



# ECOLOGICALLY SOUND, ECONOMICALLY VIABLE

## COMMUNITY MANAGED SUSTAINABLE AGRICULTURE IN ANDHRA PRADESH, INDIA

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## CONTENTS

Executive Summary .....	5
1. The Context .....	6
2. Community Managed Sustainable Agriculture—the Technologies and Practices .....	10
3. Social and Economic Mobilization and Institutions of the Poor Small Holders .....	12
4. Implementation of CMSA by Community Institutions and Their Federations .....	14
6. Key Lessons for Design and Implementation.....	26
7. The Road Ahead .....	29
References.....	29



## Executive Summary

The Green Revolution increased agricultural production for many farmers in India and achieved significant gains in terms of food security. However, many of the small-farm holders in rain-fed and resource poor areas did not benefit much from Green Revolution technology and credit. Of the small-farm holders who have been using chemical fertilizers and pesticides, many are caught in the debt trap due to the high cost of those fertilizers, lack of credit, poor access to markets, and lack of investible surplus. This has resulted in low profitability agriculture, and many smallholders have dropped out of the sector. The spate of suicides among farmers in recent years has been an unfortunate consequence.

Over 300,000 farmers have adopted CMSA in Andhra Pradesh alone, covering 1.36 million acres of farmland—5.1 per cent of the net cropped area in the state—in just over four years

To address these issues, an alternative approach to manage agriculture known as community managed sustainable agriculture (CMSA) is being tested and practiced in the state of Andhra Pradesh in India. The CMSA approach replaces the use of chemical pesticides with a combination of physical and biological measures—including eco-friendly bio-pesticides—and complements it by adopting biological and agronomic soil fertility improvement measures leading to reduced use of chemical fertilizers. This has significantly reduced the cost of cultivation, the need for large amounts of credit, and indebtedness that results. These transformational changes have been achieved without any reduction in the productivity and yields for the participating farmers. Initial results from CMSA in Andhra Pradesh show a significant net increase in farmers' incomes in addition to significant health and ecological benefits.

CMSA uses an institutional platform of community organizations and their federations to plan, implement, manage, and monitor the program and provide a single window approach for delivery of livelihood improvement services and enterprises, exclusively for small-farm holders. Over 300,000 farmers have adopted CMSA in Andhra Pradesh alone, covering 1.36 million acres of farmland—5.1 per cent of the net cropped area in the state—in just over four years.<sup>2</sup> There is a potential of scaling up this approach to the whole of India as CMSA is showing trends of being economically viable and ecologically friendly. The newly set up National Mission on Sustainable Agriculture in India is considering adopting CMSA as one of the key strategies at the national level. As this approach challenges the dominant high input subsidized model for agricultural inputs and relies more on the efforts of communities, it is likely to trigger a debate on the new paradigm for agriculture for small holder rain-fed

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<sup>2</sup> Government of Andhra Pradesh, Directorate of Economics and Statistics

farmers and its role. CMSA approach will also point to the new directions in the area of adaptation to climate change in case of agriculture sector and provision of environmental services by the small holders.

This learning note describes CMSA program and its approach, the institutional model supporting it and the implementation process. The paper also analyses the initial results of economic and environmental impact of CMSA, distills the key lessons learned from the Andhra Pradesh experience, and draws possible implications for future.

## 1. The Context

Agriculture is vital to the economy of Andhra Pradesh, but farming in the state has been fraught with a number of challenges. Sixty percent of the workforce depends on agriculture in the state and generates a quarter of the state GDP. Since adoption of the Green Revolution in the seventies, Andhra Pradesh continues to be one of India's major producers of rice, cotton, groundnut and lentils. However, agricultural growth rate and growth rates of yield of major crops had begun to decline in the nineties<sup>3</sup>. A number of factors contributed to this – the high cost of conventional<sup>4</sup> agriculture which is input intensive, the lack of access to institutional credit, insufficient irrigation and inadequate state-run extension services. Farmers across the state were in distress<sup>5</sup>, but small and marginal landholders (82 per cent of landholdings in the state); especially in rain fed (56 per cent of net sown area) areas were affected the most.

