The inconsistency of APCNF in Paddy yields need further analysis and addressed by the RySS.*** RySS is recommending the System of Root Intensification (SRI), along the APCNF package for Paddy to increase the yields. In many Focus Group Discussions (FGDs), the respondents said that line sowing is an important part of APCNF package/ model. But, it appears, that farmers are not practicing SRI/ line sowing in the field. Normally line sowing and SRI needs very less seed. As per the data shown at Table 3.1, there is no noteworthy difference in the seed cost between APCNF and non-APCNF paddy during both seasons. Further, RySS is recommending the farmers to use own seeds and local seeds, which are relatively inexpensive. The data indicate that there is no significant variation in the kind of seeds used by both category of farmers.

The major advantages of APCNF for Paddy crops are: (1) reduction in expenditure on PNPIs and (2) higher output prices. By adapting APCNF, the farmers are able to save ₹.9,295 during Kharif and ₹.5,848 during Rabi in the expenditure on PNPIs. Though the APCNF Paddy yields were higher by just 5.85 per cent, the gross returns were 13.14 percent higher than that of non-APCNF, during the Kharif season. The same is more interesting during Rabi. Despite the APCNF Paddy yields were lower by 7.02 per cent and the values of by-product was less than that of non-APCNF by 24.71 per cent, the gross APCNF returns were higher than non-APCNF by 2.05 per cent. It implies that APCNF Paddy was fetching higher price.

It was mentioned in IDSAP (2020a), only a few APCNF farmers are tapping into the huge market for the chemical free food. The FGDs also revealed that the farmers want higher prices for their extra efforts. They said that while the chemical inputs are readily available in the market, the biological inputs need to be prepared with a lot of time and effort. There is good scope to build on the efforts of the fewer APCNF farmers in realising the premium price for APCNF product. Because of significant reduction in the expenditure on PNPIs and higher

average price realization, the APCNF farmers are able to get very high net returns of ₹.20,395 (65.73 per cent) per hectare during Kharif and ₹.9,996 (14.60 per cent) per hectare during Rabi.

Table 3.1: Cost of cultivation, yields and returns of Paddy under APCNF and Non-APCNF during Kharif and Rabi 2019-20

in Rupee and quintals per hectare

Item	Kharif 2019-20				Rabi 2019-20			
	APCNF	Non-APCNF	Differences between APCNF and non-APCNF		APCNF	Non-APCNF	Differences between APCNF and non-APCNF	
			In units	In per cent			In units	In per cent
1	2	3	4=2-3	5=(4/3)*100	6	7	8=6-7	9=(8/7)*100
Sample	787	367			192	125		
Seed	2,413	2,570	-156	-6.09	2,641	2,876	-235	-8.17
Fertilizers	-	9,714	-9,714		-	9,149	-9,149	
Chemicals	-	4,616	-4,616		-	5,359	-5,359	
Biological inputs	5,035	-	5,035		8,660	-	8,660	
PNPIs	5,035	14,330	-9,295	-64.86	8,660	14,508	-5,848	-40.31
FYM	1,848	1,256	592	47.10	836	908	-73	-7.98
Casual Male	6,383	6,167	216	3.50	3,227	3,348	-121	-3.62
Casual Female	11,109	11,913	-804	-6.75	11,460	13,692	-2,232	-16.30
Bullock Labour	367	430	-63	-14.67	368	354	14	4.09
Machine Labour	12,259	12,563	-304	-2.42	13,117	12,181	936	7.69
Implements	624	822	-198	-24.04	514	551	-38	-6.82
Water Fees	695	377	318	84.28	582	570	12	2.19
Yield³ (quintals/hectare)	51	48	3	5.85	64	68	-5	-7.02
Output Value	88,269	77,555	10,714	13.81	1,12,563	1,07,754	4,809	4.46
Bye Product Value	3,892	3,904	-13	-0.33	7,301	9,697	-2,396	-24.71
Gross Return	92,161	81,460	10,701	13.14	1,19,863	1,17,450	2,413	2.05
Paid-out cost	40,734	50,429	-9,694	-19.22	41,406	48,989	-7,583	-15.48
Net Returns	51,426	31,031	20,395	65.73	78,457	68,461	9,996	14.60

Sources: IDSAP Field Survey 2019-20

3.2.2. Groundnut

Groundnut is very important oilseed crop in the state. It is grown on about 9.15 lakh hectare (11.96 per cent of GCA) in the state. It is grown mostly in Rayalaseema. Though predominantly a Kharif crop under rainfed condition, it is also grown during Rabi under irrigation condition. The yield gap between rainfed and irrigated crop is quite high. Normally it is grown with less fertilisers and pesticides during Kharif, with moderate to heavy doses of agri-chemicals during Rabi. The seed cost in Groundnut is high. RySS is encouraging and facilitating the farmers to use their own local seeds. As a result, the APCNF farmers have saved ₹.5,828 (32.22 per cent) on the seed cost during Kharif and ₹.4,246 (18.37 per cent) per hectare during Rabi season.

³ In all these table yields data is given from CCE estimates.

While the savings on PNPIs was modest of ₹.1,007 (12.59 per cent) per hectare during Kharif; it is ₹.7,499 (53.32 per cent) per hectare during Rabi season. Despite the use of additional female hired labour during both seasons under APCNF, the savings in the paid-out costs have increased from ₹.4,698 (9.08 per cent) per hectare during Kharif to ₹.10,753 (16.19 per cent) per hectare during Rabi. Though the increase in the yields is marginal in both the seasons, the farmers got little better prices for APCNF output. Because of the cumulative effect of reduction in paid-out costs and better price realization, the APCNF farmers have got higher net returns of ₹.9,843 (23.81 per cent) per hectare during Kharif and ₹.21,131 (21.67 per cent) per hectare during Rabi (Table 3.2).

Table 3.2: Cost of cultivation, yields and returns of Groundnut under APCNF and Non-APCNF during Kharif and Rabi 2019-20

in Rupee and quintals per hectare

Item of Expenditure	Kharif 2019-20				Rabi 2019-20			
	APCNF	Non-APCNF	Differences between APCNF and non-APCNF		APCNF	Non-APCNF	Differences between APCNF and non-APCNF	
			In units	In per cent			In units	In per cent
1	2	3	4=2-3	5=(4/3)*100	6	7	8=6-7	9=(8/7)*100
Sample	120	51			98	70		
Seed	12,262	18,089	-5,828	-32.22	18,875	23,122	-4,246	-18.37
Fertilizers	-	5,734	-5,734	-100.00	-	8,916	-8,916	-100.00
Chemicals	-	2,267	-2,267	-100.00	-	5,148	-5,148	-100.00
Biological inputs	6,994	-	6,994		6,566	-	6,566	
PNPIs	6,994	8,001	-1,007	-12.59	6,566	14,064	-7,499	-53.32
FYM	663	953	-290	-30.43	1,853	777	1,076	138.50
Casual Male	2,508	2,170	338	15.58	1,683	1,196	487	40.69
Casual Female	14,109	10,554	3,555	33.68	16,686	14,094	2,592	18.39
Bullock Labour	1,520	2,043	-523	-25.58	1,949	2,942	-993	-33.76
Machine Labour	8,760	9,505	-745	-7.83	7,478	9,546	-2,068	-21.66
Implements	125	283	-158	-55.95	248	501	-254	-50.61
Water Fees	107	148	-41	-27.55	312	161	151	94.16
Yield (Quintals/Hectare)	16.53	16.38	0	0.94	28	27	1	4.76
Output Value	88,845	82,345	6,499	7.89	1,56,880	1,46,461	10,418	7.11
By-Product Value	9,392	10,746	-1,354	-12.60	17,393	17,434	-41	-0.23
Gross Return	98,237	93,091	5,145	5.53	1,74,272	1,63,895	10,378	6.33
Paid-out cost	47,047	51,745	-4,698	-9.08	55,650	66,403	-10,753	-16.19
Net Returns	51,190	41,346	9,843	23.81	1,18,623	97,492	21,131	21.67

Sources: IDSAP Field Survey 2019-20

3.2.3. Cotton

Cotton is one of resources intensive crop and is called as ‘high risks and high returns’ crop. It is grown on average on 6.57 lakh hectare (8.59 per cent) in the state. It is mostly grown under rainfed conditions, during Kharif season, with occasional irrigations given by some farmers in a few locations. It is mostly cultivated in Kurnool, Guntur, Anantapuramu, Krishna and Prakasam districts. The data of Cotton crop for Kharif season is presented at Table 3. 3. The major savings obtained under APCNF is in the expenditure on PNPIs. By adapting to APCNF, the farmers have obtained ₹.19,009 per hectare savings, which is equal to a whopping 74.63 per cent. It, in turn, resulted in the savings of ₹.26,094 (35.97 per cent) in paid-out costs. Though there was a decline of 0.57 quintal (2.93 per cent) per hectare yields, the farmers have obtained ₹.23,396 (a whopping 165.65 per cent) higher net returns per hectare; purely due to a steep decline in costs of PNPIs.

Table 3.3: Cost of cultivation, yields and returns of Cotton under APCNF and Non-APCNF during Kharif 2019-20

Indicator	APCNF	Non-APCNF	Differences between APCNF and non-APCNF	
			In units	In per cent
			4=2-3	5=(4/3)*100
1	2	3	4=2-3	5=(4/3)*100
Sample	107	85		
Seed	5,029	5,840	-811	-13.89
Fertilizers	-	15,084	-15,084	-100.00
Chemicals	-	10,387	-10,387	-100.00
Biological inputs	6,462	-	6,462	
PNPIs	6,462	25,471	-19,009	-74.63
FYM	1,557	645	912	141.23
Casual Male	1,044	2,173	-1,129	-51.96
Casual Female	21,543	26,813	-5,269	-19.65
Bullock Labour	2,867	3,370	-503	-14.92
Machine Labour	6,833	6,666	167	2.50
Implements	901	1,437	-536	-37.31
Water Fees	209	124	84	68.11
Yield (Quintals/Hectare)	18.95	19.52	-0.57	-2.93
Output Value	83,928	86,589	-2,661	-3.07
By-products Value	37	74	-37	-50.38
Gross Return	83,965	86,663	-2,698	-3.11
Paid-out costs	46,445	72,539	-26,094	-35.97
Net Returns	37,520	14,124	23,396	165.65

Sources: IDSAP Field Survey 2019-20

3.2.4. Bengal gram

Bengal gram is one of the principal pulses crops in the state. It is cultivated on about 4.41 lakh hectare (6 per cent of GCA). It is mostly cultivated during Rabi season and completely under rainfed conditions. However, farmers give an odd irrigation as per the need and availability of the water. Though it is a predominantly a Rabi crop, the study got good number of sample due to coverage of early sown Rabi fields in the sample. These days farmers are growing Bengal gram extensively under rainfed conditions, replacing the conventional and risky commercial crops like Tobacco, Cotton and Chillies. They are also investing reasonably good amount on this crop and reaping good yields. By shifting to APCNF, farmers are able to save substantial amounts in the expenditure on PNPIs and paid-out costs. The savings in the expenditure on PNPIs is ₹.8,085 (62.39 per cent) per hectare during Kharif and ₹.7,434 (55.54 per cent) per hectare during Rabi. The savings in the paid-out costs is ₹.16,181 (33.45 per cent) per hectare during Kharif and ₹.13,009 (27.45 per cent) per hectare during Rabi season. But the crop yields have increased marginally (1.69 per cent) during Kharif and notable declined by (9.47 per cent) during Rabi. As the APCNF crop got marginally better price and significant savings in the costs, the net returns have increased by ₹24,686 (181.90 per cent) per hectare during Kharif and ₹9,389 (116.07 per cent) during Rabi season (Table 3.5).

Table 3.4: Cost of cultivation, yields and returns of Bengal gram under APCNF and Non-APCNF during Kharif and Rabi 2019-20

Item	Bengal gram in Rupee and quintals per hectare							
	Kharif 2019-20				Rabi 2019-20			
	APCNF	Non-APCNF	Differences between APCNF and non-APCNF		APCNF	Non-APCNF	Differences between APCNF and non-APCNF	
			In units	In per cent			In units	In per cent
1	2	3	4=2-3	5= (4/3) *100	6	7	8=6-7	9= (8/7) *100
Sample	70	53			19	35		
Seed	5,535	6,793	-1,259	-18.53	4,472	5,761	-1,289	-22.37
Fertilizers	-	9,309	-9,309	-100.00	-	11,037	-11,037	-100.00
Chemicals	-	3,649	-3,649	-100.00	-	2,347	-2,347	-100.00
Biological inputs	4,874	-	4,874		5,951	-	5,951	
PNPIs	4,874	12,958	-8,085	-62.39	5,951	13,385	-7,434	-55.54
FYM	641	778	-137	-17.60	-	35	-35	-100.00
Casual Male	1,214	841	373	44.42	2,694	949	1,744	183.76
Casual Female	8,159	14,336	-6,177	-43.09	9,362	11,846	-2,484	-20.97
Bullock Labour	565	596	-31	-5.21	130	377	-246	-65.46
Machine Labour	10,971	11,226	-255	-2.27	10,481	12,557	-2,076	-16.53
Implements	130	831	-701	-84.39	1,275	2,452	-1,177	-47.99
Water Fees	108	19	90	481.11	11	23	-12	-51.17
Yield (Quintals/Hectare)	16	15	0	1.69	14	16	-1	-9.47
Output Value	69,924	61,546	8,378	13.61	51,600	55,428	-3,828	-6.91

By-Product Value	529	402	127	31.50	256	46	209	450.68
Gross Return	70,453	61,948	8,505	13.73	51,855	55,474	-3,619	-6.52
Paid-out cost	32,197	48,377	-16,181	-33.45	34,377	47,385	-13,009	-27.45
Net Returns	38,257	13,571	24,686	181.90	17,478	8,089	9,389	116.07

Sources: IDSAP Field Survey 2019-20

3.2.5. Black gram

Black gram is one of the principal pulses grown in the state. It is grown on about 3.89 lakh hectare, i.e., 5 per cent of gross cropped area (GCA) in the state. It is grown in both the seasons under rainfed conditions. During Rabi, it is grown on post Paddy harvested fields in the Delta area with minimum inputs. However, there is a scope to reduce the expenditure on PNPIs and paid-out costs, especially during Kharif season. The APCNF farmers have saved ₹5,746 (48.08 per cent) per hectare in the expenditure on PNPIs during Kharif. However, the same is quite less ₹88 (3.54 per cent) during Rabi. More concern is an increase in the paid-out costs under APCNF during Rabi by ₹2,961 (21.12 per cent) per hectare⁴; which in turn, has resulted in lesser net returns during the Rabi season. On the other hand, the APCNF farmers have saved ₹6,718 (20.51 per cent) in paid-out costs per hectare and got ₹23,988 (67.08 per cent) per hectare, additional net returns during Kharif season (Table 3.5). As discussed elsewhere in the report, that APCNF is more effective to replace chemical inputs and to increase the crop yields under rainfed conditions proved, once again, true in this case.

Table 3.5: Cost of cultivation, yields and returns of Black gram under APCNF and Non-APCNF during Kharif and Rabi 2019-20

in Rupee and quintals per hectare

Item of Expenditure	Kharif 2019-20				Rabi 2019-20			
	APCNF	Non-APCNF	Differences between APCNF and non-APCNF		APCNF	Non-APCNF	Differences between APCNF and non-APCNF	
			In units	In per cent			In units	In per cent
1	2	3	4=2-3	5= (4/3)*100	6	7	8=6-7	9= (8/7)*100
Sample	64	19			57	41		
Seed	2,109	1,707	402	23.55	2,075	1,308	766	58.57
Fertilizers	-	8,902	-8,902	-100.00	-	1,551	-1,551	-100.00
Chemicals	-	3,050	-3,050	-100.00	-	923	-923	-100.00
Biological inputs	6,206	-	6,206		2,386	-	2,386	
PNPIs	6,206	11,953	-5,746	-48.08	2,386	2,474	-88	-3.54

⁴ Normally the farmers cultivate pulses such as Black gram, Green gram, and Bengal gram on the post Paddy fields with little or no inputs. Naturally APCNF cultivation, which involves mandatory application of biological inputs, would result in additional cost of cultivation. The yields may improve, if not immediately, gradually depending on soil and other conditions.

FYM	425	780	-356	-45.57	158	285	-128	-44.79
Casual Male	1,840	375	1,465	390.63	1,625	1,724	-99	-5.72
Casual Female	6,314	8,234	-1,920	-23.31	6,336	5,836	500	8.57
Bullock Labour	598	195	403	206.77	395	110	284	257.08
Machine Labour	7,882	9,246	-1,364	-14.76	3,668	2,164	1,504	69.51
Implements	384	221	163	73.70	141	79	62	77.99
Water Fees	278	42	235	556.71	193	34	159	460.88
Yield (Quintals/Hectare)	12.62	10.24	2.38	23.21	11.53	11.26	0.28	2.45
Output Value	85,450	68,277	17,173	25.15	75,723	73,531	2,192	2.98
By-Product Value	334	237	97	40.80	335	722	-387	-53.64
Gross Return	85,785	68,514	17,270	25.21	76,057	74,252	1,805	2.43
Paid-out cost	26,036	32,753	-6,718	-20.51	16,976	14,016	2,961	21.12
Net Returns	59,749	35,761	23,988	67.08	59,081	60,237	-1,156	-1.92

Sources: IDSAP Field Survey 2019-20

3.2.6. Maize

Maize is another important cereal crop. It is cultivated on about three lakh hectares (4 per cent of GCA) in the state. It has wider use and demand. It is being cultivated both during Kharif and Rabi seasons under rainfed conditions and irrigated dry conditions. Under APCNF, Maize has performed very well during year 2018-19 - has given higher yields and net returns during both Kharif 2018-19 and Rabi 2018-19 (CESS, 2020). However, Maize, under APCNF, has given less yields and returns during Kharif 2019-20. Relatively lesser APCNF Maize yields during Kharif 2019-20 was the result of an aberration (big jump) in non-APCNF maize yields. In the Rabi, the APCNF crop has registered 8.94 per cent higher yields and 21.31 per cent higher net returns. The crop also recorded large savings of 56.72 per cent during Kharif and 70.25 per cent during Rabi 2019-20 in the expenditure on PNPIs (Table 3.6)

Table 3.6: Cost of cultivation, yields and returns of Maize under APCNF and Non-APCNF during Kharif and Rabi 2019-20

Item of Expenditure	Kharif 2019-20				Rabi 2019-20			
	APCNF	Non-APCNF	Differences between APCNF and non-APCNF		APCNF	Non-APCNF	Differences between APCNF and non-APCNF	
			In units	In per cent			In units	In per cent
1	2	3	4=2-3	5= (4/3) *100	6	7	8=6-7	9= (8/7) *100
Sample	76	53			158	158		
Seed	5,553	5,904	-351	-5.94	6,284	6,073	211	3.48
Fertilizers	-	8,336	-8,336	-100	-	12,867	-12,867	-100
Chemicals	-	3,503	-3,503	-100	-	6,766	-6,766	-100
Biological inputs	5,124	-	5,124		5,841	-	5,841	
PNPIs	5,124	11,838	-6,715	-56.72	5,841	19,633	-13,792	-70.25
FYM	1,961	1,356	605	44.58	12,340	110	1,129	1,025.98
Casual Male	3,968	3,495	473	13.53	3,358	2,891	467	16.14

Casual Female	9,869	10,568	-699	-6.62	11,503	10,549	954	9.05
Bullock Labour	2,675	2,780	-104	-3.76	1,206	1,959	-752	-38.4
Machine Labour	7,866	8,979	-1,113	-12.4	9,427	7,779	1,647	21.18
Implements	204	299	-95	-31.88	1,220	634	586	92.46
Water Fees	334	843	-508	-60.33	1,761	1,030	730	70.87
Yield (quintals/hectare)	53.69	56.35	-2.66	-4.73	76.90	70.59	6.31	8.94
Output Value	92,968	1,03,280	-10,312	-9.98	1,20,277	1,14,841	5,436	4.73
Bye Product Value	2,008	3,393	-1,385	-40.83	767	1,107	-340	-30.72
Gross Return	94,976	1,06,673	-11,697	-10.97	1,21,044	1,15,948	5,096	4.39
Paid-out cost	37,554	46,063	-8,509	-18.47	41,839	50,658	-8,819	-17.41
Net Returns	57,422	60,610	-3,188	-5.26	79,205	65,290	13,915	21.31

Sources: IDSAP, Field Survey 2019-20

3.2.7. Red gram

Red gram is one of the principal pulses crop in the state. Since it is long duration crop, it is, usually, grown during Kharif season, under rainfed conditions. The Red gram crop is heavily concentrated in Anantapuramu, Prakasam, Kurnool and Guntur districts. It is, normally, grown as mixed crop with Groundnut and some other crops. The crop is grown on about 2.37 lakh hectare (3.1 per cent of GCA) in the state. It is one of the important food crops in the state. The study got the good data of Red gram for Kharif season. The same is presented at Table 3.7.