Conventional agriculture is input intensive and costly. Investments are needed in HYVs, pesticides, fertilizer and irrigation to ensure a good harvest. In Andhra Pradesh farmers spend as much as 35 per cent of their total cultivation expenditure on pesticides and fertilizers alone (figure 1), whereas the all India average is 30 per cent. State provided irrigation reaches less than 28 per cent of the total cropped area in the state, leaving a majority of farmers to invest in their own irrigation facilities or risk the uncertainty of rains.

Despite the investments, income from conventional agriculture has been uncertain and inadequate to meet the cost of cultivation. In many cases crop

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<sup>3</sup> Growth Rates aggregate value of crop outputs in AP were 3.87 from 1966-67 to 1979-80 and dropped to 2.66 for the period 1980-81 to 1991-92. It dropped further to 2.39 per cent per annum from 1990-91 till 2001-02. Human Development Report 2007, Andhra Pradesh

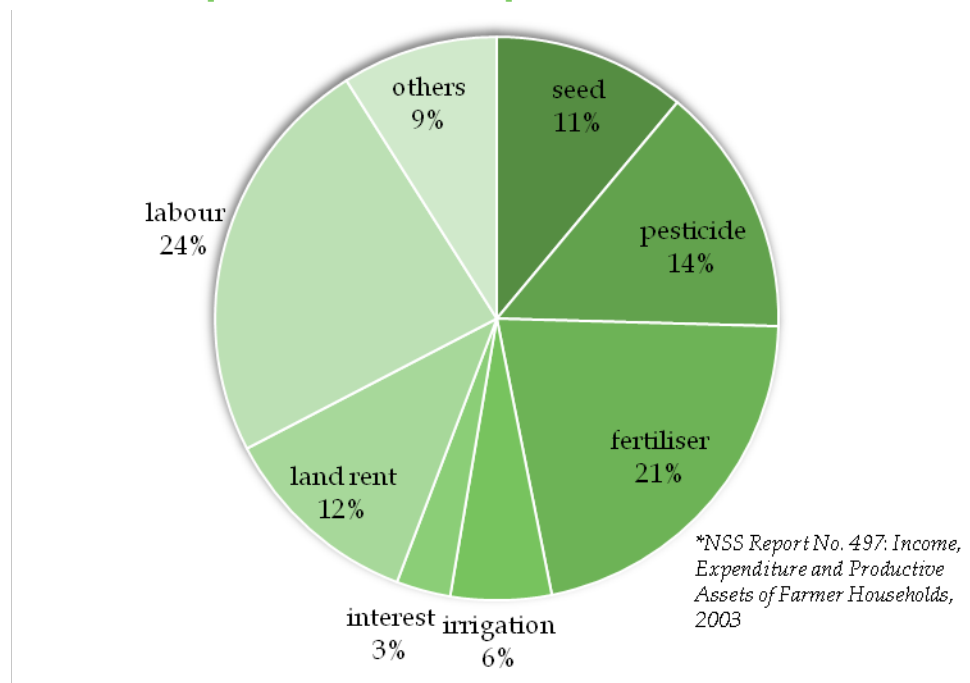
<sup>4</sup> In this paper conventional agriculture refers to continued use of chemical pesticides and chemical fertilizers

<sup>5</sup> A number of news reports and studies document the cases of farmer suicides and cases of high incidence of debt and crop failure in the state. See References listed at the end of this paper.

failure continued even after pesticides, HYV seed and fertilizer were used<sup>6</sup>. During 2002-03 the average annual income from agriculture and related sources for farmers with small holdings (1-2hectares) was US\$440, whereas average expenditure on cultivation during the same period was US\$286, leaving the farmer with only US\$154 to invest in farming and household expenses during the year.<sup>7</sup>

To meet the high cost of cultivation farmers have been under pressure to borrow. The estimated prevalence of indebtedness among farmer households in the state was very high at 82 percent<sup>8</sup> and, the average outstanding loan for farmers with small landholdings was more than twice the national average.<sup>9</sup> The main purpose of these loans was to meet *current expenditure* in farming,<sup>10</sup> which means that income from farming was insufficient to meet the associated expenditure.