By adapting APCNF, the farmers have saved ₹.6,279 (58.83 per cent) per hectare in the expenditure on PNPIs; and ₹.9,069 (33.30 per cent) per hectare in paid-out costs. Though the APCNF yields have increased just by 6.2 per cent, the output value has increased by 18.34 per cent. Needless to say, that APCNF output got better prices. Due to the cumulative effect of costs savings, better yields and better price realization, the net returns of, APCNF farmers of Red gram, have increased by 361.43 per cent (₹.15,248) per hectare.

Table 3.7: Cost of cultivation, yields and returns of Red gram under APCNF and Non-APCNF during Kharif 2019-20

Indicator	APCNF	Non-APCNF	Differences between APCNF and non-APCNF	
			In units	In per cent
			4=2-3	5=(4/3)*100
Sample	116	58		
Seed	969	1,012	-43	-4.26
Fertilizers	-	6,687	-6,687	-100.00
Chemicals	-	3,985	-3,985	-100.00
Biological inputs	4,393	-	4,393	
PNPIs	4,393	10,672	-6,279	-58.83
FYM	1,412	1,033	379	36.65
Casual Male	871	1,176	-305	-25.91
Casual Female	3,964	5,420	-1,456	-26.87
Bullock Labour	1,509	1,689	-180	-10.68
Machine Labour	4,914	5,948	-1,034	-17.38

Implements	125	242	-117	-48.33
Water Fees	7	41	-33	-81.87
Yield (Quintals/Hectare)	6.47	6.09	0.38	6.20
Output Value	36,181	30,575	5,606	18.34
By-Product Value	1,449	877	572	65.21
Gross Return	37,630	31,452	6,178	19.64
Paid-out cost	18,164	27,233	-9,069	-33.30
Net Returns	19,466	4,219	15,248	361.43

Sources: IDSAP Field Survey 2019-20

3.2.8. Chillies

Chillies is important commercial crop in the state, grown on 1.51 lakh hectare (1.97 per cent) of GCA. It is grown in both seasons, mostly during Kharif. As the crop requires higher investments, it is considered as the risky crop. It is completely irrigated crop. As mentioned elsewhere in the report the crops with higher investment/ inputs offer a good scope for savings in the paid-out costs. By adapting APCNF, the farmers have saved ₹.83,905 (89.87 per cent) and ₹.22,337 (59.79 per cent) per hectare in the expenditure on PNPIs during Kharif and Rabi seasons respectively. They have saved ₹.61,320 (25.77 per cent) and ₹.27,460 (28.87 per cent) per hectare in the paid-out costs during Kharif and Rabi seasons respectively. In both seasons, the APCNF farmers have realized a better price for their chemical free output, especially during Rabi. While APCNF farmers got higher yields by 8.98 per cent during Kharif, their Chilly yields were less than that of non-APCNF farmers by 7.84 per cent (Table 3.8). Though the Rabi yields were lower than that of non-APCNF, the farmers have got ₹.1,04,533 per hectare higher net returns due to savings in the costs and better price realization.

Table 3.8: Cost of cultivation, yields and returns of Chillies under APCNF and Non-APCNF during Kharif and Rabi 2019-20

in Rupee and quintals per hectare

Item	Kharif 2019-20				Rabi 2019-20			
	APCNF	Non-APCNF	Differences between APCNF and non-APCNF		APCNF	Non-APCNF	Differences between APCNF and non-APCNF	
			In units	In per cent			In units	In per cent
1	2	3	4=2-3	5= (4/3) *100	6	7	8=6-7	9= (8/7) *100
Sample	36	39			14	14		
Seed	9,884	12,545	-2,661	-21.21	10,238	13,691	-3,453	-25.22
Fertilizers	-	53,291	-53,291	-100.00	-	25,872	-25,872	-100.00
Chemicals	-	40,068	-40,068	-100.00	-	11,486	-11,486	-100.00
Biological inputs	9,454	-	9,454		15,021	-	15,021	
PNPIs	9,454	93,359	-83,905	-89.87	15,021	37,358	-22,337	-59.79
FYM	1,907	63	1,843	2,908.90	1,412	927	485	52.38
Casual Male	7,449	5,203	2,246	43.17	3,689	1,772	1,917	108.19

Casual Female	1,18,559	1,00,591	17,968	17.86	25,576	30,799	-5,223	-16.96
Bullock Labour	5,459	4,619	840	18.19	1,730	1,052	678	64.43
Machine Labour	11,513	15,801	-4,288	-27.14	7,749	9,261	-1,513	-16.33
Implements	4,250	3,666	584	15.94	265	-	265	
Water Fees	8,117	2,064	6,053	293.27	1,971	251	1,720	686.27
Yield (Quintals/Hectare)	50	46	4	8.98	46	50	-4	-7.84
Output Value	6,24,899	5,59,099	65,801	11.77	6,37,832	5,60,759	77,073	13.74
By-Product Value	-	-	-		-	-	-	/0!
Gross Return	6,24,899	5,59,099	65,801	11.77	6,37,832	5,60,759	77,073	13.74
Paid-out cost	1,76,592	2,37,912	-61,320	-25.77	67,650	95,111	-27,460	-28.87
Net Returns	4,48,307	3,21,187	1,27,121	39.58	5,70,181	4,65,648	1,04,533	22.45

Sources: IDSAP Field Survey 2019-20

3.2.9. Green gram

Green gram is yet another important pulses crop grown in the state. It is grown on about 1.58 lakh hectare (2 per cent of GSA) in the state, completely under rainfed conditions. Though grown in both seasons, it is mostly grown during Rabi. It is predominately grown on post Paddy fields with minimum inputs in the Delta region. Hence, the scope for reduction in the expenditure on PNPIs and paid-out costs is limited. Major scope for improvements is:(1) yield improvement and (2) higher price realization. The study got sample data for Rabi season. However, the number of sample observation is small; hence did not include this crop in the Rabi report. The APCNF farmers have saved just ₹.163 per hectare in the expenditure on PNPIs. Actually, they have incurred ₹.2,465 (29.17 per cent) per hectare additional paid-out costs. As mentioned above that non-APCNF farmers grows Green gram and Black gram and other similar crops with zero or minimum inputs and investment during Rabi on post Paddy fields. There is little scope to reduce the costs under such condition. APCNF farmers may have to spend more on the mandatory biological inputs; consequently, on the paid cost vis-à-vis non-APCNF. The potential gains would be from: (1) increase in yields and (2) premium prices. As anticipated, the APCNF farmers got higher crop yields (14.62 per cent) and better price (about ₹.950 per quintal higher price) for the output. As a result, the APCNF farmers have earned ₹.14,062 (31.52 per cent) per hectare additional net returns, due to APCNF (Table 3.9). Given the sample size, the results must be treated as the anecdotal evidence only.

Table 3.9: Cost of cultivation, yields and returns of Green gram under APCNF and Non-APCNF during Rabi 2019-20

in Rupee and quintals per hectare

Item	APCNF	Non-APCNF	Differences between APCNF and non-APCNF	
			In units	In per cent
1	2	3	4=2-3	5= (4/3)*100
Sample	16	12		
Seed	1,524	1,079	445	41.19
Fertilizers	-	762	-762	-100.00
Chemicals	-	815	-815	-100.00
Biological inputs	1,414	-	1,414	
PNPIs	1,414	1,577	-163	-10.31
FYM	264	165	99	60.00
Casual Male	1,626	1,441	185	12.86
Casual Female	2,199	2,080	119	5.73
Bullock Labour	648	154	494	319.56
Machine Labour	2,824	1,900	924	48.60
Implements	267	18	250	1,425.75
Water Fees	152	39	113	289.59
Yield (Quinta/ hectare)	8.94	7.80	1.14	14.62
Output Value	68,995	52,803	16,191	30.66
By-Product Value	597	261	336	128.70
Gross Return	69,591	53,064	16,527	31.15
Paid-out cost	10,918	8,453	2,465	29.17
Net Returns	58,673	44,611	14,062	31.52

Sources: IDSAP Field Survey 2019-20

3.2.10. Jowar

Jowar is yet another cereal crop, grown during both Kharif and Rabi seasons. It is cultivated on about 1.35 lakh hectare (2 per cent of GCA). It is predominantly grown under the rainfed conditions, with less investment. As mentioned in the earlier reports, especially in IDSAP, (2020a), the scope for reduction in the expenditure on PNPIs and paid-out costs is less in the less resource intensive crops. As Jowar is one of the less resource intensive crops, it has recorded relatively less reduction in the expenditure on PNPIs; just ₹.986 in Kharif and ₹.3,961 in Rabi. The paid-out costs have declined just by ₹.480 per hectare during Kharif. However, the same is substantial- ₹.9,982 during Rabi. It may be noted that farmers, in the state, usually cultivate crops during Rabi with more investment and inputs. The only expectations are pulses taken on the post Paddy harvested fields. In Jowar also the farmers have invested more than double amount on fertilisers and pesticides during Rabi (₹.14,754 per hectare) compare to ₹.7001 per hectare investment during Kharif. The average investment on irrigation was ₹.7,298 per hectare vis-à-vis ₹.29 per hectare during Kharif. Because of the high investment, the formers normally get higher yields during Rabi compared to Kharif season. APCNF farmers have got 10.42 per cent higher Jowar yield compared to non-APCNF farmers during Kharif.

But the difference is quite less (1.88 per cent) during Rabi (Table 3.3). However, the net returns under APCNF are higher than that of non-APCNF by ₹.6,435 per hectare during Kharif and ₹.8,366 per hectare during Rabi.

Table 3.10: Cost of cultivation, yields and returns of Jowar under APCNF and Non-APCNF during Kharif and Rabi 2019-20

in Rupee and quintals per hectare

Item of Expenditure	Kharif 2019-20				Rabi 2019-20			
	APCNF	Non-APCNF	Differences between APCNF and non-APCNF		APCNF	Non-APCNF	Differences between APCNF and non-APCNF	
			In units	In per cent			In units	In per cent
1	2	3	4=2-3	5= (4/3)*100	6	7	8=6-7	9= (8/7)*100
Sample	76	39			16	36		
Seed	938	938	-0	-0.02	2,482	2,571	-89	-3.48
Fertilizers	-	5,151	-5,151	-100.00	-	6,672	-6,672	-100.00
Chemicals	-	1,850	-1,850	-100.00	-	8,083	-8,083	-100.00
Biological inputs	6,015	-	6,015		10,793	-	10,793	
PNPIs	6,015	7,001	-986	-14.08	10,793	14,754	-3,961	-26.85
FYM	706	1,259	-553	-43.93	-	-	-	
Casual Male	1,182	1,041	141	13.50	3,063	7,611	-4,548	-59.75
Casual Female	7,121	7,457	-335	-4.50	10,251	8,637	1,615	18.70
Bullock Labour	1,531	788	743	94.29	257	227	31	13.64
Machine Labour	7,308	6,827	481	7.04	8,057	9,315	-1,257	-13.50
Implements	113	84	30	35.34	4,899	2,743	2,156	78.57
Water Fees	30	29	0	1.49	3,371	7,298	-3,927	-53.81
Yield (quintals/hectare)	20.15	18.25	1.90	10.42	34.81	34.17	0.64	1.88
Output Value	53,061	46,437	6,623	14.26	61,495	63,429	-1,934	-3.05
By-product Value	5,692	6,361	-669	-10.52	1,409	1,091	318	29.12
Gross Return	58,753	52,799	5,954	11.28	62,904	64,520	-1,616	-2.51
Paid-out cost	24,943	25,424	-480	-1.89	43,175	53,157	-9,982	-18.78
Net Returns	33,810	27,375	6,435	23.51	19,729	11,363	8,366	73.62

Sources: IDSAP Field Survey 2019-20

3.2.11. Sugarcane

Sugarcane is important commercial crop in the state. Mostly grown under irrigation conditions. It is a year-long crop, predominantly sown and harvested during Rabi. It is mainly cultivated in Visakhapatnam, Chittoor, Krishna, Vizianagaram, East Godavari and West Godavari districts; and farmers will not take up this crop without assured and adequate public and/ or own irrigation sources. It is cultivated on about 1.23 lakh hectares (1.61 per cent) of GCA. Though it is considered as Rabi crop, the research team has collected Kharif data up to February end and covered some Rabi crops, especially in the CCEs. Sugarcane was covered in the Kharif sample. Due to Covid 19 related restrictions, the team could not get complete the Sugarcane

CCE for Rabi sample. Hence the crop is shown as Kharif crop in this report. The data is presented at Table 3.11.

Sugarcane crop needs a lot of irrigation. As there are no irrigation charges and electricity is supplied freely for agriculture, the cost of irrigation of any crop is very low in the state. Hence, the scope for saving on the irrigation cost is limited in case of Sugarcane and also in all other heavily irrigated crops. In fact, APCNF farmers have incurred ₹.493 per hectare higher cost on irrigation. However, APCNF farmers have saved ₹.4,711 (43.26 per cent), ₹.4,124 (16.77 per cent) and ₹.3,304 (3.32) per hectare in costs of PNPIs, machine labour, and paid-out costs respectively. Though the APCNF yields are marginally less than that of non-APCNF by 9 quintals (1.12 per cent), the APCNF farmers got over 10 per cent higher price and higher value for the output. One of the major reasons for the higher price realization is that some of the APCNF farmers have prepared Jaggary and realized higher values for their production. In total the APCNF farmers got ₹.20,816 (18.81 per cent) per hectare higher net returns.

Table 3.11: Cost of cultivation, yields and returns of Sugarcane under APCNF and Non-APCNF during Kharif 2019-20

Indicator	APCNF	Non-APCNF	in Rupee and quintals per hectare	
			Difference between APCNF and non-APCNF	
			In units	In per cent
1	2	3	4=2-3	5= (4/3) *100
Sample	70	30		
Seed	13,261	12,170	1,092	8.97
Fertilizers	-	8,013	-8,013	-100.00
Chemicals	-	2,877	-2,877	-100.00
Biological inputs	6,179	-	6,179	
PNPIs	6,179	10,890	-4,711	-43.26
FYM	2,161	3,136	-974	-31.07
Casual Male	27,848	23,994	3,854	16.06
Casual Female	22,062	23,408	-1,346	-5.75
Bullock Labour	867	-	867	
Machine Labour	20,471	24,595	-4,124	-16.77
Implements	2,611	1,065	1,546	145.08
Water Fees	864	371	493	132.76
Yield (Quintals/Hectare)	778	787	-9	-1.12
Output Value	2,22,846	2,02,285	20,562	10.16
By-Product Value	4,935	7,985	-3,049	-38.19
Gross Return	2,27,782	2,10,269	17,512	8.33
Paid-out cost	96,326	99,630	-3,304	-3.32
Net Returns	1,31,456	1,10,640	20,816	18.81

Sources: IDSAP Field Survey 2019-20

3.2.12. Sesamum

Sesamum is important oilseed crop in the north-coastal districts and Prakasam district. It is grown on about 0.61 lakh hectares in the state. It is grown in both seasons, slightly higher during Rabi season. The study got the crop data during the Rabi season. The same is presented at Table 3.12. As per the data, the crop is, usually, grown with very little investments and inputs under the chemical-based agriculture. Hence there is little scope for reduction of costs in this crop. In fact, the expenditure on PNPIs has increased by 91.02 per cent (₹.1,798 per hectare) due to APCNF; and the paid-out costs have increased by ₹.3,394 (23.68 per cent) per hectare. As mentioned elsewhere in this report the scope for increasing yields is high in these kinds (low input/ investment) crops, proved to be true in case of Sesamum. The crop yields have increased by 32.78 per cent (1.3 quintal per hectare). Purely because of yield effect, the net returns have increased by 32.57 per cent (₹.5,372 per hectare) due to APCNF.

Table 3.12: Cost of cultivation, yields and returns of Sesamum under APCNF and Non-APCNF during Rabi 2019-20

in Rupee and quintals per hectare

Item	APCNF	Non-APCNF	Differences between APCNF and non-APCNF	
			In units	In per cent
1	2	3	4=2-3	5=(4/3)*100
Sample	67	67		
Seed	1,221	1,243	-21	-1.70
Fertilizers	-	746	-746	-100.00
Chemicals	-	1,228	-1,228	-100.00
Biological inputs	3,772	-	3,772	
PNPIs	3,772	1,975	1,798	91.02
FYM	368	697	-329	-47.27
Casual Male	502	356	146	41.02
Casual Female	4,376	3,226	1,150	35.66
Bullock Labour	918	817	100	12.29
Machine Labour	5,433	4,955	479	9.66
Implements	568	248	320	129.09
Water Fees	568	817	-249	-30.46
Yield (Qtls./Hectare)	5.26	3.96	1.30	32.78
Output Value	39,506	30,732	8,774	28.55
By-Product Value	83	92	-9	-9.34
Gross Return	39,589	30,824	8,766	28.44
Paid-out cost	17,727	14,333	3,394	23.68
Net Returns	21,862	16,491	5,372	32.57

Sources: IDSAP Field Survey 2019-20

3.2.13. Ragi

Though the sample size is not adequate for Ragi in both seasons, the results are discussed here. The comparative analyses may be considered as anecdotal evidence only. Ragi is another

important cereal crop in the state, being cultivated during both the seasons. The crop is grown on about 0.34 lakh hectares together in both the seasons. It is mostly cultivated under the rainfed conditions during Kharif and under both irrigated and rainfed conditions during Rabi. It is also cultivated with less investment and inputs, especially, under rainfed conditions. As a result, there are very less savings in the expenditure on PNPIs during Kharif (₹.620 per hectare) and Rabi (₹.821 per hectare). However, the savings in paid-out costs is over ₹.10,000 per hectare during Kharif and over ₹.4,000 during Rabi season. The major savings were obtained in hired labour and machine labour during Kharif and machine labour during Rabi. It may be due to improvement in the soil quality (softening of soil). According to the farmers, in a few FGDs, the need for ploughing has declined due to APCNF. Further, they said that the need for intra-season operations have also declined under APCNF. The practices such as mulching and maintenance of continues green cover in the APCNF fields, have resulted in less weed growth. As mentioned above that scope for yield improvement is quite high, among the low investment/ input crops, under APCNF. The Ragi yields, under APCNF, are higher than that of non-APCNF by 4 quintals (23.26 per cent) per hectare during Kharif. Surprisingly, the yields of Ragi during Rabi are less than that of Kharif for both APCNF and non-APCNF farmers.⁵ More surprising is that the APCNF yields are lower than that of non-APCNF by 3.62 per cent during the Rabi, which has, in turn, resulted in a lower net-returns, for APCNF farmers (Table 3.13). It may an aberration, may be due to a smaller number of sample observations, or any other specific reason.