**FIGURE 1 DISTRIBUTION OF AGRICULTURAL COST COMPONENTS FOR A SMALL FARMER [1- 2HA LAND HOLDING] IN ANDHRA PRADESH\***



<sup>6</sup> No Pesticides: Down to Earth, May20, 2006

<sup>7</sup> National Sample Survey Organization (NSS) Report No. 497: Income, Expenditure and Productive Assets of Farmer Households, 2003

<sup>8</sup> At 82 percent Andhra Pradesh recorded the highest estimated prevalence rate of indebtedness among farmer households in the country. National Sample Survey Organization (NSS) Report No. 498:Situation Assessment Survey of Farmers, 2005

<sup>9</sup> Small farmers in AP had an outstanding loan of US\$660 per farmer as compared to the national average of US \$280. Human Development Report 2007, Andhra Pradesh

<sup>10</sup> 38%of the loan amount; 23% of the loan amount was for capital expenditure in farming. NSSO Report No.498, 2005

Farmers were borrowing from traders and money-lenders at astronomical interest rates as access to institutional credit was difficult, especially for those with small and marginal holdings.<sup>11</sup> Many farmers were using their land as collateral and turning into tenant farmers on their own land and working for wages. With debt, land mortgages and no guarantee of profits, agriculture was increasingly perceived as a high risk occupation. As a result, cropping intensity in the state was stagnant from the eighties through the nineties and the gross area sown had declined marginally since the eighties.<sup>12</sup>

The decline in government-provided extension services during this period, led farmers to rely more on input traders. These 'all-in-one dealers' filled the gap in information supply, credit and inputs, and also entered into buyback agreements with farmers at below-market prices in return for these services.<sup>13</sup> The failure of state provided extension services also led to unregulated and excessive use of pesticides in the state as farmers were inadequately informed of the dangers of excessive pesticide use. Andhra Pradesh currently records the highest consumption of pesticides in the country<sup>14</sup> at 0.82kgs/hectare as against the national average of 0.3kgs/hectare. This results in not only a monetary burden for the farmer, but it does not always result in higher yields either. It also threatens human and livestock health and, the environment.

Farmers' livelihoods were thus inextricably tied to inputs supplied by unregulated markets and the costs associated with such transactions. And those who failed to meet the costs were left with few options. The crisis intensified in the late nineties and came into sharp public spotlight following a spate of farmers' suicides in the state. Conventional agriculture was becoming unviable as a means of livelihood. This reality strengthened the need for a paradigm shift in agriculture. The first step in this direction was taken with the practice of Non-Pesticide Management (NPM) of agriculture by some NGOs, prominent among which was the Centre for World Solidarity. The aim of NPM was to reduce the cost of cultivation and provide relief from debt by replacing pesticide application with ecologically friendly chemical free farming techniques. Although several farmers had been experimenting and developing alternative methods of pest management in the state, these were not widely known. With the initiation of NPM several such farmer innovations began to be carefully evaluated and

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<sup>11</sup> Small Farmers=1.0-2.0ha; Marginal Farmers =0-1.0ha

<sup>12</sup> Human Development Report Andhra Pradesh 2007: Cropping intensity during 1980-81 and 1990-91 was 1.16; Gross Cropped area declined from 12.5million hectares in 1980-81 to 12.1million ha in 2004-05

<sup>13</sup> Non-pesticidal Management: Learning from Experiences: G.V Ramanjaneyulu et.al; Centre for Sustainable Agriculture, Undated

<sup>14</sup> Government of AP Department of Agriculture web site



promoted as viable pest management technologies. The concept of farmers contributing to development of technologies *in situ* started gaining acceptance.

The Centre for World Solidarity and other NGOs made efforts to raise awareness among farmers about the low importance of synthetic chemical pesticides in raising productivity and the harmful effects of these chemicals on soil, water and health. In 2004 an entire village, Punukula in Khammam District of the state became pesticide free. All 200 farmers in the village had good yields and profits despite *not* using synthetic pesticides. The success of NPM showed that farmers were ready to change from conventional intensive input-driven agriculture. However, access to good seed and fertilizer and, procurement and marketing services continued to be largely under conventional trader-dominated systems. A more comprehensive approach was required to make farming a viable enterprise.

To achieve a complete paradigm shift from conventional agriculture, and offer farmers stable and secure livelihoods, the Society for Elimination of Rural Poverty (SERP)<sup>15</sup> supported Community Managed Sustainable Agriculture (CMSA) through its rural poverty reduction program—the Indira Kranti Patham [IKP], in 2004. IKP is owned and managed by community institutions—federation of women’s self-help groups (SHGs). These institutions are the bedrock of all rural poverty reduction activities of IKP, including CMSA. Presence of these community institutions is fundamental to the growth and success of CMSA. In 2004, CMSA started on 400 acres of land in 12 villages and by January 2009 it had grown to cover 1.3 million acres (over 552,000 ha). Currently, over 318,000 farmers in 3,171 villages (about 12 per cent of the all villages in the state) are practicing CMSA. The program covers 18 of the 23 districts of the state (see Fig 2 on page 5). The knowledge support to the community institutions was provided by dedicated N.G.Os with hands on experience in Non-pesticidal management of agriculture. In the last 3 years there has been a paradigm shift - the community institutions having internalized the core principles of NPM have begun to provide the knowledge to other villages. They have also expanded the knowledge base to include soil fertility management, soil and water conservation. Scaling up was possible only when the community institutions themselves started handling the knowledge production and knowledge sharing.

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<sup>15</sup> Society for Elimination of Rural Poverty, a non-profit entity set up by the Department of Rural Development, Government of Andhra Pradesh to implement the Indira Kranti Patham [IKP]. This program is financed through community savings and thrift Government of Andhra Pradesh, Government of India, Commercial Banks and the World Bank.

## 2. Community Managed Sustainable Agriculture—the Technologies and Practices

CMSA technologies and practices are a mixture of scientifically proven methods, indigenous knowledge and traditional wisdom and are deployed in a sequence which farmers learn during their training. The first stage of adoption of CMSA is based on the IPM technology practiced in many parts of the world. Farmers undertake pest prevention and management training. They learn the diagnostic skills to observe, document and understand the behavior and life cycles of pests and the role of natural predators.

Subsequently the farmers begin replacing chemical pesticides with a combination of physical methods such as pheromone traps and sticker plates, and biological methods such as bio-pesticides like Neem extracts.<sup>16</sup> In the third stage of CMSA, pest management through physical and biological means is complemented by measures to increase soil fertility. Farmers are encouraged to replace the use of conventional chemical fertilizers. This includes use of microbial formulations, intensive use of composting techniques, vermiculture and use of bio-fertilizers

The guiding principles of CMSA are in box 1 on the right. A generic list of the technology options for CMSA is given in Table1 on the following page.

### BOX 1 THE GUIDING PRINCIPLES OF CMSA

- Observation and documentation of pest and predator behavior, pest incidence on the farms
- Replace chemical pesticides with physical methods of pest management complemented by botanical formulations and bio pesticides
- Aim to manage pest populations; not to eliminate pests;
- Focus on balancing predator and pest populations;
- Enhance and maintain soil health through mulching, green manure and vermicompost
- Reduce usage of synthetic(inorganic) fertilizers and later stop using it
- Increase diversity and intensity of crops
- Identify appropriate cropping systems - inter-cropping, multi-cropping, crop rotations;
- Preserve local varieties and land race
- Maintain local land races and crop genetic diversity

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<sup>16</sup> Pheromone traps are part of the biochemical pesticides which are naturally occurring substances that control pests by non-toxic mechanisms. Insect sex pheromones interfere with mating. Additionally, various scented plant extracts attract insect pests to traps. Biopesticides on the other hand are certain types of pesticides derived from such natural materials as plants, bacteria, animal wastes, and certain minerals.