Table 3.13: Cost of cultivation, yields and returns of Ragi under APCNF and Non-APCNF during Kharif and Rabi 2019-20

in Rupee and quintals per hectare

Item of Expenditure	Kharif 2019-20				Rabi 2019-20			
	APCNF	Non-APCNF	Differences between APCNF and non-APCNF		APCNF	Non-APCNF	Differences between APCNF and non-APCNF	
			In units	In per cent			In units	In per cent
1	2	3	4=2-3	5=(4/3)*100	6	7	8=6-7	9=(8/7)*100
Sample	89	25			23	29		
Seed	572	524	48	9.17	739	947	-208	-21.92
Fertilizers	-	3,153	-3,153	-100.00	-	5,541	-5,541	-100.00
Chemicals	-	148	-148	-100.00	-	620	-620	-100.00
Biological inputs	3,922	-	3,922		5,340	-	5,340	
PNPIs	3,922	3,301	620	18.80	5,340	6,161	-821	-13.33
FYM	1,266	1,599	-333	-20.82	510	1,090	-580	-53.19

⁵ One possible reason could be inclusion of late Kharif and early Rabi sown fields in the Kharif sample to meet the target.

Casual Male	408	1,413	-1,005	-71.13	2,269	2,314	-45	-1.94
Casual Female	5,192	11,239	-6,047	-53.80	11,931	12,071	-140	-1.16
Bullock Labour	257	1,601	-1,344	-83.96	430	818	-388	-47.43
Machine Labour	2,054	4,077	-2,023	-49.62	5,404	7,773	-2,369	-30.48
Implements	125	-	125		-	121	-121	-100.00
Water Fees	53	95	-42	-43.83	850	298	552	185.57
Yield (Quintals/Hectare)	21	17	4	23.26	16	16	-1	-3.62
Output Value	74,792	58,965	15,827	26.84	55,337	60,273	-4,936	-8.19
By-Product Value	7,399	10,643	-3,244	-30.48	6,153	8,998	-2,845	-31.62
Gross Return	82,191	69,607	12,584	18.08	61,490	69,271	-7,781	-11.23
Paid-out cost	13,849	23,850	-10,001	-41.93	27,474	31,592	-4,118	-13.04
Net Returns	68,342	45,757	22,584	49.36	34,016	37,679	-3,663	-9.72

Sources: IDSAP Field Survey 2019-20

3.2.14. Onion

Onion is important vegetable crop in the state. It is one of the high risks and high profitable crops, involves higher investment. It is grown on about 0.32 lakh hectare (0.42 per cent of GCA) in the state. About 74 per cent of total cropped area is in Kurnool district only. YSR Kadapa and Anantapur other important Onion growing districts in the state. It is predominantly grown under irrigation dry conditions. Though grown in both seasons, it is mostly grown during Kharif season. The field data obtained in the study is presented at Table 3.12. As Onion is resource intensive crop, there are ample opportunities to save in the cost of cultivation. By adapting APCNF, the farmers have saved ₹.2,463 (31.7 per cent), ₹.30,500 (74.40 per cent) and ₹.42,248 in the costs of seeds, PNPIs costs and paid-out costs respectively during Kharif 2019-20. While APCNF yields were higher and fetched higher prices during Kharif season, it was opposite during Rabi season. Despite lower yields and realizing lower price, the APCNF farmers got ₹.12,198 (13.27 per cent) per hectare higher net returns due to substantial decline in the paid-costs by ₹.51,942 (42.41 per cent) per hectare during Rabi season. Due to higher yields and better price realization and substantial reduction in the paid-out costs, during Kharif, the farmers have got ₹.1,62,398 (43.06 per cent) per hectare higher net returns (Table 3.14). Needless to say, that because of small sample size the results were not used in the estimation of project level benefits and state level potential benefits in the Kharif Report (IDSAP, 2020a); and also, in the household incomes presented in the next chapter.

Table 3.14: Cost of cultivation, yields and returns of Onion under APCNF and Non-APCNF during Kharif and Rabi 2019-20

in Rupee and quintals per hectare

Item	Kharif 2019-20				Rabi 2019-20			
	APCNF	Non-APCNF	Differences between APCNF and non-APCNF		APCNF	Non-APCNF	Differences between APCNF and non-APCNF	
			In units	In per cent			In units	In per cent
1	2	3	4=2-3	5= (4/3)*100	6	7	8=6-7	9= (8/7)*100
Sample	34	17			32	51		
Seed	5,308	7,771	-2,463	-31.70	10,129	18,066	-7,937	-43.93
Fertilizers	-	27,630	-27,630	-100.00	-	32,882	-32,882	-100.00
Chemicals	-	13,367	-13,367	-100.00	-	20,493	-20,493	-100.00
Biological inputs	10,497	-	10,497		11,595	-	11,595	
PNPIs	10,497	40,997	-30,500	-74.40	11,595	53,376	-41,781	-78.28
FYM	3,713	3,800	-87	-2.28	-	775.3	-775	-100.00
Casual Male	2,523	1,321	1,202	91.04	817.3	855.0	-38	-4.41
Casual Female	30,870	39,091	-8,221	-21.03	34,313.2	33,438.7	875	2.62
Bullock Labour	2,308	1,067	1,240	116.21	2,330.7	909.5	1,421	156.25
Machine Labour	10,139	12,036	-1,896	-15.76	9,757.9	12,976.9	-3,219	-24.81
Implements	160	-	160		-	710.7	-711	-100.00
Water Fees	359	2,042	-1,683	-82.41	1,586.4	1,363.5	223	16.35
Yield (Qntl/Hectare)	213	195	18.25	9.36	173.4	197.9	-24	-12.35
Output Value	6,02,131	4,82,982	1,19,149	24.67	1,74,661.3	2,14,404.8	-39,744	-18.54
By-Product Value	-	-	-		-	-	-	
Gross Return	6,02,131	4,82,982	1,19,149	24.67	1,74,661.3	2,14,404.8	-39,744	-18.54
Paid-out cost	65,877	1,08,125	-42,248	-39.07	70,529.1	1,22,470.8	-51,942	-42.41
Net Returns	5,36,254	3,74,857	1,61,398	43.06	1,04,132.3	91,934.0	12,198	13.27

Sources: IDSAP Field Survey 2019-20

3.2.15. Turmeric

Turmeric is one of important spices crop in the state. It was grown on over 0.20 lakh ha, covering about 0.28 per cent of GCA in the state during 2018-19. It is predominantly grown during Kharif season, mostly with irrigation. The costs, yields and returns of Turmeric during Kharif season 2019-20 are shown at Table 3.15. Turmeric is one of the resource intensive crop, needing higher investments. Hence there is a scope for reduction in the cost of cultivation through APCNF. Through the adaption of APCNF, the farmers have saved ₹.31,685 (67.72 per cent) per hectare on PNPIs, ₹.15,303 (26.36 per cent) on female hired labour, ₹.7,613 (33.34 per cent) on machine labour and ₹.62,243 (32.27 per cent) per hectare in total paid-out costs. The farmers have also got 11.08 quintal (9.7 per cent) per higher yields. Because of higher yields and significant savings in total paid-out costs, the farmers got ₹.1,35,844 (26.20 per cent)

per hectare higher net returns due to APCNF. The excitement of such spectacular results is dampened by the smaller size of non-APCNF sample. Needless to say, that these results are not used in the estimates of the macro benefits and household incomes in the next two chapters.

Table 3.15: Cost of cultivation, yields and returns of Turmeric under APCNF and Non-APCNF during Kharif 2019-20

Indicator	APCNF	Non-APCNF	Gap between APCNF & non-APCNF	
			In units	In percentages
1	2	3	4=2-3	5=(4/3)*100
Sample	56	17		
Seed	27,072	24,632	2,440	9.91
Fertilizers	-	28,463	-28,463	-100.00
Chemicals	-	18,325	-18,325	-100.00
Biological inputs	15,103	-	15,103	
PNPIs	15,103	46,788	-31,685	-67.72
FYM	6,790	13,078	-6,288	-48.08
Casual Male	14,092	11,793	2,299	19.49
Casual Female	42,760	58,063	-15,303	-26.36
Bullock Labour	10,085	13,009	-2,924	-22.48
Machine Labour	15,219	22,832	-7,613	-33.34
Implements	3,651	7,369	-3,718	-50.45
Water Fees	2,006	1,456	550	37.74
Yield (Quintals/Hectare)	125.32	114.24	11.08	9.70
Output Value	7,90,939	7,17,538	73,401	10.23
By-Product Value	200	-	200	
Gross Return	7,91,139	7,17,538	73,601	10.26
Paid-out costs	1,36,778	1,99,021	-62,243	-31.27
Net Returns	6,54,361	5,18,516	1,35,844	26.20

Sources: IDSAP Field Survey 2019-20

3.3. Other benefits

As can be seen above, the farmers were able to save substantial amounts on plant nutrients and plant protection without any significant loss in the output of almost all crops. *Another important benefit of APCNF is that it has resulted in a significant reduction in farmers' exposure to the input market.* It is well known fact that farmers have to procure each and every item of chemical inputs for plant nourishment and plant protection from the market. As the chemical inputs form the major component in the conventional/ non-APCNF farming, the farmers' major worry, always, is timely procurement and application of agri-chemical inputs. To procure those inputs the farmers, often, enter into credit agreements with the input suppliers with unfair terms or borrow money with exploitative terms and conditions. The scenario has been changing. Apart from the monetary issues, the adulteration of agri-chemical inputs, especially, the pesticides pose another set of risks to the farmers. APCNF farming has relieved the participating farmers from those risks, exploitations and vulnerabilities. Another benefit of

biological inputs is their long term and cascading benefits to the farmers and farming. Normally the impact of chemical inputs lasts for very short period of time. All their positive benefits would end with the harvesting of the crop. The inputs have to be applied in subsequent season/ year in the same dose or package. On the other hand, the toxic residuals of chemical inputs not only pollute the natural resources such as land/ soils, water bodies, atmosphere, but also adversely affect the health of human beings and other living beings for longer periods. In sharp contrast, the positive benefits of biological inputs last long and have benevolent cascading effects. The negative⁶ impact, if any, would be short lived. The reduction in the cost of cultivation of resource intensive crops has resulted in APCNF farmers' borrowings from all sources, especially, from input suppliers and non-institutional sources going down sharply. The point is confirmed in some of the FGDs.

3.4. Conclusions

Normally the farmers in the state used to raise certain crops such as Paddy, Cotton, Chillies, Horticulture-crops, Sugarcane, etc., with higher investments/ higher doses of inputs such as fertilizers, pesticides, irrigation. These crops are also known as resource intensive crops. Some of these crops often referred as high risks and high profitable crops. On the other hand, they used to grow many crops such as pulses, oilseeds, coarse and minor cereals, etc., under rainfed conditions, with minimum inputs. Shortage of funds/ cash flows is, often, cited reason for such practice. In fact, as per some FGDs, some farmers have been leaving their land fallow, due to the shortage of working capital. The results clearly show that APCNF has resulted in the substantial savings in the paid-out costs, especially, in the resource intensive crops. More heartening is that substantial costs savings were achieved without any noteworthy declines in the yields. APCNF has resulted in a significant increase in the yields of some less resource intensive crops. The net returns in almost all sample crops have increased. Most of them are significantly.

⁶ The common negative features, reported in the field, of biological inputs are (1) foul smell during the preparation of the cultures, (2) higher demand on the family labour, (3) shortage of raw materials, (4) production losses in the initial years in a few crops, etc.

Chapter 4: Panel study

4.1. Introduction

To assess the changes over the time, due to APCNF, the IDSAP has planned to conduct the panel study also as part of the overall APCNF impact assessment process. For this purpose, 260 sample farmers were identified as the panel farmers from 2018-19 sample farmers. The panel farmers have spread across all 13 districts, at the rate of 20 from two village, per districts. The same farmers were visited during 2019-20 study. Effectively they were treated as 2019-20 sample farmers in all respects. The data obtained from the panel farmers was included in the cross-section analyses of this report and also in earlier reports, i.e., Kharif and Rabi Reports (IDSAP, 2020a and 2020b). In this chapter, the data obtained from the panel farmers in 2018-19 and 2019-20 are, together, analysed to know the changes during these two year. While other chapters, in the report, focus on the differences between APCNF and non-APCNF farmers' outcomes, this chapter analyses the changes in the APCNF farmers outcomes in 2019-20 over that of 2018-19. This chapter covers all changes, such as changes in cost of crop cultivation, yields, and gross and net returns, environmental and health benefits. As this is just two years data, the analysis is simple and straight forward. The data collected from 260 panel farmers during Kharif season in 2018-19 and 2019-20 is used in this chapter.

4.2. Crop wise analysis

The panel farmers have cultivated four common crops during two years. The common crops are Paddy, groundnut, Bengal gram and Red gram. Changes in each crop during two reference years are discussed below. It may be noted that the changes obtained in the below analyses are due to farmers' experience in APCNF. Farmers might have or might not have cultivated same crop in the same field/ plot in both the years. As farmers are not putting their entire operational area under APCNF, the plots cultivated under APCNF in 2019-20, might be or might not be under APCNF in 2018-19. What is, obviously, common is the farmers and his experience only. It may also be noted that sample size of only Paddy is sufficient to provide conclusive evidence. The results of remaining three crops may be treated as anecdotal evidence, which gives a number of insights.

4.2.1. Paddy

The details of the Paddy crop cultivated by the panel farmers is presented at Table 4.1. Overall, there is an increase in paid-out cost by ₹.3,684 (9.90 per cent). Major contributory factor in the increased paid-out costs is machine labour (₹.2,204)⁷. There are marginal increases in the expenditure on biological inputs (₹.477), FYM (₹.624) and hired labour (₹.436). It may be noted that the application of FYM, normally, not only depends on the need, but also on availability of the material⁸. The panel farmers have achieved an increase of five quintal per hectare Paddy during 2019-20 over that of 2018-19. This 11.71 per cent increase in yield could be mostly attributed to the experience and expertise of the panel APCNF farmers. Purely due to higher yields, the farmers got ₹.9,615 (10.07 per cent) and ₹.5,932 (11.59 per cent) higher gross and net returns respectively during 2019-20.

Table 4.1: Changes in cost of cultivation, yields and returns of Paddy under APCNF during 2018-19 & 2019-20

Sample is in number, area is in hectares, yield in quintals and all other in ₹.

Indicator	2018-19	2019-20	Change in 2019-20 over 2018-19	
			In units	In per cent
Sample	103	175	72	69.90
Area cultivated in hectare	47.86	81.76	33.90	70.83
Seed	2,332	2,407	75	3.21
Biological inputs	4,153	4,630	477	11.48
FYM	1,049	1,673	624	59.50
Hired Labour	17,485	17,921	436	2.49
Bullock Labour	499	473	-26	-5.20
Machine Labour	10,713	12,917	2,204	20.57
Implements	446	406	-40	-9.04
Others	528	462	-66	-12.53
Yield (Qtls/ hectare)	45.64	50.99	5.34	11.71
Price (₹. per quintal)	1,889	1,871	-19	-0.99
Value of output	86,235	95,376	9,141	10.60
By-product value	2,147	2,621	474	22.07
Gross Returns	88,382	97,997	9,615	10.88
Paid-out Cost	37,205	40,889	3,684	9.90
Net Returns	51,176	57,108	5,932	11.59

Sources: IDSAP Field Survey, 2019-20

⁷ One of the possible reasons could be that some Panel farmers might have brought in fallow lands into cultivation. Such trend was reported in many FGDs.

⁸ As per the FGDs, the number of cows, in some villages, are increasing, after introduction of APCNF. For example, in Pathurnatham village of Chittoor district, the number of cows has increased from 6 to 53 after APCNF. Similar trend was reported in few other FGDs. As per the household data, the incidence of livestock holding is higher among the APCNF farmers compared to non-APCNF farmers. Increase in livestock, naturally, leads to an increase in the supply of FYM and its application in the fields. The increase in waste from cattle rearing is naturally applied as FYM in the fields, irrespective of the need. In any case is a critical need to increase soil corban in the state. FYM is one of methods to increase the soil corban.

4.2.2. Groundnut

The number of farmers cultivating Groundnut, among panel farmers, has increased from 21 in 2018-19 to 34 in 2019-20. During the same period, area under the crop has increased from 16.93 hectare to 40.39 ha; an increase of 138.58 per cent. On the cost side, the major change is a steep increase (272.91 per cent) in the expenditure on biological inputs. The possible reason could be that the farmers might have gained confidence to invest on the biological inputs. Higher demand from a greater number of farmers and larger cultivated area may be another reason. There are no noteworthy differences in the expenditure on other items during the two study years. The steep increase in the expenditure on the biological inputs, in turn, has resulted in over 17 per cent increase in the paid-out costs. Seemingly, the Groundnut farmers have under invested during 2018-19. Apparently, it has also resulted in a 4.41 quintal (25.42 per cent) increase in the groundnut yield in 2019-20 over 2018-19. Because of a significant increase in yield, and despite a marginal fall in the output price, the gross and net returns have increased by ₹.24,085 (23.17 per cent) and ₹.17,433 (26.75 per cent) respectively (Table 4.2).

Table 4.2: Changes in cost of cultivation, yields and returns of Groundnut under APCNF during 2018-19 & 2019-20

Sample is in number, area is in hectares, yield in quintals and all other in ₹.

Indicator	2018-19	2019-20	Change in 2019-20 over 2018-19	
			In units	In per cent
Sample size	21	34	13	61.9
Area cultivated	16.93	40.39	23.46	138.58
Seed cost	13,331	12,904	-427	-3.2
Biological inputs cost	2,396	8,935	6,539	272.91
FYM costs	147	436	289	196.66
Hired Labour cost	10,994	11,295	301	2.74
Bullock Labour cost	749	699	-50	-6.69
Machine Labour cost	10,967	10,920	-46	-0.42
Implements cost	12	74	62	529.13
Other costs	174	158	-16	-9.47
Yield (quintal/ hectare)	17.34	21.75	4.41	25.42
Price ₹. per quintal	5,663	5,607	-56	-0.99
Output Value	98,219	1,21,968	23,749	24.18
By-product value	5,724	6,059	335	5.86
Gross returns	1,03,943	1,28,028	24,085	23.17
Paid-out cost	38,770	45,421	6,651	17.16
Net returns	65,173	82,606	17,433	26.75

Sources: IDSAP Field Survey, 2019-20

4.2.3. Bengal gram

During the study period, while the number of farmers has increased from 9 to 14, the area cultivated has increased by one hectare only. There are no notable changes in the expenditure on different inputs and also in the paid-out cost of Bengal gram. The yield has increased by 1 quintal (7.58 per cent) in 2019-20. Despite a marginal decline in the output price, in 2019-20, the gross and net returns have increased by ₹.3,701 (5.99 per cent) and ₹.3,743 (14.38 per cent) respectively, due to the increase in the yield (Table 4.3).

Table 4.3: Changes in cost of cultivation, yields and returns of Bengal gram under APCNF during 2018-19 & 2019-20

Sample is in number, area is in hectares, yield in quintals and all other in ₹.

Indicator	2018-19	2019-20	Change in 2019-20 over 2018-19	
			In units	In per cent
Sample size	9	14	5	55.56
Area cultivated	8.86	9.71	0.85	9.59
Seed cost	6,270	6,750	480	7.66
Biological inputs cost	3,419	3,219	-199	-5.83
FYM costs	-	-	-	-
Hired Labour cost	11,484	11,914	430	3.75
Bullock Labour cost	-	-	-	-
Machine Labour cost	14,246	13,714	-532	-3.73
Implements cost	46	88	42	92.86
Other costs	265	-	-265	-100.00
Yield (quintal/ hectare)	15.80	17.00	1.20	7.58
Price ₹. per quintal	3,902	3,844	-58	-1.50
Output Value	61,660	65,340	3,681	5.97
By-product value	110	130	20	18.06
Gross returns	61,770	65,470	3,701	5.99
Paid-out cost	35,729	35,686	-43	-0.12
Net returns	26,041	29,784	3,743	14.38

Sources: IDSAP Field Survey, 2019-20

4.2.4. Red gram

Though the number of sample Red gram cultivators has declined from 14 in 2018-19 to 11 in 2019-20, the area under the crop has increased by 1.84 hectare (14.77 per cent). The expenditure on hired labour has increased, in 2019-20, by ₹.1,319 (232.47 per cent). The expenditure on bullock labour has increased by ₹.598 (99.56 per cent) and the expenditure on machine labour has declined by 785 (25.52 per cent). The possible reason could be, as claimed by the promoters of the natural farming, that APCNF needs less, in fact no, ploughing, eventually. The soil naturally softens. The farmers, in a few FGDs, too claimed that soils have softened and needs less ploughing. In fact, most, if not majority, of APCNF farmers have reported that soil has softened after the initiation of APCNF. One of the possible reasons for

steep increase in the expenditure on hired labour could be increase in yield by 43.49 per cent. The output has also fetched marginally a higher price. Because of steep increase in yield and better price realization, the gross and net returns have increased by ₹.12,849 (45.29 per cent) and ₹.11,665 (58.63 per cent) respectively.

Table 4.4: Changes in cost of cultivation, yields and returns of Red gram under APCNF during 2018-19 & 2019-20

Sample is in number, area is in hectares, yield in quintals and all other in ₹.

Indicator	2018-19	2019-20	Change in 2019-20 over 2018-19	
			In units	In per cent
Sample size	14	11	-3	-21.43
Area cultivated	12.46	14.3	1.84	14.77
Seed cost	1,079	1,103	23	2.15
Biological inputs cost	1,735	1,721	-14	-0.79
FYM costs	1,287	1,326	38	2.97
Hired Labour cost	568	1,887	1,319	232.47
Bullock Labour cost	600	1,198	598	99.56
Machine Labour cost	3,077	2,291	-785	-25.52
Implements cost	131	135	4	2.92
Other costs	-	-	-	-
Yield (quintal/ hectare)	6.07	8.71	2.64	43.49
Price ₹. per quintal	4,563	4,640	77	1.69
Output Value	27,703	40,422	12,719	45.91
By-product value	670	800	130	19.44
Gross returns	28,373	41,222	12,849	45.29
Paid-out cost	8,477	9,661	1,184	13.96
Net returns	19,896	31,561	11,665	58.63

Sources: IDSAP Field Survey, 2019-20

As this analysis is confined to APCNF farmers' experience in two years, one cannot expect a spectacular variation in the costs, yields and prices. One, obvious, expectation is an increase in the yields. The experience of four crops during last two years is on expected lines. There are some crop and context specific variation in the expenditure on different inputs. The steep increase in the expenditure on biological input, as mentioned above, may be due to underinvestment by the farmers in the first year. RySS may monitor and guide the new participants in the program, rather closely. As expected, and hoped, the yields of all four crops have increased; a couple of them have registered impressive growth rates of 25 per cent and 43 per cent.

4.3. Other benefits, issues and challenges

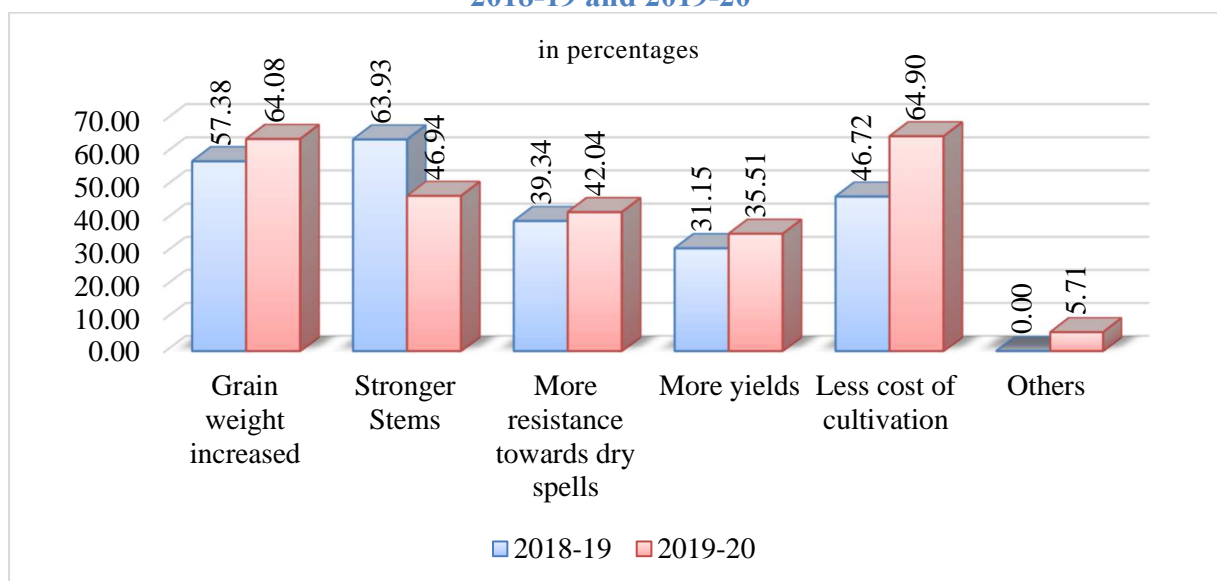
Changes in the perceived or experienced benefits and issues and challenges have been analysed in this section. While there is a continuance of reluctance to continue in the agriculture, farmers

are liking APCNF. There is a decline in the proportion of the farmers liking agriculture from 93.60 per cent in 2018-19 to 92.85 per cent in 2019-20. At the same time, the percentage of farmers wishing to continue APCNF has increased from 96.80 per cent to 100 per cent. The proportion of APCNF farmers, who find APCNF food is tasty, has increased from 83.20 per cent to 89.34 per cent during last two years. The detailed issues and challenges in this section are grouped into economic benefits, environmental benefits, working capital and challenges.

4.3.1. Economic benefits

Though the characteristics of APCNF crops such as heavy grains, strong stems, resistance to weather variations are quality improvements, these would result in higher and stable output and by-products and can be monetized. Hence these are referred as economic benefits here. Major improvement in the farmers' perception is noticed in cost of cultivation. About 65 per cent farmers have reported, in 2019-20, that APCNF has reduced the cost of cultivation. The same was about 47 per cent in 2018-19. Compared to 2018-19, while a greater number of farmers (7 percentage points) stated that APCNF grains are heavier; lesser number of farmers (17 percentage points) said that stems of APCNF crop are strong, in 2019-20. In the participants in many FGDs said that APCNF crops' colour and appearance are less attractive compared chemical-based crops. If that were the case, the assumption that stems of APCNF crops are strong, needs to be reviewed. Relatively higher number of farmers (3 percentage points) have testified that APCNF crops are more resistant to weather anomalies such as drought, longer dry spells, moisture stress, heavy rains, untimely rains, flooding, heavy winds, etc., in 2019-20. The percentage of farmers, who said that APCNF would increase the yield, has increased from 31.15 per cent in 2018-19 to 35.51 per cent in 2019-20 (Figure 4.1).

Figure 4.1: APCNF farmers' perception about economic benefits from APCNF during 2018-19 and 2019-20

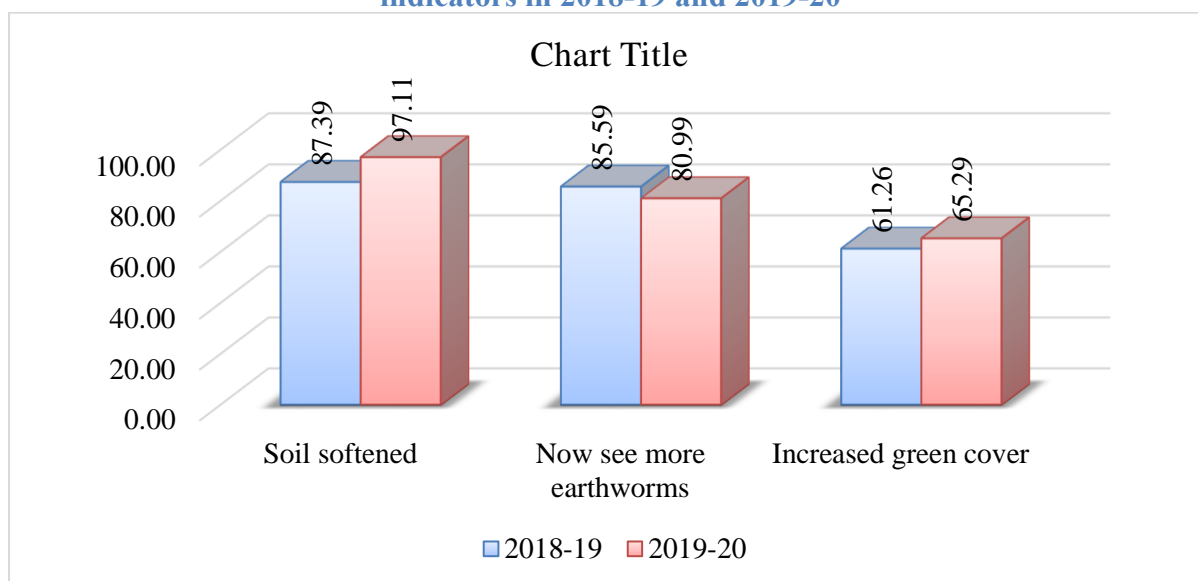


Sources: IDSAP Field Survey, 2019-20

4.3.2. Soil quality improvement

The APCNF farmers were asked their response with respect to soil quality improvement indicators. The indicators considered are: (1) softening of soil, (2) visibility of earthworms and (3) improvement in green cover in the fields. Their responses are presented at Figure 4.2. Over 87 per cent of farmers, in 2018-19, have confirmed the softening of soils due to APCNF. The same has increased further to over 97 per cent in 2019-20. The number of farmers, who have experienced a higher number of earthworms in their fields, has declined from 85.59 per cent in 2018-19 to 80.99 per cent in 2019-20. One of the possible reasons could be that the earthworms may be moving freely and swiftly due to softening of the soils. Relatively less proportion of farmers (61.26 per cent in 2018-19 and 65.29 per cent in 2019-20) have witnessed an increase in green cover in their fields. It may be noted, that RySS is encouraging the farmers to take up the pre-monsoon dry sowing (PMDS) to increase the green cover in the fields. The PMDS is given a major push, in recent times.

Figure 4.2: Percentage of APCNF farmers confirmed improvement in soil quality indicators in 2018-19 and 2019-20



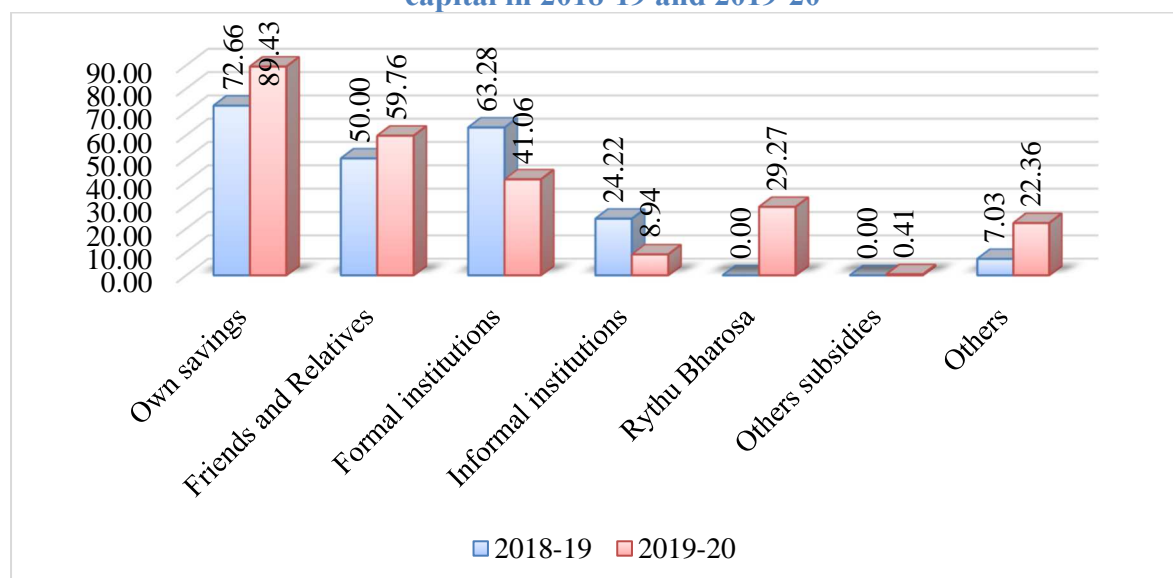
Sources: IDSAP Field Survey, 2019-20

4.3.3. Source of working capital

Shortage of working capital is the major challenge for the farmers in India and in the state. Because of shortage of working capital, farmers usually under invest on some crops, especially the on the rainfed crops. Some of the farmers also leave a part of their fields fallow. Because of their “less creditworthiness”, the small and medium farmers borrow from multiple sources, especially from informal sources at higher rate of interest and with unfair conditions. Because of these reasons, the poor farmers remain in the vicious circle of poverty. In this section the changes in experience of Panel farmers on this critical issue is analysed. By reducing the cost of cultivation significantly, especially among the resource intensive crops and increasing profitability, in almost all crops, APCNF has enabled the poor farmers to break their vicious circle. The changes presented at Figure 4.3 illustrates the point. APCNF farmers’ ability to meet working capital requirement from own sources is not only high, in 2018-19, but increased further in 2019-20. Their dependency on formal and informal institutions has declined by a significant margin in 2019-20. One other contributory factor for the decline in farmers dependency on formal and informal sources of credit is the introduction of Rythu Bharosa, and also Kisan Samman. Majority of APCF farmers have also got loans from friends and relatives. The same have also registered a significant increase during the study period. One possible reason could be that the friends and relatives may be sourcing their food requirements from

APCNF farmers. Participants in many FGDs have pointed out that the APCNF farmers are getting good recognition and respect in their social circles.

Figure 4.3: Percentages of responses of APCNF farmers for different sources of working capital in 2018-19 and 2019-20



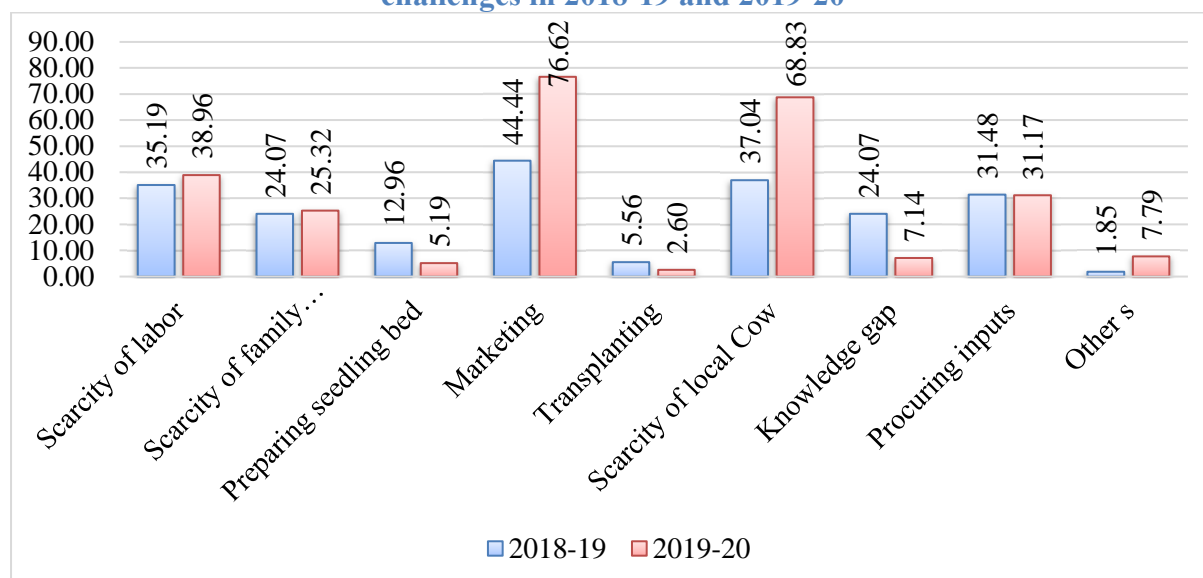
Sources: IDSAP Field Survey, 2019-20

4.3.4. Challenges

The APCNF impact assessment studies, by IDSAP and CESS during last two years, have identified some practical problems in adoption of APCNF in the field. The problems include-marketing, shortage of Desi cows, shortage of labour, shortage of family labour, non-availability of biological inputs in the market, non-availability of raw material for preparation of the biological inputs, inadequate knowledge to prepare the biological inputs, etc. As APCNF is advising and encouraging the farmers to sow the seeds in rows and transplantation in rows, instead of simple broadcasting, some farmers are uncomfortable in raining the seedlings and transplantation. Farmers' responses with respect to each of identified challenges are presented at Figure 4.4. Marketing remained a bigger challenge. It may be noted that the output price of three crops, out four analysed above, have declined in 2019-20 compared to previous year. While the major problems of marketing and shortage of Desi cow become more severe in 2019-20, the panel farmers appeared to be overcoming and managing other problems such as knowhow to prepare the biological inputs, transplantation, nursery raising, procurement of inputs and shortage of family, 2019-20. Though the labour shortage is reported as a problem, actually, there was a marginal decline in hired labour use under APCNF compared to non-

APCNF conditions (see, IDSAP, 2020a). The farmers may be reflecting the overall shortage hired labour in agriculture.

Figure 4.4: Percentages of responses of APCNF farmers to different identified challenges in 2018-19 and 2019-20



Sources: IDSAP Field Survey, 2019-20

4.4. Conclusion

Analysis of the performance of four APCNF crops, cultivated by the panel farmers, during last two years, indicate that, except one, there are no significant aberrations in the cost of cultivation of the four crops. Improvement in gross and net returns in 2019-20 over previous year is very good sign. It implies that the program, not only sustain, but also improve in coming years. The first-year farmers need greater awareness and careful handholding.

The statistical analysis indicates that the efficiency of all panel Paddy farmers, in the state, has increased from 0.6962 in 2018-19 to 0.9580 in 2019-20. The efficiency has increased in each and every district in the state and all farm categories. Given such widespread increase in the efficiency of panel Paddy farmers, there is every reason to expect such increase in efficiency in all other APCNF crops and other categories of APCNF farmers, viz., best farmers and cross section farmers.

Despite general reluctance towards agriculture, farmers are interested in APCNF. Increasing number of farmers have, not only, found APCNF food healthy, but, also tasty. Compared to

2018-19, relatively higher percentage of farmers in 2019-20 indicated that APCNF grains are heavier, crop is more resistant to variances in the weather, give higher crop yields and reduces the cost of cultivation. But, relatively lesser proportion of farmers, in 2019-20, have said that the stems of APCNF crops are strong. Nearly 100 per cent farmers have experienced softening of soils, in 2019-20, due to APCNF. Earthworms may be moving freely and swiftly in the fields due to softening of the soils. Recent emphasis on PMDS is a timely move.

A significant decline in farmers' dependence on institutional and informal credit sources, in 2019-20, indicate that APCNF has freed the participating farmers from exploitations of the credit and input markets. While the major problems of marketing and shortage of Desi cow become more severe in 2019-20, the panel farmers appeared to be overcoming and managing other problems such as knowhow to prepare the biological inputs, transplantation, nursery raising, procurement of inputs and shortage of family labour, etc., in 2019-20.

Chapter 5: Best Farmers

5.1. Introductions

The study is also designed to examine and document the experience of the best farmers of APCNF. As per the agreement that RySS would identify the best farmers from its own internal studies and provide the list of those farmers to IDSAP for the third-party evaluation. Using the APCNF household schedule, IDSAP has collected data from 130 identified best farmers. These farmers are mostly consisting of internal community resource persons (ICRPs), natural farming fellows (NFF), model and progressive farmers, etc. The main purpose of these farmers is the action research. They experiment and perfect various practices and formulations of the biological inputs, particularly the Kashayams and Asthrams of APCNF. Obtaining higher yields is one of the expected incidental benefits for the best farmers. As per the scope of the study, very few CCEs were conducted for the best farmers. In this chapter, the yields of the best farmers were estimated using their *reported yields and the correction factor, which was estimated from the reported and CCE yields obtained from the best farmers*. As the best farmers are expected to adhere to the all-recommended practices and packages, they are expected to experience all qualitative changes in the crops and soils. Hence, this chapter focuses on quantitative improvements in the cost of cultivation, crop yields and gross and net returns. The performance of the best farmers is compared with that of all APCNF farmers, including best farmers, panel farmers and cross-section farmers. Further, the chapter throws light on the profile of the best farmers vis-à-vis cross-section and panel APCNF farmers.

5.2. Profile of best farmers

The profile of the best farmers is analysed with respect to social category, farm category, farmers' education, age, gender and occupation.

5.2.1. Social category

The list of best farmers is provided by RySS, based on their own internal assessment, including internal CCEs. As the best farmers are selected separately, a brief discussion about their profile is useful, before analysing their experience. Among the four social categories, other categories or open categories (OC) have larger presence in the best farmers, followed backward categories (BCs). Compared to their 12.66 percentage share in total APCNF sample farmers, scheduled coasts (SCs) have only 2.31 per cent share in the best farmers. Scheduled Tribes (ST) have only

6.15 percent presence in the best farmers vis-à-vis their 16.53 percent presence in the total sample. While BCs have near same presence in the total sample and best farmers, OC have near double presence in the best farmers compare to their presence in the total sample (Table 5.1).

Table 5.1 Presence of different social categories in the best farmers' group

In number and percentages				
Social category	Cross-section	Panel farmers	Best farmers	Total
SC	136	41	3	180
ST	183	44	8	235
BC	475	106	55	636
OC	245	62	64	371
Total	1,039	253	130	1,422
Column wise percentages				
SC	13.09	16.21	2.31	12.66
ST	17.61	17.39	6.15	16.53
BC	45.72	41.90	42.31	44.73
OC	23.58	24.51	49.23	26.09
Total	100.00	100.00	100.00	100.00

Sources: IDSAP Field Survey, 2019-20

5.2.2. Farm category

Distribution of farm categories in different sample groups is presented in Table 5.2. The tenant and small farmers' representations, in the best farmers, are almost equal to their proportions in the total APCNF sample farmers. While marginal farmers are under represented by about 10 percentage points, other farmers are over represented by the same margin in the best farmers (Table 5.2).

Table 5.2: Percentage presence of farm categories in different APCNF sample groups

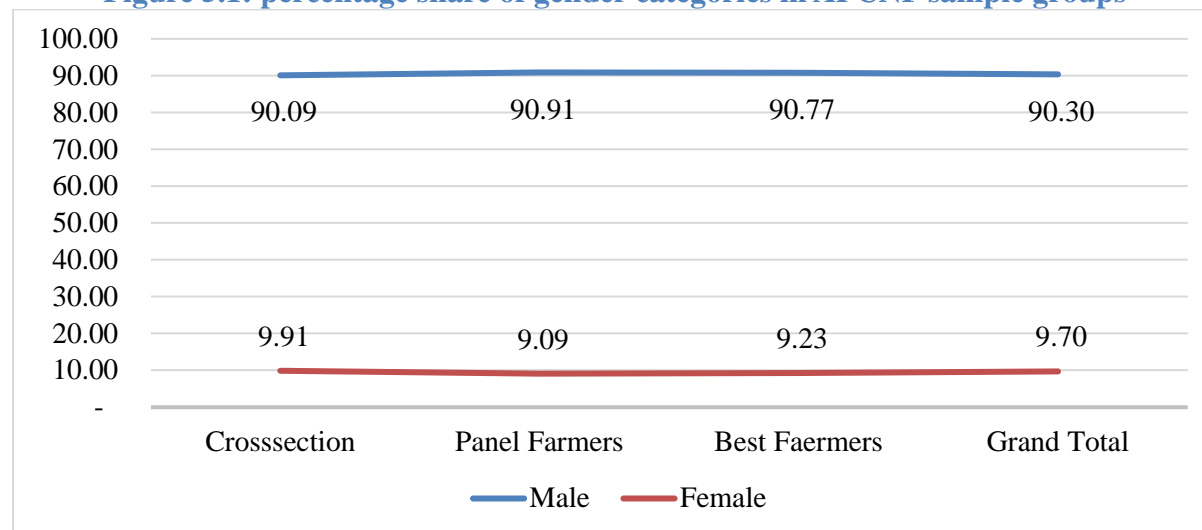
Farm category	Cross-section	Panel farmers	Best farmers	Total
Tenant farmers	6.64	6.32	6.15	6.54
Marginal farmers	47.16	41.90	35.38	45.15
Small farmers	32.63	34.39	33.85	33.05
Other farmers	13.57	17.39	24.62	15.26
Total in percentages	100.00	100.00	100.00	100.00
Total in numbers	1039	253	130	1422

Sources: IDSAP Field Survey, 2019-20

5.2.3. Gender category

Women farmers are same level of participation (over nine percentage) in all categories of farmers, viz., cross-section, panel and best farmers (Figure 5.1). It reflects the RySS's focus on women.

Figure 5.1: percentage share of gender categories in APCNF sample groups



Sources: IDSAP Field Survey, 2019-20

5.2.4. Age of farmers

It is surprising to note that younger farmers, of up to 39-year-old, are underrepresented in the best farmers, by over eight percentage points; and older farmers, of 60 plus years old, are over represented by over five percentage points. Perhaps the younger farmers may be exploring other occupational options and not able to focus completely on APCNF. On the other hand, the older farmers, who have fewer other options and diversions may be completely focusing on the APCNF. They might have also connected to APCNF, which is somewhat similar to older agriculture practices. Other age categories also over represented in the best farmers, albeit, in smaller percentage points.

Table 5.3: Percentage share of different age groups in the APCNF sample categories

Age (in years)	Cross-section	Panel Farmers	Best Farmers	Total
Up to 39	25.79	24.11	16.15	24.61
40 to 49	31.86	23.72	34.62	30.66
50 to 59	23.10	32.02	24.62	24.82
60 and above	19.25	20.16	24.62	19.90
Total in percentage	100.00	100.00	100.00	100.00
Total in numbers	1,039	253	130	1,422

Sources: IDSAP Field Survey, 2019-20

5.2.5. Education of farmers

As expected, that illiterates are underrepresented in the best farmers group by over 12 percentage points. Similarly, the primary and middle level educated farmers are relatively, underrepresented in the best farmers' group. Farmers with secondary and above education levels are relatively overrepresented in the best farmers group. As anticipated, the farmers with graduation and above education are overrepresented by about 11 percentage points, in the best farmers group (Table 5.4).

Table 5.4: percentages of different education level farmers in the APCNF sample groups

Education level	Cross-section	Panel farmers	Best farmers	Total
Illiterates	33.49	25.69	18.46	30.73
Primary	22.04	28.85	23.08	23.35
Middle	11.55	11.07	6.15	10.97
Secondary	17.13	18.97	20.00	17.72
Higher secondary	9.53	7.11	13.85	9.49
Graduates and above	6.26	8.30	18.46	7.74
Total in percentages	100.00	100.00	100.00	100.00
Total in numbers	1,039	253	130	1,422

Sources: IDSAP Field Survey, 2019-20

5.2.6. Primary occupation of sample farmers

Though it appears to be a surprising categorization, this is a fact that many cultivators are spend most of their time on occupations, other than cultivation, and deriving major part of their incomes from those occupations. These kinds of farmers are taking up APCNF with interest and curiosity. Their proportion is relatively higher among the best farmers. Predictably the cultivators and agriculture wage labour have relatively lesser presence in the best farmers group and others categories of farmers have relatively higher representation in the best farmers' group. The farmers with salary employment have over two percentage points overrepresentations (Table 5.5).

Table 5.5: Percentages of different categories of cultivators in the sample groups

Primary occupation	Cross-section	Panel farmers	Best farmers	Total
Cultivators	87.58	84.98	83.08	86.71
Agriculture labour	3.46	3.56	2.31	3.38
Self-employment	2.02	2.77	3.08	2.25
Salary employed	2.89	3.56	5.38	3.23
Others	4.04	5.14	6.15	4.43
Total in percentage	100.00	100.00	100.00	100.00
Total in number	1,039	253	130	1,422

Sources: IDSAP Field Survey, 2019-20

5.3. Cost of cultivation, yields and returns

In this section the costs of cultivation, crop yields and returns of the best farmers are compared with that of all APCNF farmers. Though the best farmers have cultivated 11 out of 13 crops⁹ included in the Kharif sample, the sample size is quite low in all but Paddy crop. Hence the results may be treated as anecdotal evidence. As usual, the comparisons are made with respect to the expenditure on PNPIs, paid-out cots, yields, gross returns and net returns.

5.3.1. Expenditure on biological inputs

The critical intervention of the APCNF is replacement of agri-chemicals (fertilizers and pesticides) with the biological inputs (Jeevamrutham and Asthrams and Kashayams). The application practices of best farmers, across the select crops, are compared with that of all APCNF farmers at Table 5.5. There is no difference between the best and all farmers in the expenditure on biological inputs in the Paddy. It is the only crop with adequate sample to make the tangible comparison. The best farmers have spent significantly less expenditure on biological inputs in Jowar (71.07%), Maize (57.54%), Bengal gram (55.95%), Black gram (20.38%) and Sugarcane (19.22%). On the other hand, the best farmers have invested significantly higher amounts on biological inputs by 94.52% in Chillies, 93.76% in Ragi, 67.72% in Red gram, and 29.13% in Groundnut. There is no particular trend. Perhaps the smaller size of sample observation may be preventing us from noticing any trend.

Table 5.6: Crop wise expenditure on biological inputs by the best farmers and all APCNF farmers during Kharif 2019-20

Crop	Expenditure per hectare in Rs.		Difference between best and all farmers	
	Best farmers	All farmers	In Rs,	in %
Paddy	5,033	5,035	-2	-0.05
Groundnut	9,031	6,994	2,037	29.13
Cotton	6,422	6,462	-40	-0.62
Bengal gram	2,147	4,874	-2,727	-55.95
Black gram	4,941	6,206	-1,265	-20.38
Maize	2,176	5,124	-2,948	-57.54
Red gram	7,369	4,393	2,975	67.72
Chillies	18,389	9,454	8,936	94.52
Jowar	1,740	6,015	-4,275	-71.07
Sugarcane	4,992	6,179	-1,188	-19.22
Ragi	7,599	3,922	3,677	93.76

Sources: IDSAP Field Survey, 2019-20

⁹ None of the sample best farmers have cultivated Onion and Turmeric during Kharif 2019-20 season

5.3.2. Paid-out costs

The best farmers have incurred lesser paid-out cost than all APCNF farmers in six out of 11 crops considered here. The best farmers have saved substantial amounts in paid-out costs, compared to their additional cost in some crops. The savings are more than Rs.25,000 in one crop, more than Rs.10,000 in two crops, Rs.9-10 thousands in two crops and about Rs.2,000 in two crops. On the other hand, they have incurred additional cost of about Rs.18,000 in one crop and less Rs.7,000 remaining four crops (Table 5.7). As mentioned elsewhere in the report that there is scope of savings in the costs in resource intensive crop, the best farmers have saved 15% in paid-out cost in Chillies and 7% in Sugarcane, the most resources intensive crops. They have also invested additional investment in some of less resource intensive crops such as Red gram (23%) and Ragi (130%).

Table 5.7: Crop wise paid-out costs by the best farmers and all APCNF farmers during Kharif 2019-20

Crop	Expenditure per hectare in Rs.		Difference between best and all farmers	
	Best farmers	All farmers	In Rs,	in %
Chillies	1,50,914	1,76,592	-25,678	-15
Bengal gram	21,803	32,197	-10,394	-32
Maize	27,439	37,554	-10,115	-27
Jowar	16,188	24,943	-8,755	-35
Sugarcane	89,386	96,326	-6,940	-7
Black gram	24,116	26,036	-1,919	-7
Paddy	42,608	40,734	1,874	5
Groundnut	50,482	47,047	3,435	7
Red gram	22,407	18,164	4,243	23
Cotton	53,157	46,445	6,712	14
Ragi	31,811	13,849	17,962	130

Sources: IDSAP Field Survey, 2019-20

5.3.3. Crop yields

The best farmers have got higher yields than all farmers in seven out of 11 crops considered here and got lesser yields than that of all farmers in five crops. The best farmers got higher yields by bigger margin ranging from 0.54 quintals per hectare in Black gram to 7.61 quintal 25.19 quintal in Sugarcane. On other hand, they got lesser yields in the range of 0.66 quintal per hectare in Paddy to 5.74 quintals per hectare in Cotton (Table 5.8). It is interesting to note that the best farmers have obtained significantly higher yields in less resource intensive crops, viz., Jowar (45.10%) and Ragi (36.58%). This confirms the hypothesis that APCNF will be

more effective in saving costs in resources intensive crops and increasing the yields in less resource intensive crops, discussed at many places in this report, particularly in chapter 3.

Table 5.8: Crop wise yields obtained by the best farmers and all APCNF farmers during Kharif 2019-20

Crop	Yields in quintals per hectare		Difference between best and all farmers	
	Best farmers	All farmers	In quintal	in percentage
Sugarcane	803.22	778.02	25.19	3.24
Jowar	29.24	20.15	9.09	45.10
Ragi	28.42	20.81	7.61	36.58
Chillies	51.78	49.78	2.00	4.01
Red gram	7.50	6.47	1.03	15.94
Groundnut	17.09	16.53	0.56	3.41
Black gram	13.17	12.62	0.54	4.31
Paddy	50.20	50.87	-0.66	-1.31
Bengal gram	13.59	15.57	-1.98	-12.70
Maize	46.91	49.96	-3.05	-6.10
Cotton	13.20 ¹⁰	18.95	-5.74	-30.32

Sources: IDSAP Field Survey, 2019-20

5.3.4. Prices

Apart from the crop yields, prices will determine the farm returns and profits. Crop wise average prices realised by the best and all farmers and their differences in absolute and percentage terms are given in Table 5.9. Out of 11 crops considered in this chapter, in seven crops, the best farmers have realized higher average price than all APCNF farmers. The margin is quite high, in the range of Rs.145 per quintal in Ragi to Rs.6,599 per quintal in Chillies. The best farmers have got 15% higher price to the all-important crop-Paddy. The best farmers got 38.21% less price for Sugarcane. The reason is that some the APCNF (other than best farmers) farmers prepared Jaggary from their Sugarcane and realized higher prices. Timing of the sale crop output will also determine the price realization.

Table 5.9: Crop wise average price realised by the best and all farmers during Kharif 2019-20

Crop	Average price per quintal		Difference between best and all farmers	
	Best farmers	All farmers	In Rupee	in percentage
Chillies	19,152	12,553	6,599	52.57
Red gram	6,632	5,593	1,039	18.57
Groundnut	6,071	5,375	696	12.96

¹⁰ It may be noted that the yields of best farmers, for all crops, have been estimated using their reported yields and the correction factor (the ration of the state level average CCE yields to the average reported yields). The best farmers might have under reported their yields. It was noticed that APCNF farmers, usually under report their benefits to avoid the rent hike, discourage their fellow farmers in adopting APCNF, to gain monopoly position, etc.

Cotton	4,711	4,429	282	6.36
Paddy	1,997	1,735	262	15.11
Black gram	6,933	6,770	162	2.40
Ragi	3,739	3,594	145	4.03
Maize	1,768	1,861	-93	-5.02
Sugarcane	260	421	-161	-38.21
Bengal gram	4,191	4,492	-301	-6.69
Jowar	2,234	2,633	-399	-15.16

Sources: IDSAP Field Survey, 2019-20

5.3.5. Gross returns

Crop wise gross returns obtained by the best and all farmers and the differences between them are presented at Table 5.10. Out of 11 crops covered here, in seven crops, the best farmers have obtained higher gross returns than all farmers. Out of these seven, the gap in percentage terms is in two digits in six crops. The highest higher returns of Rs.3,66,749 (58.69%) per hectare were obtained in Chillies, followed by Rs.45,074 (54.84%) per hectare in Ragi. On the other hand, the best farmers have got Rs.21,763 (25.92%) per hectare lower gross returns in Cotton, preceded by Rs.12,716 (5.58%) per hectare in Sugarcane and Rs.11,022 (15.64%) per hectare in Bengal gram.

Table 5.10: Crop wise gross returns obtained by the best farmers and all APCNF farmers during Kharif 2019-20

Crop	Gross returns per hectare		Difference between best and all farmers	
	Best farmers	All farmers	In Rupee	in percentage
Chillies	9,91,649	6,24,899	3,66,749	58.69
Ragi	1,27,264	82,191	45,074	54.84
Groundnut	1,12,503	98,236	14,267	14.52
Paddy	1,06,017	92,161	13,856	15.03
Red gram	50,724	37,630	13,093	34.79
Jowar	68,986	58,753	10,233	17.42
Black gram	91,734	85,785	5,949	6.93
Maize	85,683	94,976	-9,293	-9.78
Bengal gram	59,431	70,453	-11,022	-15.64
Sugarcane	2,15,066	2,27,782	-12,716	-5.58
Cotton	62,202	83,965	-21,763	-25.92

Sources: IDSAP Field Survey, 2019-20

5.3.6. Net returns

Crop wise net returns obtained by the best and all farmers and the differences between them are presented at Table 5.11. Out of 11 crops covered here, in eight crops, the best farmers have obtained higher net returns than all farmers. The difference is over 87% in Chillies, over 56% in Jowar, over 45% in Red gram and about 40% in Ragi. In two crops viz., Bengal gram and

Sugarcane, the best farmers got marginally lower net returns of 1.64% and 4.39% respectively. In Sugarcane, the major reason was that the many (other than best farmers) APCNF farmers have prepared Jaggary and realised significantly higher prices. The only exceptional case is Cotton, in which the best farmers got about 76% lower net returns.

Table 5.11: Crop wise net returns obtained by the best farmers and all APCNF farmers during Kharif 2019-20

Crop	Net returns per hectare		Difference between best and all farmers	
	Best farmers	All farmers	In Rupee	in percentage
Chillies	8,40,734	4,48,307	3,92,427	87.54
Ragi	95,453	68,342	27,112	39.67
Jowar	52,798	33,810	18,989	56.16
Paddy	63,408	51,426	11,982	23.30
Groundnut	62,021	51,190	10,831	21.16
Red gram	28,317	19,466	8,850	45.47
Black gram	67,617	59,749	7,868	13.17
Maize	58,244	57,422	822	1.43
Bengal gram	37,628	38,257	-629	-1.64
Sugarcane	1,25,680	1,31,456	-5,776	-4.39
Cotton	9,045	37,520	-28,475	-75.89

Sources: IDSAP Field Survey, 2019-20

5.4. Clearer picture through Paddy

The above analysis was carried with limited number of sample observations. The 11 crops considered in this chapter together have total 152 sample observations. Out of these, 104 were Paddy sample. Groundnut has 17 observations and other nine crops have only two to five sample observations. Hence, the results have shown wide variations. Still the results confirm overall trend observed in this report and previous reports. In this section the results of Paddy are analysed further. The detailed costs, yield, price and returns of Paddy are presented at Table 5.12. The message is clear- that the best farmers are able to reduce their expenditure on machinery, implements, irrigation, and bullock labour. It confirms the hypothesis that APCNF needs less ploughing, irrigation, etc. The only increase in expenditure is on hired labour. It again confirms that APCNF is labour intensive model. The best farmers have marginally higher paid-out cost and marginally lesser yields. But they have obtained higher net returns of over 23%, due to better price realization. In a sense best farmer is a 'known' or 'recognised' farmer, who can sell their produce at premium price. It demonstrates the potential of the market for APCNF.

Table 5.12: Costs, yields, prices and returns of best and all farmers in Paddy during Kharif 2019-20

Indicator	Costs, yields, prices & returns in Rs. per hectare/ quintal		Difference between best and all farmers	
	Best farmers	All farmers	in units	in percentage
Sample observations	104	787		
Seed	2,369	2,413	-44	-1.83
Biological inputs	5,033	5,035	-2	-0.05
FYM	2,057	1,848	209	11.29
Hired labour-male	8,237	6,383	1,854	29.05
Hired labour -female	12,541	11,109	1,433	12.90
Bullock Labour	220	367	-147	-40.03
Machine Labour	11,638	12,259	-622	-5.07
Implements	160	624	-464	-74.37
Water Fees	354	695	-342	-49.13
Paid out cost	42,608	40,734	1,874	4.60
Yield in quintals per hectare	50.20	50.87	-1	-1.31
Price in Rs. per quintal	1,997	1,735	262	15.11
Output Value	1,00,282	88,269	12,013	13.61
By Product Value	5,735	3,892	1,843	47.37
Gross Returns	1,06,017	92,161	13,856	15.03
Net Income	63,408	51,426	11,982	23.30

Sources: IDSAP Field Survey, 2019-20

5.5. Conclusions

The chapter confirms the well-established hypotheses about APCNF, with respect to resource intensive and less resource intensive crops, expected changes in the APCNF farming, etc. The presence of higher proportion of the OC category and other (medium and large) farmers in the best farmers group, indicates that APCNF has won over the trust of the influential sections in the agriculture. It is a good sign. At the same time there is not much difference in costs and yields of best and all farmers in Paddy. The only difference is price.

Without adequate number of CCEs, the chapter looks a bit sketchy. In coming years, adequate number of CCEs may be conducted for each selected crop. Since, the sample size is limited to 130, every year, 3-4 crops may be covered, in rotation.

Chapter 6: Macro estimates and issues

6.1. Introduction

In the Kharif 2019-20 Report (IDSAP, 2020a), impact of APCNF was estimated. In that report, area under APCNF project was estimated based on sample data. Recently RySS has provided data about the area under APCNF. In this report, using the project area figures provided by RySS, the impact of APCNF at the project level has been estimated. Further, the analysis of state level potential benefits estimates was extended to potential increase in the cropping intensity. Potential employment benefits are also estimated. As these calculations are based on some assumptions and limited data, the results may be treated as anecdotal evidence to get new ideas and to initiate new research. The chapter also summarizes the changes with respect to marketing of APCNF produce, discussed in IDSAP, 2020a and IDSAP, 2020b.

6.2. Actual project level benefits

As per the data provided by RySS, as on December 2020, the area under APCNF crops, in the state, is 2,89,614.90 hectare Total nine crops, which have 30+ sample observations, have been covered in the project level and state level estimations, in IDSAP, 2020a. The same nine crops are used in estimates in this chapter also. As these crops include some Rabi fields, and adequate data was not available for Rabi crops, only nine crops covered in Kharif report, viz., Bengal gram, Chillies, Cotton, Groundnut, Jowar, Maize, Paddy, Red gram and Sugarcane, are, used here for whole year estimates. As per the last five years (2014-15 to 2018-19) data on the cropping pattern in the state, these nine crops together cover 52.5 lakh hectares (68.63 per cent) of gross cropped area (GCA) in the state. Total GCA in the state is 76.5 lakh hectares. Using these parameters, the total project area under select nine crops is estimated and shown in Table 6.1. Out of total 2.9 lakh hectares under APCNF crops in the state, 1.99 lakh hectares (68.63 per cent) are under the select nine crops. As expected, Paddy has the largest area of 0.87 lakh hectares, followed by Groundnut, Cotton, Bengal gram, so on.

Table 6.1: Area under select crops at the state and project level

Crop	State area in lakh hectares	In percentages	Project area in lakh hectares
Paddy	22.95	30.00	0.87
Groundnut	9.15	11.96	0.35
Cotton	6.57	8.59	0.25

Bengal gram	4.41	5.76	0.17
Maize	2.96	3.87	0.11
Red gram	2.37	3.10	0.09
Chillies	1.51	1.97	0.06
Jowar	1.35	1.76	0.05
Sugarcane	1.23	1.61	0.05
Total of nine crops	52.50	68.63	1.99
Other crops	24.00	31.37	0.91
Total GCA	76.50	100.00	2.90

Sources: *IDSAP Field Survey 2019-20*

Using the per hectare costs and returns of select nine crops, as discussed in chapter 3 and project level area figures discussed at Table 6.1, total savings in the expenditure on fertilizers and pesticides, and paid-out costs; and gains in gross and net returns from are estimated. Using weighted averages of savings and returns obtained in the select nine crops, the outcomes of other crops were estimated. The same are presented at Table 6.2. Because of APCNF interventions, the participating farmers have saved Rs.469.30 cr worth fertilisers and pesticides. This has larger environmental and health benefits. However, the farmers have spent Rs.164.98 cr worth biological inputs. Still, they have saved over Rs.300 (64.85 per cent) expenditure on PNPIs. This saving, in turn, has resulted in about Rs.360 cr (21.47 per cent) savings in the paid-out costs. Even without application of agri-chemicals, which are considered as the critical inputs in the ‘Green Revolution’ agriculture, the APCNF farmers, in the state, have got over Rs.233 crore (8.26 per cent) higher gross revenue and over Rs.593 crore (51.90 per cent) higher net returns. These are actual benefits realised by the project participating farmers by putting a part of their operational holdings under APCNF. Needless to say, had the participating farmers put their entire holdings under APCNF, they would have even higher benefits.

6.3. Potential state level benefits

One curious question that follows the above analysis is, if the entire cropped area were put under APCNF, what would be the magnitude of the benefits. Using same methodology used in the estimations of project level benefits, the state level benefits were also estimated and presented at Table 6.3.

Table 6.2: APCNF Project level savings in PNPIs, paid-out costs and gains in gross and net revenues

Area in lakh hectares and others in Rs. Crores

Crop	Project level area in lakh hectares	Expenditure on PNPIs		Gross Income		Cost of Cultivation		Net income		Percentage differences between APCNF & non-APCNF in			
		APCNF	Non-APCNF	APCNF	Non-APCNF	APCNF	Non-APCNF	APCNF	Non-APCNF	PNPIs	Gross income	Paid-out costs	Net income
Paddy	86,884.47	43.75	124.51	800.73	707.76	353.92	438.15	446.81	269.61	-64.86	13.14	-19.22	65.73
Groundnut	34,640.21	24.23	27.71	340.29	322.47	162.97	179.25	177.32	143.23	-12.59	5.53	-9.08	23.81
Cotton	24,872.81	16.07	63.35	208.84	215.56	115.52	180.42	93.32	35.13	-74.63	-3.11	-35.97	165.65
Bengal gram	16,695.45	8.14	21.63	117.62	103.43	53.75	80.77	63.87	22.66	-62.39	13.73	-33.45	181.90
Maize	11,206.01	5.74	13.27	106.43	119.54	42.08	51.62	64.35	60.77	-56.72	-10.97	-18.47	5.88
Red gram	8,972.38	3.94	9.58	33.76	28.22	16.30	24.43	17.47	3.79	-58.83	19.64	-33.30	361.43
Chillies	5,716.58	5.40	53.37	357.23	319.61	100.95	136.00	256.28	183.61	-89.87	11.77	-25.77	39.58
Jowar	5,110.85	3.07	3.58	30.03	26.98	12.75	12.99	17.28	20.57	-14.08	11.28	-1.89	-15.99
Sugarcane	4,656.55	2.88	5.07	106.85	97.91	44.85	46.39	54.55	44.86	-43.26	9.12	-3.32	21.61
Total of nine crops	1,98,755.32	113.22	322.07	2,101.79	1,941.48	903.10	1,150.03	1,191.25	784.22	-64.85	8.26	-21.47	51.90
<i>Total of other crops</i>	<i>90,859.58</i>	<i>51.76</i>	<i>147.23</i>	<i>960.82</i>	<i>887.53</i>	<i>412.85</i>	<i>525.73</i>	<i>544.57</i>	<i>358.50</i>	<i>-64.85</i>	<i>8.26</i>	<i>-21.47</i>	<i>51.90</i>
Grand total	2,89,614.90	164.98	469.30	3,062.61	2,829.01	1,315.94	1,675.76	1,735.83	1,142.72	-64.85	8.26	-21.47	51.90

Sources: IDSAP Field Survey 2019-20

Table 6.3: State level potential savings in PNPIs, paid-out costs and gains in gross and net revenues, if the entire cropped area were put under APCNF

Area in lakh hectares and others in Rs. Crores

Crop	Project level area in lakh hectares	Expenditure on PNPIs		Gross Income		Cost of Cultivation		Net income		Percentage differences between APCNF & non-APCNF in			
		APCNF	Non-APCNF	APCNF	Non-APCNF	APCNF	Non-APCNF	APCNF	Non-APCNF	PNPIs	Gross income	Paid-out costs	Net income
Paddy	22,95,000	1,155.55	3,288.81	21,150.87	18,695.02	9,348.55	11,573.40	11,802.32	7,121.62	-64.86	13.14	-19.22	65.73
Groundnut	9,15,000	639.92	732.05	8,988.64	8,517.86	4,304.79	4,734.66	4,683.85	3,783.20	-12.59	5.53	-9.08	23.81
Cotton	6,57,000	424.56	1,673.44	5,516.49	5,693.76	3,051.42	4,765.82	2,465.06	927.94	-74.63	-3.11	-35.97	165.65
Bengal gram	4,41,000	214.94	571.47	3,106.99	2,731.93	1,419.87	2,133.45	1,687.12	598.48	-62.39	13.73	-33.45	181.90
Maize	2,96,000	151.66	350.41	2,811.29	3,157.52	1,111.59	1,363.46	1,699.70	1,605.33	-56.72	-10.97	-18.47	5.88
Red gram	2,37,000	104.12	252.94	891.84	745.41	430.49	645.43	461.35	99.98	-58.83	19.64	-33.30	361.43
Chillies	1,51,000	142.75	1,409.72	9,435.98	8,442.39	2,666.54	3,592.47	6,769.44	4,849.92	-89.87	11.77	-25.77	39.58
Jowar	1,35,000	81.20	94.51	793.16	712.78	336.73	343.22	456.43	543.30	-14.08	11.28	-1.89	-15.99
Sugarcane	1,23,000	76.01	133.95	2,822.30	2,586.31	1,184.81	1,225.44	1,440.94	1,184.90	-43.26	9.12	-3.32	21.61
Total of nine crops	52,50,000	2,990.70	8,507.31	55,517.56	51,282.99	23,854.79	30,377.34	31,466.22	20,714.68	-64.85	8.26	-21.47	51.90
<i>Total of other crops</i>	<i>24,00,000</i>	<i>1,367.18</i>	<i>3,889.06</i>	<i>25,379.46</i>	<i>23,443.65</i>	<i>10,905.05</i>	<i>13,886.78</i>	<i>14,384.56</i>	<i>9,469.57</i>	<i>-64.85</i>	<i>8.26</i>	<i>-21.47</i>	<i>51.90</i>
Grand total	76,50,000	4,357.87	12,396.37	80,897.02	74,726.64	34,759.84	44,264.12	45,850.78	30,184.25	-64.85	8.26	-21.47	51.90

Sources: IDSAP Field Survey 2019-20

If the entire GCA were converted into APCNF, the Government would have saved subsidies and logistic expenditure related to Rs.12,396.37 crore worth agri.-chemicals and the state would have reaped the corresponding environmental and health benefits. The farmers, in the state, would have saved Rs.8,038.5 crore (64.85 per cent) in the expenditure on PNPIs and Rs.9,504.27 crore (21.47 per cent) in the paid-out costs. They would have realized Rs.6,170.38 (8.26 per cent) higher gross revenue and Rs.15,666.53 crore (51.90 per cent) higher net revenue.

6.4. Doubling of the cropping intensity

Yet another dimension to assess the impact of APCNF is the potential increase in the cropping intensity. As per DES latest data, the net sown area (NSA) in the state is 60.48 lakh hectares and GCA is 76.5 lakh hectare. It implies that the cropping intensity in the state is 1.26 (126 per cent). Potentially it can be increased to 2+ (more than 200 per cent). It may be a bit difficult for RySS to convert the non-APCNF farmers/ fields into APCNF farmers, but it would be relatively easy to increase the cropping intensity among the APCNF farmers/ fields. Through its pre-monsoon dry sowing (PMDS) and other methods, RySS has positively influenced the cropping intensity, among the participating farmers. Improvement in the soil quality is the necessary precondition to increase the cropping intensity. As mentioned in chapter 1, that the participants in some FGDs, mentioned that because of excess and continuous use of agri-chemicals, soil is getting hard and not fit for cultivating more than once in a year. *The scientific reason for deterioration of soil quality (hardening of the soil) could be the loss of living microorganism in the soils. There is overwhelming evidence, elsewhere in this report, previous reports (IDSAP, 2020a and 2020b) and also in the FGDs for softening of the soil (revival of microorganism in the soil) under APCNF.* In this way, APCNF is creating the necessary conditions for enhancing the cropping intensity in the state.

Some other crucial factors which influence the cropping intensity are: availability of the working capital, profitability of cultivation, availability of family labour/ members (at least for supervision and coordination), etc. Some FGDs have revealed that due to shortage of working capital, growing cost of cultivation, decline in profitability, many (traditional) farmers have leased out their lands. Some have leased out just for grazing animals at nominal rent and some have left, at least, a part of their lands fallow. Some FGDs have also pointed out that as the cost

of cultivation decline, under APCNF, some farmers have started cultivating the fallow lands. Some landless/ leased-in farmers also started cultivating, hitherto, fallow lands. As per the recent data from the Directorate of Economics and Statistics (DES), there are about 24 lakh hectares of fallow lands in the state. Assuming about 40 per cent fallow lands can be brought back under cultivation, there would be about 9.53 lakh hectare additional area to put into cultivation. The implications/ raise in the net revenue of raising cropping intensity to 2 (200 percent) and bringing back 9.53 lakh hectare under cultivation are shown at Table 6.4. The estimates in the table are based on the weighted average net revenue of nine select crops, shown above, of Rs.39,457 under non-APCNF and Rs.59,936 under APCNF. Under non-APCNF, the per hectare net return of Rs.39,457 is per one season only. If the cropping intensity of 1.26 is considered the net returns would be Rs.49,908 per hectare of NSA per year. If the fallow lands of 9.53 lakh hectare are included with 1.26 cropping intensity, there won't be any change in the net returns of Rs.49,908 per hectare of NSA; however, the net returns from the crop sector in the state would increase from Rs.30,184.25 crore to Rs.34,940.47 crore. If the fallow lands are included and cropping intensity increases to 200 per cent, the net revenue per hectare of NSA would increase to Rs.78,913; and the net revenue from the crops in the state would increase to Rs.55,248.63 crore. The same, under APCNF, would increase to Rs.1,19,871 per hectare of NSA and Rs.83,924.31 crore respectively. At any scenario, APCNF yields 51.90 per cent higher net returns. *It is important to note that a significant increase in cropping intensity is technically feasible and financially viable only under APCNF.*

Table 6.4: Expected change in net revenue due to raising of cropping intensity and bringing back fallow lands

Indicator	Net Sown Area	Gross cropped area	Cropping intensity	Net income per hectare of NSA	Rate of change	Net income from crop sector	Rate of change
Unit	Lakh ha	Lakh ha	Number	Rs. per ha	Per cent	Rs. Crore	Per cent
Non-APCNF Scenario							
At present without 1.26 cropping intensity	60.48			39,457		23,863.32	
At present with 1.26 cropping intensity	60.48	76.50	1.26	49,908	26.49	30,184.25	26.49
If Fallow lands are included with 1.26 cropping intensity	70.01	88.51	1.26	49,908	-	34,940.47	15.76
If fallow lands are included with 200%	70.01	140.024	2.00	78,913	58.12	55,248.63	83.04
APCNF Scenario							
At present without 1.26 cropping intensity	60.48			59,936		36,249.09	
At present with 1.26 cropping intensity	60.48	76.50	1.26	75,811	26.49	45,850.78	26.49

If fallow lands are included with 1.26 cropping intensity	70.01	88.51	1.26	75,811	-	53,075.61	15.76
If fallow lands are included with 200%	70.01	140.024	2.00	1,19,871	58.12	83,924.31	83.04

Sources: IDSAP Field Survey 2019-20

6.5. Potential employment benefits

Yet another dimension to assess the impact of APCNF is its employment generation potentials. In this section only employment generation within crop production sector, including labour requirement in preparation of own biological inputs are considered. The employment generation in the backward and forward sectors are not considered. The (weighted) average of labour use in select nine crops is given at Table 6.5. Under APCNF, the average labour used per hectare is 120 days. It includes 50 days own labour and 69 days hired labour. Compared non-APCNF crops, on average 15 days additional labour is applied per hectare in APCNF crops. It mostly consists of own labour, including exchange labour of 13 days and 2 hired labour. Most probably, the additional family labour was used in the preparation of the biological inputs. The nature of the preparation of biological inputs demands higher amount of family labour. Preparation of biological inputs involves several small and tiny tasks such as collection of raw materials, cleaning, grading, drying, soaking, mixing, grinding, fermenting, etc., are spread across several days, which can't be entrusted to the hired labour, need to be attended by the family members only.

Table 6.5: Average of labour used in select nine crops

Farming type	Own Labour	Hired Labour	<i>In person days</i>
			Total
APCNF	50	69	120
Non-APCNF	37	67	104
Difference	13	2	15

Sources: IDSAP Field Survey 2019-20

These average labour use rates are used in the estimation of labour requirement under different scenarios. Under non-APCNF scenario, 104 labour days are required per hectare in one season. With 1.26 cropping intensity, labour requirement would be 132 days per hectare per year. If fallow lands are included with 1.26 cropping intensity, there won't be any change in the labour requirement per hectare per year. But, the total labour requirement in the crop sector would increase, by 15.7 per cent, to 9.231.23 lakh days. If the cropping intensity increase to 200 per cent, the labour would reach 209 days per hectare per year. If the entire area is put under APCNF, the labour requirement would be 239 per hectare per year (Table 6.6).

Table 6.6: Potential increase in the labour requirement under different scenarios

Indicator	Net Sown Area	Gross cropped area	Cropping intensity	Labour days required	Rate of change	Labour required in crop sector	Rate of change
Unit	Lakh ha	Lakh ha	Number	Per hectare of NSA	Per cent	Lakh days	Per cent
Non-APCNF Scenario							
At present without 1.26 cropping intensity	60.48			104		6,289.92	
At present with 1.26 cropping intensity	60.48	76.50	1.26	132	26.85	7,978.61	26.85
If Fallow lands are included with 1.26 cropping intensity	70.01	88.51	1.26	132	-0.05	9,231.23	15.70
If fallow lands are included with 200% cropping intensity	70.01	140.024	2.00	209	58.12	14,603.88	83.04
APCNF Scenario							
At present without 1.26 cropping intensity	60.48			120		7,229.19	
At present with 1.26 cropping intensity	60.48	76.50	1.26	151	26.49	9,144.06	26.49
If fallow lands are included with 1.26 cropping intensity	70.01	88.51	1.26	151	-0.05	10,579.66	15.70
If fallow lands are included with 200% cropping intensity	70.01	140.02	2.00	239	58.12	16,737.10	83.04

Sources: IDSAP Field Survey 2019-20

Assuming 300 person days are equal to one person employment, the present and potential employment generation, under APCNF, are estimated and presented at Table 6.7. At present the crop sector needs 26.60 lakh persons, if the entire area is under non-APCNF. The same would increase to 30.48 lakh persons, if the entire area is put under APCNF. Most of the additional employment of 3.88 lakh persons would accrue to own labour (3.28 lakh persons) and hired labour would get just 0.60 lakh persons employment. If 40 per cent fallow lands are brought under cultivation and cropping intensity is raised to 200 per cent, the demand for employment would increase to 48.68 lakh persons under non-APCNF and 55.79 lakh persons, under APCNF farming. Out of 7.11 lakh new jobs created with APCNF, 6.01 lakh jobs would be confined to the family labour and hired labour would get 1.1 lakh jobs. As APCNF focus on cropping diversity and increasing the cropping intensity, there would be a marked reduction in the peak time demand for labour. ***Under APCNF, agriculture employment may undergo a transition in coming years. It may change from seasonal employment for many to yearlong employment for lesser people.*** In this context, the projection that almost all additional employment would accrue to the family labour appears to be valid.

Table 6.7: Present and potential employment scenarios in the crop sector

In lakh persons

Farming type	Own Labour	Hired Labour	Total
Current scenario			
APCNF	12.76	17.72	30.48
Non-APCNF	9.48	17.12	26.60
Difference	3.28	0.60	3.88
With inclusion of 40 per cent fallow lands and 200 per cent cropping intensity			
APCNF	23.36	32.43	55.79
Non-APCNF	17.35	31.33	48.68
Difference	6.01	1.10	7.11

Sources: IDSAP Field Survey 2019-20

6.6. Marketing

Yet another factor, which would have immense impact on the farm incomes is the marketing. There is a good consumer demand for chemical free food among the urban consumers, especially, among the rich and middle-class. RySS is facilitating marketing place for APCNF at Rythu Bazars, Weekly/ Irregular Bazars (Shandies) and dedicated shops. The farmers themselves have developed new market channels such as online marketing, selling to friends and relatives, urban consumers, factories, etc. All these initiatives are in the nascent stage. Given the importance of marketing, IDSAP has covered this topic in a section in IDSAP, 2020a and a chapter in IDSAP, 2020b. The findings are summarised below.

1. Most of the APCNF outputs are being sold in the local markets, which include friends, relatives and local shops. It indicates the local interest/ demand for the APCNF output. Small quantities of APCNF products are sold to factories, cooperatives, urban consumers, through online markets and others.
2. Out of 13 sample crops, data collected during Kharif survey, 10 APCNF crops got higher prices, and three crops received lower price.
3. As per the Rabi survey/ report, that almost all the APCNF products have more diverse market channels. The bulk of Sesamum output was sold to factories directly, which is an additional channel to three channels, where non-APCNF produces were also sold, during the Rabi season.
4. APCNF farmers, albeit in smaller numbers, have started processing their crop outputs before selling.
5. APCNF farmers are able to withhold at least a small part of the output to sell at later date. Such a practices not necessarily fetch, always, higher prices.

6.7. Conclusions

Though the analysis in this chapter is carried out with limited data and with few assumptions, it gives interesting and useful insights for informed decisions and initiatives. As select crops together cover about 69 per cent of GCA in the state, the data can be used in the advocacy in different for a. All the APCNF farmers, together, have saved over Rs.300 (64.85 per cent) expenditure on PNPIs and about Rs.360 cr (21.47 per cent) savings in the paid-out costs. Even without application of agri-chemicals, which are considered as the critical inputs in the 'Green Revolution' agriculture, the APCNF farmers, in the state, have got over Rs.233 crore (8.26 per cent) higher gross revenue and over Rs.593 crore (51.90 per cent) higher net returns.

Had the entire GCA were put under APCNF, the farmers, in the state, would have saved Rs.8,038.5 crore (64.85 per cent) in the expenditure on PNPIs and Rs.9,504.27 crore (21.47 per cent) in the paid-out costs. They would have realized Rs.6,170.38 (8.26 per cent) higher gross revenue and Rs.15,666.53 crore (51.90 per cent) higher net revenue. APCNF is one of the most effective, if not the only, option to increase the cropping intensity in the state. Under APCNF, agriculture employment may undergo a transition in coming years. It may change from seasonal employment for many to the yearlong employment for lesser people. Most of increased employment, under APCNF, would accrue to own labour. APCNF farmers are getting diverse marketing channels. RySS may build on these opportunities.

Chapter 7: Household Income

7.1. Introduction

It was planned to estimate the household incomes during Rabi survey. Two new blocks regarding incomes from livestock and other sources, including remittances, wages, salaries, rents, government cash transfers, etc, were included in the Rabi household schedule. household incomes from Rabi crops, livestock and other sources were estimated from the data collected during the Rabi survey. Income from Kharif crops was estimated from the data collected during Kharif schedule.

The estimate has one serious methodological challenge. The cropping intensity in the state is 1.26; i.e., only 26 per cent of NSA in the state is put under crops, more than once in a year. Majority of farmers cultivate either in Kharif or Rabi. A small percentage of farmers cultivate during both seasons. As Rabi sample has to be the households, who were cultivating crops during Rabi season, the Rabi survey has covered all those Kharif sample, who have cultivated during Rabi season; and picked up, randomly, new sample from listed households, who were cultivating during Rabi 2019-20. In total, 136 new APCNF farmers and 253 new non-APCNF farmers have been included in the Rabi sample to get all sample households, who were cultivating Rabi crops during the study period. Because of all these changes in sample composition during Rabi survey, each Rabi sample farmer has cultivated in both Rabi and Kharif season. This is not the case in the state. The cropping intensity of Rabi sample farmers would be about 2.00 (200 per cent), vis-à-vis 1.26 (126 per cent) in the state. Because of these methodological issues, the household's estimated income in this chapter is not comparable with the state average.¹¹ However, as the same methodology and data sources are used in the estimation of household incomes of APCNF and non-APCNF farmers, they are comparable, which is the major interest of this study.

¹¹ To overcome these kinds of challenges, the sample design for 2020-21 study has changed. Sample selection was completed at the beginning of the study. The same sample farmers would be visited and data would be collected, irrespective their cultivation status in Summer, Kharif and Rabi seasons. In the processes, the study planned to estimate, among many other things, the cropping intensity also.

The farmers' household incomes, in this chapter, have been derived from four major sources, viz., (1) Crop income from Rabi season, (2) Crop income from Kharif season, (3) Income from livestock, and (4) Other income. Other incomes include wage income, salaries, government transfers, rental incomes, etc. First time, the household incomes of both APCNF and non-APCNF farmers are estimated in this report. As the data on income from livestock and other sources was available for Rabi sample only, the *average household incomes* of 902 APCNF and 601 non-APCNF farmers were estimated for Rabi crops, livestock income and income from other sources, from Rabi data. Similarly, the average income from Kharif crops of 1,422 APCNF farmers and 622 non-APCNF farmers was estimated using the Kharif data. For further analysis, the individual household data of 766 APCNF farmers and 348 non-APCNF farmers, who are common in both Kharif and Rabi sample, were used after making necessary corrections.

7.2. Crop income in the Rabi season

The APCNF farmers' Rabi crop income has four components, viz. (1) Income (net returns) from six APCNF sample crops, (2) Income from other APCNF crops; this is estimated from the *average* net returns of six APCNF sample crops (previous point), (3) Income from non-APCNF crops; this is estimated from the average net returns of six non-APCNF sample crops, and (4) Income from the model crops. The non-APCNF farmers' crop income has two components, viz. (1) Income (net returns) from six non-APCNF sample crops, and (2) Income from other non-APCNF crops; this is estimated from the *average* net returns of six non-APCNF sample crops (previous point).

The sample 902 APCNF farmers together have cultivated 964.94 hectare during Rabi season. Out of this, 473.10 hectare was put under six sample APCNF crops, 72.90 hectare was under other APCNF crops and 418.94 hectare under non-APCNF crops/ cultivation. The sample 601 non-APCNF farmers have cultivated 616.80 hectare during the season. It includes 381.05 hectare under six sample crops and 235.75 under other crops. From six sample APCNF crops, the farmers have obtained the average net returns of ₹82,111 per hectare and total income of ₹388.47 lakh. Using the same per hectare average net revenue, the total income from 72.90 hectare of other APCNF crops was estimated at ₹59.86 lakh. Using the average net returns of six sample crops, under non-APCNF, of ₹71,840 per hectare, the total income from 418.94 ha, under non-APCNF crops, was estimated at ₹300.97 lakh. Further, APCNF sample farmers have

obtained additional net income of ₹1.95 lakh from model crops, mostly from border crops.¹² During the Rabi season, 902 APCNF farmers have earned ₹751.25 lakh net returns, which turns out to be ₹83,287 per household. Similarly, 601 non-APCNF farmers have earned total ₹443.11 lakh net returns, which turns out to be ₹73,729 per household (Table 7.1).

Table 7.1: Estimation of per HH income of APCNF & non-APCNF sample during Rabi

Crops	Area cultivated in ha		Average net returns Rs/ha		Total income in Rs Lakh	
	APCNF	Non- APCNF	APCNF	Non- APCNF	APCNF	Non-APCNF
Paddy	164.28	99.84	78,457	68,461	128.89	68.35
Maize	95.48	133.99	79,205	65,290	75.63	87.49
Groundnut	103.93	76.01	1,18,623	97,492	123.29	74.10
Block gram	54.14	23.94	59,081	60,237	31.99	14.42
Sesamum	35.09	39.67	21,862	16,491	7.67	6.54
Onion	20.17	24.85	1,04,132	91,934	21.01	22.85
Total of 6 crops ¹³	473.10	381.05	82,111	71,840	388.47	273.75
Other APCNF crops	72.90		82,111		59.86	
Other non-APCNF crops	418.94	235.75	71,840	71,840	300.97	169.36
Model crops					1.95	
Grand Total	964.94	616.80			751.25	443.11
	Number of HHs				Per HH income in ₹	
Sample HH	902	601			83,287	73,729

Sources: IDSAP: Field Survey 2019-20

7.3. Crop income in the Kharif season

Using the same methodology discussed above, the per HH income from the Kharif crops are estimated, using the Kharif data. Each of 1,422 APCNF sample HHs got ₹72,078 income from the Kharif. The same is ₹62,296 per non-APCNF HHs (Table 7.2).

Table 7.2: Estimation of per HH income of APCNF & non-APCNF sample during Kharif

Crop/ Indicator	Area cultivated in ha		Per hectare net returns in ₹/ha		Total income in ₹ Lakh	
	APCNF	Non- APCNF	APCNF	Non- APCNF	APCNF	Non- APCNF
Paddy	454.06	289.16	51,426	31,031	233.51	89.73
Groundnut	125.28	115.28	51,190	41,346	64.13	47.66
Cotton	89.75	29.88	37,520	14,124	33.67	4.22

¹² It appears to be too small. The possible reasons are -trees and perennial crops, under model crops, need yearlong nurturing, but give returns in a particular season. Further, some of the trees are too young to give the full yields

¹³ The total income estimated from six crops are for non-APCNF crops/ farmers estimated in this chapter, is slightly different from that of chapter 3. In chapter 3 the areas under six APCNF crops were used as common weights for both APCNF and non-APCNF crops to get net impact of APCNF. In this chapter, the areas under APCNF and non-APCNF crops were separately used as weights to get actual incomes from the APCNF and non-APCNF crops respectively.

Red gram	83.35	82.80	19,466	4,219	16.23	3.49
Jowar	71.07	37.30	33,810	40,244	24.03	15.01
Bengal gram	69.7	16.96	38,257	13,571	26.66	2.30
Maize	46.25	55.52	57,422	54,234	26.56	30.11
Chillies	20.58	18.99	4,48,307	3,21,187	92.26	60.99
Sugarcane	30.55	15.52	1,17,150	96,333	35.79	14.95
Sub-total of nine crops	990.59	661.50	55,809	40,584	552.84	268.46
Other four crops	132.12		55,809		73.73	
Other non-APCNF crops	922.27	302.46	40,584	40,584	374.30	122.75
Model crops					24.07	
Total cultivated area	2,044.98	963.86			1,024.94	391.22
	No. of sample HHs				Per HH income in ₹	
Sample HH	1,422	628			72,078	62,296

Sources: IDSAP: Field Survey, 2019-20 (Kharif season data)

7.4. Income from livestock

The income from livestock sector as a whole, and sub-components are presented at Table 7.3. It is interesting to note that the prevalence of dairy animals holding is 64 per cent among the APCNF HHs, which is over 15 per cent higher than that of non-APCNF. It implies that APCNF farmers are incentivised to hold a greater number of dairy animals just for the dung and urine. It will, naturally, yields additional income from dairy products and calves. The APCNF families are also rearing relatively a greater number of all categories of livestock. As a result, they are earning about 25 per cent higher per HH income vis-à-vis non-APCNF HHs. The per HH income from livestock sector is ₹20,315 per APCNF HH and ₹16,277 per non-APCNF HH (Table 7.3). These changes in the livestock holdings will alter the family time utilization and occupations. More livestock holding would reduce the time for seasonal migration and wage employment. These issues will be discussed in details in the next section.

Table 7.3: Total and per household income of APCNF and non-APCNF farmers from Livestock sector

Livestock	No of HHs who own animals (No.)		per cent of HHs holding the livestock (%)		Average income from Livestock (₹)		Total income from Livestock (₹)	
	APCNF	Non-APCNF	APCNF	Non-APCNF	APCNF	Non-APCNF	APCNF	Non-APCNF
Dairy animals	578	292	64.08	48.59	23,114	24,570	133,60,150	71,74,305
Drought animals	134	75	14.86	12.48	25,448	25,221	34,09,995	18,91,574
Small ruminants	91	52	10.09	8.65	13,796	12,424	12,55,411	6,46,074
Poultry	183	86	20.29	14.31	1,631	818	2,98,460	70,343
Total							183,24,015	97,82,297
	No. of HHs						Per HH income	
Sample HHs	902	601					20,315	16,277

Sources: IDSAP: Field Survey, 2019-20

7.5. Income from other sources

It is well known fact that the agriculture households (AHHs), these days, are drawing a significant portion of their income from a variety of sources, other than cultivation and livestock rearing. These include remittances from family members, wage employment in agriculture, wage employment in non-agriculture, salary or regular employment, own business, cash transfers from the government, etc. Among all the sources, Cash transfers from the Govt. is widely reported, by 731 APCNF HHs and 491 non-APCNF HHs;¹⁴ followed by Agriculture wages and Non-agriculture wages. Highest average income reported by APCNF HH is ₹1,01,714 through salary/ regular employment followed by ₹48,680 in others and ₹43,875 through Renting of Agri-implements. In case of non-APCNF HHs, the highest income of ₹91,350 is drawn from others, followed by Salary/ regular employment (₹40,370) and Rent from agri-implements (₹38,123). It may be noted that very few non-APCNF farmers are getting larger incomes from others (8) and rent from agri-implement (20). In case of APCNF farmers, the Salary/ regular employment contributes largest share (34.61 per cent) followed by Cash transfers by Govt., under Rythu Bharosa (30.13 per cent). As mentioned in chapter 2 and IDSAP (2020a), the proportion of Educated and Regular job holders is higher among APCNF farmers, hence the higher share of Salary and regular employment in total other income of APCNF farmers. *It also indicates that APCNF is popular among the informed farmers.* In case of non-APCNF, the highest contribution of 38.79 per cent is provided by Cash Transfers, in the total income from Other Sources, followed by Agriculture Wages (30.88 per cent). Each of APCNF HH got ₹61,583 from Other sources, which is about ₹15,987 higher than that of non-APCNF HHs income of ₹.45,595 (Table 7.4).

Table 7.4: Income from other sources of APCNF and non-APCNF households

Other income sources	No of households with income from other sources		Average income from each source		Total income from each source		per cent share of each source of income	
	APCNF	Non-APCNF	APCNF	Non-APCNF	APCNF	Non-APCNF	APCNF	Non-APCNF
Remittances received	38	19	20,671	15,327	7,85,495	2,91,222	1.41	1.06
Salary/ regular employment	189	50	1,01,714	40,370	192,23,853	20,18,484	34.61	7.37
Agriculture wages	338	271	18,243	30,454	61,66,270	82,53,153	11.10	30.12
Non-Agriculture wages	311	242	13,646	15,632	42,44,004	37,82,891	7.64	13.80
Self-employment	133	77	26,727	9,832	35,54,649	7,57,054	6.40	2.76
NTFP collection	74	41	3,779	1,601	2,79,657	65,643	0.50	0.24

¹⁴ Each and every sample farmer is expected to get Rythu Bharosa transfer. Perhaps, the landless and a few other did not get the assistance.

Cash transfer from Govt	731	491	22,894	21,646	167,35,771	106,28,405	30.13	38.79
Rent from land	46	5	38,343	6,689	17,63,794	33,444	3.18	0.12
Rent from house	18	8	17,968	9,912	3,23,428	79,298	0.58	0.29
Rent from agri-implements	43	20	43,875	38,123	18,86,629	7,62,467	3.40	2.78
Others	12	8	48,680	91,350	5,84,160	7,30,800	1.05	2.67
Total					555,47,709	274,02,861	100.00	100.00
	No. of households				Per household income			
Sample households	902	601			61,583	45,595		

Sources: IDSAP: Field Survey, 2019-20

7.6. Consolidated income

Per household income of sample farmers is obtained by adding the above four sources, i.e., income from Kharif crops, Rabi crops, Livestock and Other sources. The per household income of APCNF farmers is ₹2,37,263 and the same for non-APCNF is ₹1,97,897 (Table 7.5). This is per household income of sample farmers. The sample farmers have cultivated in both Kharif and Rabi seasons, which is not common in the state. Bulk of the farmers, in the state, cultivate either of one season only. RySS is encouraging and facilitating the farmers to cultivate throughout the year, including in the summer season.

APCNF farmers per household income is higher than that of non-APCNF by ₹39,365, in absolute terms and 19.89 per cent in percentages terms. In absolute terms, highest variation (₹15,987) is in Other Sources and least variation (₹4,038) is in Livestock. Also, Other Income sources have provided highest rate of change of 35.06 per cent and least rate of change (12.96 per cent) is recorded in Rabi Crops. Surprisingly, Rabi crops have provided highest contributions in per household income for both APCNF (35.10 per cent) and non-APCNF (37.26 per cent) farmers.

Table 7.5: Estimated average APCNF and non-APCNF sample households' income

Sources	Income in Rs		Differences in Rs	Differences in per cent	per cent share of each source	
	APCNF	Non-APCNF			APCNF	Non-APCNF
Kharif crops	72,078	62,296	9,782	15.70	30.38	31.48
Rabi crops	83,287	73,729	9,558	12.96	35.10	37.26
Livestock	20,315	16,277	4,038	24.81	8.56	8.22
Other sources	61,583	45,595	15,987	35.06	25.96	23.04
Total	2,37,263	1,97,897	39,365	19.89	100.00	100.00

Sources: IDSAP: Field Survey, 2019-20

7.7. Farmer category wise income

To know the impact APCNF on the incomes of difference farm categories, the average incomes of those categories of APCNF and non-APCNF have been worked out and presented in Table 7.6. The marginal and small farmers have benefitted the most from the APCNF. The marginal and small farmers of APCNF got significantly higher incomes than their non-APCNF counterparts. While marginal farmers, of APCNF, got ₹.46,125 (27.69 per cent) higher income, the small farmers, of APCNF have obtained ₹.39,277 (19.78 per cent) higher income (Table 7.6). On the other hand, the landless and other farmers of APCNF have obtained marginally lesser income than their non-APCNF counterparts. While landless APCNF farmers got Rs.2,018 (1.45 per cent) lesser income, other APCNF farmers have got RS.3,455 (0.98 per cent) than their counterparts in non-APCNF.

Table 7.6: Farm category wise income of APCNF and non-APCNF farmers and differences

Farm categories	APCNF	Non-APCNF	Difference between APCNF & non-APCNF	
			In Rupee	In per cent
1	2	3	4=2-3	5=(4/3)*100
				-1.45
Landless	1,36,783	1,38,801	-2,018	
Marginal	2,12,688	1,66,562	46,125	27.69
Small	2,37,843	1,98,566	39,277	19.78
Others	3,48,447	3,51,902	-3,455	-0.98
Total	2,37,263	1,97,897	39,366	19.89

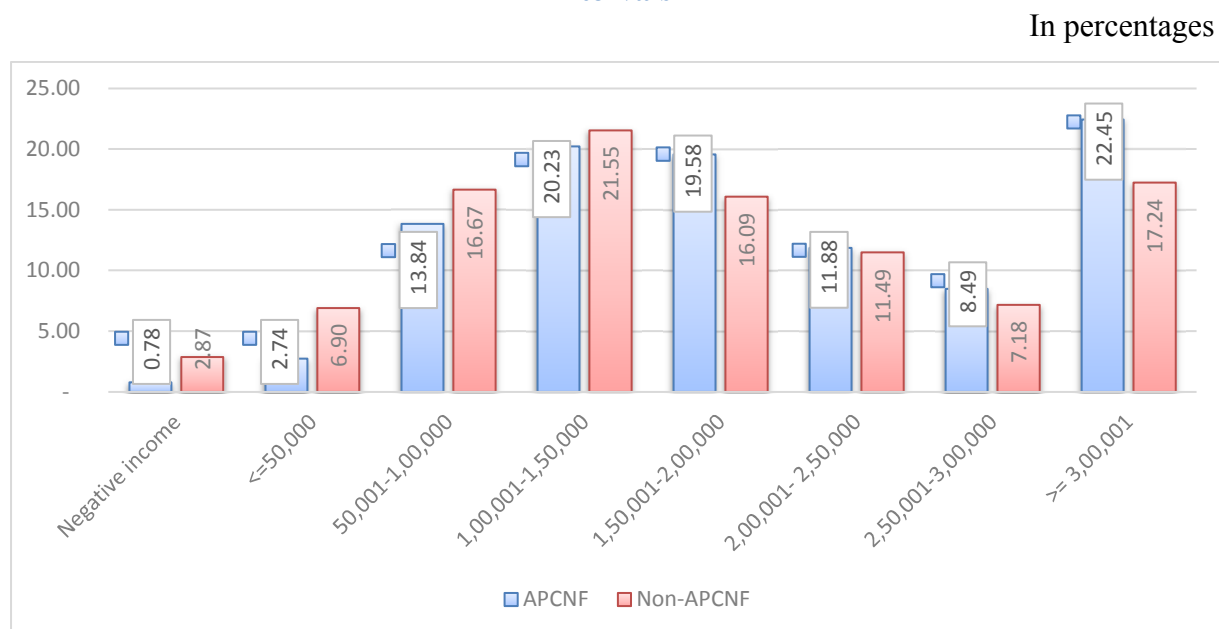
Sources: IDSAP Field Survey 2019-20

7.8. Distribution of households across income intervals

Another way of assessing the performance of APCNF farmers vis-a-vis non-APCNF farmers, with respect to income, is the analysing the distribution of households across different income intervals. The income range is divided into eight class intervals, starting with negative income (<0); less than or equal to Rs.50,000; Rs.50,001 to Rs.1,00,000; 3,00,000 and above. The percentage distributions of APCNF and non-APCNF household, across the eight income intervals, are presented at Figure 7.1. It is interesting to see that percentages of non-APCNF households are higher than that of APCNF at lower intervals and vice versa at higher income levels. For example, nearly 3 per cent non-APCNF household got negative income during the study period. The same is less than one per cent for APCNF households. Highest percentage (22.45 per cent) of APCNF farmers is at the highest income category of Rs.3 lakh and above.

On the other hand, highest percentage (21.55 per cent) of non-APCNF, is in the income interval of Rs.1 to 1.5 lakh. The gap between APCNF and non-APCNF farmers at the highest income category is over five percentage points.

Figure 7.1: Distribution of APCNF and non-APCNF household across income class intervals



Sources: IDSAP Field Survey 2019-20

7.9. Conclusions

The project APCNF not only enabling the participants to earn high income, but also facilitating a positive shift in households' occupations. Higher prevalence of livestock holding, particularly the dairy animals, would naturally result in an occupational shift towards livestock from other occupations, such as wage labour, migration, etc., which are considered as vulnerable occupations. The project is also facilitating an increase in the cropping intensity. These trends will lead to larger and positive changes in the agriculture and rural areas, in coming years. Farmer's category wise and household distribution across the difference levels of income category analysis indicates that APCNF is benefitting the marginal and small farmers most.

Chapter 8: Environmental, Health and Well-being

8.1. Introduction

The issues of environmental benefits, health benefits and farmers well-being have been covered in a chapter in each of IDSAP, 2020a and 2020b. Both chapters were prepared with data obtained from the household schedules. Households' responses were quantified and presented in a number of graphs and tables, in those reports. The same are summarized below.

8.2. Kharif Report

1. Overwhelming majority of the farmers have reported that the quality of the soils and crops have improved due to APCNF. The increase in yields in almost all crops and higher gross and net returns realized by the farmers are solid evidence for increased quality of soils and other improvements in the crops and the crops' resilience to weather anomalies.
2. Increase in the area allocated to APCNF crops is another indicator of the APCNF's success.
3. Over 72 per cent APCNF farmers in the total sample have reported that the health condition of their family members has increased due to APCNF. The same varies from 43.2 percent in Srikakulam to 96.09 percent in Vizianagaram.
4. Nearly 90 per cent sample farmers have experienced a reduction in their out-of-pocket expenditure on the health due to APCNF. It is widely experienced across the districts.
5. APCNF has been improving the farmers' perceptions towards agriculture and the overall wellbeing of the farmers.
6. About 92 percent of sample households are consuming the APCNF food. The same varies from 67 percent in Prakasam district to 99 percent in Guntur. It is possible that some of farmers, who are not consuming the APCNF food, may not be cultivating the food crops or food crops of their choice food.
7. About 86 percent of sample farmers said that APCNF food is tasty. The same vary from 58 percent to 98 percent across the districts
8. As APCNF has been resulting in increased profit margins and reduced health risks due to application of fertilizers and pesticides, and lower out-of-pocket expenditure, there is a growing interest in farming among the APCNF farmers.

9. About 93 percent APCNF sample farmers expressed their liking for agriculture due to APCNF. The same vary from 62 percent in Chittoor to 100 percent in East Godavari.
10. About 63 percent of APCNF farmers have reported that their financial position has improved due to APCNF.
11. About 71 percent sample farmers have experienced a significant reduction in their agriculture related tensions, and corresponding increase in their happiness.

8.3. Rabi Report

12. About 94 percent of APCNF farmers in the state have reported that the quality of the soils in their fields have improved. It is interesting to note that in five districts, 100 per cent farmers have reported and experienced improvement in their soil quality.
13. Soil improvements are not just the farmers' perceptions, they have manifested into higher and resilient crop yields and quality crop outputs; and higher gross and net returns.
14. Over 92 percent of sample households are consuming the APCNF food. The same varies from 36.11 percent in Nellore district to 100 percent in five districts.
15. About 81.5 per cent off APCNF farmers have stated that their families' health status has increased due to APCNF; the same varies from 22.22 per cent in PSR Nellore to 100 per cent in Vizianagaram.
16. More encouraging trend is that 89.11 percent sample farmers have experienced a reduction in their out-of-pocket expenditure on the health due to APCNF; the same varies from 58.33 per cent in PSR Nellore to 100 per cent in East Godavari.
17. By addressing the major farming issues such as profitability, health hazards, risks, tensions, etc, the APCNF programme has changed the farmers' outlook towards agriculture.
18. APCNF farmers are freed from their dependence on the exploitative agri-chemical market completely and unfair credit markets, at least partially. These developments, naturally, reduce the farming related pressures and tensions; and improves the family happiness. In total, 78.23 per cent sample farmers have indicated a reduction in the agriculture related tensions and an improvement in their family happiness.
19. Over 83 per cent of APCNF families find that APCNF food is tastier. The same varies from 22.22 per cent in PSR Nellore to 100 per cent in Chittoor.

20. Nearly 72 per cent farmers, in the state, have stated an improvement in their financial positions. The same varies from 26.58 per cent in Srikakulam to 97.44 per cent in Vizianagaram.

8.4. Conclusions

Overwhelming majority of the farmers have reported that the quality of the soils and crops have improved due to APCNF. Soil improvements are not just the farmers' perceptions, they have manifested into higher and resilient crop yields and quality crop outputs, which, in turn, resulted in higher gross and net returns.

Again, overwhelming majority of the farmers are consuming the APCNF natural food, and have experienced an improvement in the health status of their family members and a reduction in their expenditure on health. Further, majority of members reported improvement in their financial position; their outlook towards agriculture; and their happiness, due to APCNF. The wider variations across the districts in some indicators need attention from the project.

Chapter 9: Issues, Challenges and Policy Options

9.1. Introduction

The APCNF project is doing exceptionally well and results are encouraging. However, it is important to identify the challenges, how so small they may be, and address them for rapid expansion and sustainability of the project. In this context the survey has elicited the farmers, in the household schedule, to report their difficulties in adapting the APCNF. The survey is also collecting the qualitative information through strategic interviews (SIs), with District Project Managers (DPMs), and Focus Group Discussions (FGDs) with the primary stakeholders and key resource persons. The data was analysed in two separate chapters in the previous two reports. Similar analysis is carried out in chapter 4 – Panel study, in this report. Hence, a different analysis is carried in this chapter. The identified issues and challenges are put in the strengths, weaknesses, opportunities and Threats, popularly known as SWOT framework. The framework automatically provides the insights to build on the strengths, to overcome the weaknesses, to capitalize the opportunities and to neutralize the threats. Then the policy options are presented.

9.2. SWOT Analysis

All the following points are, mostly, taken from FGD records.

9.2.1. Strengths

1. Providing wonderful solutions to the challenges of present agriculture in the state, in the country and in the world.
2. Reducing significantly the expenditure on PNPIs
3. Reducing the paid-out cost of cultivation.
4. Increasing the yields
5. Improving the crop quality
6. Improving the gross and net revenue
7. Improving the soil quality. Moisture levels in the soils have increased
8. Contributing to the global effort to overcome the challenges of climate change
9. Improving the health of farmers
10. Providing safe food to the consumers
11. Some of fallow lands are being cultivated due to less investment requirement.

12. A few APCNF villages have witnessed a spurt in Desi cow rearing
13. There is marked increase in mixed cropping, crop rotation and horticulture due to APCNF.
14. APCNF farmers are getting good recognition and respect in their social circles.
15. Friends and relatives are purchasing the APCNF food.
16. Educated persons are interested in APCNF
17. Cow rearing is getting respected.
18. Less dependence on credits. Credit worthiness of APCNF farmers has increased. May be due to the interest in APCNF food, traders and others may be giving the farmers free advances.
19. Birds are coming back to the fields. It also indicates an increase in biodiversity in the fields, i.e., below and above soils; and also, the local environment.
20. People have learned about Navadanyalu and PMDS
21. Fertilizer and pesticide use has come down by 50 per cent and 30 per cent respectively.

9.2.2. Weaknesses

1. Not able to reach the needy. Distressed by the chemical based agriculture, the farmers in the state, and also in the country, are looking for APCNF kind of alternatives. In some of the FGDs in non-APCNF villages, the farmers, after learning about the APCNF, wanted the programme to be launched in their villages. As per the latest data, as on December 2020, the programme has covered about 11 per cent farmers and five percent GCA in the state
2. Not able to command the premium price or at least a commensurate price for their quality (chemical free) products. Marketing is major challenge cited by the majority of households. The same was pointed in all previous reports and also in chapter 4- Panel study.
3. Less awareness and inadequate extension services, even in the APCNF villages. In the FGDs, the farmers, appeared to be giving general answers such as that natural farming will give less yields, at least initially. Whereas, the CCEs shows that APCNF gives at least same level of yields, if not higher yields, in almost all crops. This information is not percolating down properly. Shortage of hired labour was commonly cited reason for not adoption of APCNF. But data obtained in the present and previous surveys clearly indicate that the increase in the demand for hired labour is marginal. Some

farmers have expressed inadequate knowhow to prepare Kashayams and Asthrams. Some farmers wanted more and timely extension services.

4. Non-availability of readymade Kashayams and Asthrams, when required. Preparation of these Kashayams and Asthrams takes time. But the pests and diseases have to be controlled in real-time.
5. No improvement in Kashayams and Asthrams formulations. At times, these Kashayams and Asthrams proved ineffective in controlling the pest attacks, such as Laddepurugu. There are local solutions to some of these problems¹⁵. But the project has no mechanism to build on those technologies, knowledge and practices.
6. Shortage of livestock, especially the Desi cow; hence, shortage of inputs to prepare the biological inputs.
7. Shortage of instruments, implements and utensils to prepare the biological inputs and Kashayams and Asthrams.
8. Shortage of raw materials for preparation of the biological inputs.
9. Problems of tenant farmers
10. RySS field staff is too busy with prepare work, reports submissions and attending review meetings.
11. Some farmers in the interior villages have dropped out of the programme

9.2.3. Opportunities

1. Growing demand for chemical free food
2. International support for the mitigation and adaption of the climate change

9.2.4. Threats

1. As per the discussions in some FGDs, the programme is going against the powerful mainstream industries, institutions and policies. Some statements are reproduced below.
2. Farmers in some FGDs have asked for the ban on the fertilisers and pesticides shops.

¹⁵ In one FGD, farmers said that the mixer of Kerosine, green chillies and garlic spray would control the Luddepurugu. It may or may not be a APCNF recommendation. The point is such local techniques and practices are plenty. There is a need for documenting those and build on them.

3. Farmers in some FGDs have suggested that the Government should limit all the subsidies and other support to APCNF farmers only
4. Conflicting extension services by RySS and Agriculture Department

General recommendations of the SWOT analysis are:

1. Address all the sections for sustainable and balance development
2. For effective progress, prioritise all items under each section and start with top two under each section. Needless to say, there need for reviewing and enlarging this list, before initiating the action.

9.3. Policy Options

Apart from the general SWOT analysis related recommendations, the following specific recommendations are provided. Most of these recommendations are repetitive from previous reports. Still, these are worth repetition.

9.3.1. Improvement of soil quality and crop yields

Low and fluctuations in some crops is a serious issue. RySS has initiated, on a large scale, the pre-monsoon dry sowing (PMDS) to boost the soil quality and productivity. This measure is expected to give very good results, in increasing and stabilizing the crop productivity, in coming days. Other natural farming methods such as tree-based farming and System of Root Intensifications (SRI) may also be implemented at the appropriate places. The process of introducing the medicinal and cosmetic plants may be widened.

9.3.2. Marketing

- a. RySS may facilitate the procurement of APCNF products for the Public Distribution System (PDS), School Mid-day Meals, Anganwadi programs, etc. It is pleasing to note that there is some progress on this issue.
- b. RySS may rope in the Girijana Cooperative Corporation (GCC) in the marketing of the APCNF products, in the Tribal areas.
- c. RySS may facilitate tie up between big malls and certain villages/ mandals. The SHG institutions may also be roped in for simple preparation of agri-products/ food processing such as cleaning, grading, grinding, deseeding, shelling, packing, etc.

- d. As and when the medicinal plants and cosmetic related plants are introduced in the farming systems, simultaneously, their processing and marketing interventions have to be initiated.

9.3.3. Non-availability of Raw Materials for Biological Inputs

- a. RySS may introduce the required forest species in the cropping systems; and may also facilitate the growing of the required species in the village common lands and homesteads.
- b. The project may consider to strengthen the biological inputs shops in the villages, which are facing an acute shortage; and challenges in preparing their own inputs.

9.3.4. Strengthening of Extension and Awareness

- a. Self-learning literatures, along with case studies, such as booklets, pamphlets, etc, may be printed and distributed extensively and frequently.
- b. All the television channels in the state may be encouraged and facilitated, under corporate social responsibility, to cover APCNF program, food quality, health issues, etc.

9.3.5. Strengthening the Institutions and Influencing the Governments

- a. There is a need for a close coordination of all departments dealing with natural resources, agriculture and farmers such as agriculture, rural development, animal husbandry, forestry, civil supplies, etc. Such integration enables the RySS/ field staff to share their resources and responsibilities for the productive/ fruitful engagement with the farmers and for the rapid expansion of the program/ project. Such coordination is essential to expand the project coverage quickly.
- b. Internal evaluations, inter-district evaluation by the DPM staff for mutual learning may be facilitated and institutionalized. Such visits could be instrumental to appreciate the good work done by DPMs and their colleagues. Third party evaluations by organisations like IDS, dissemination of Successful Innovations would enthuse the DPMs and their staff in implementing APCNF programme effectively.
- c. The conduct of crop cutting experiments by Directorate Economics and Statistics and estimating area under APCNF and publication of this information in their

documents do further enthuse the DPMs and their field staff in the implementation of APCNF.

- d. At present the mainstream agriculture research in the state and country is not focusing on APCNF. There is a need for the basic and action research on APCNF. RySS is already doing some action research. The mainstream research institutions, in the country, should get involved. APCNF should get integrated in the research agenda of those institutions. The potential research topics include perfection and improvement of Kashayams and Asthrams; shade management in agri-forestry; combination of crops under mixed crops and agri-forestry in different local conditions; appropriate machinery and tools to manage the mixed cropping and agri-forestry; and so on.
- e. Both Government of India and State Government are investing and spending huge amounts on conventional, also known as modern and industrial agriculture. These policies and investments are leading to many scary consequences such as climate change, deterioration of soil quality, degradation of natural resources, health hazards for both human beings and other living beings, etc. RySS may take a lead role in reversing these dreadful trends, policies and practices.

9.3.6. Access international green funds

There are several funding opportunities with respect to climate change and afforestation. RySS may access those funds and use for the benefit of participating farmers

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