**TABLE 1 SUSTAINABLE TECHNOLOGIES PRACTICED BY CMSA FARMERS**

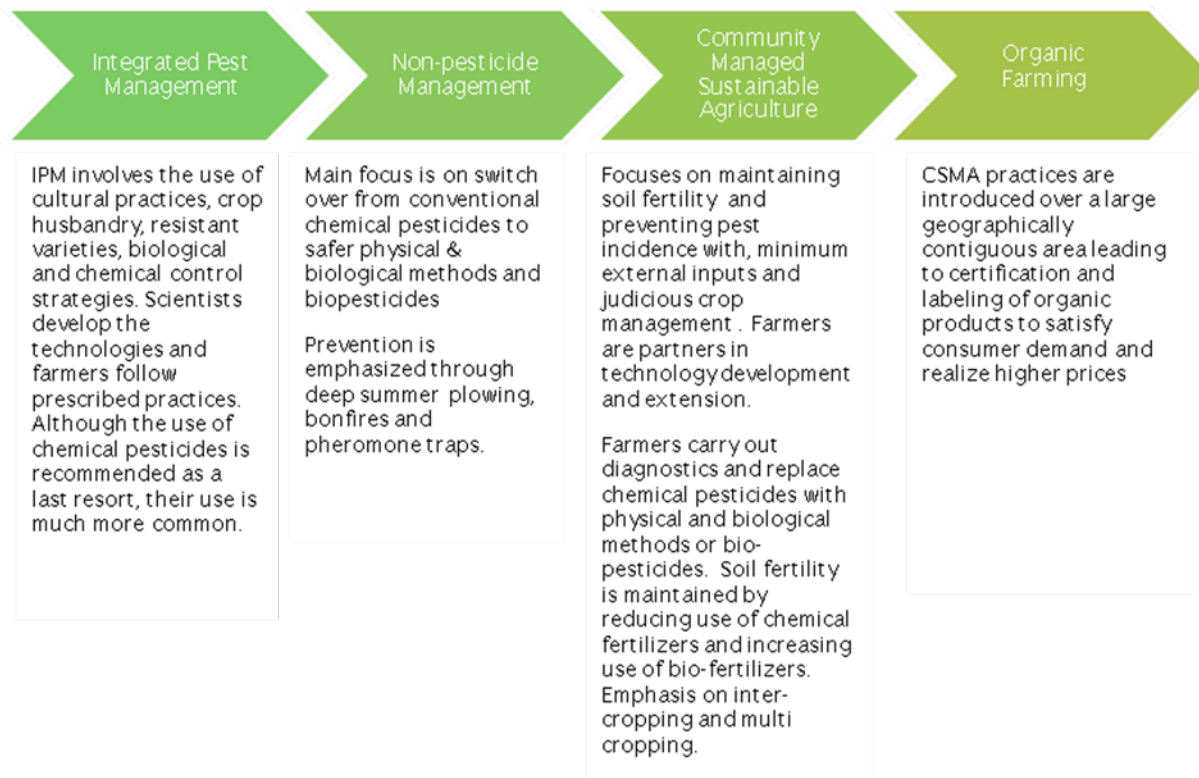
Pest Management	Soil Fertility Management	Crop Management
<b>Stage 1 CMSA (Non Pesticide Management)</b>		
<p>Step 1: Observations and Diagnostics Observe and document pest and predator behavior Understand pest life cycle</p> <p>Step 2: Physical methods of Pest Management Summer plowing Bonfires and pheromone traps Sticker plates Bird perches</p> <p>Step 3: Biological Methods of Pest Management Trap crops along perimeter or in rows</p> <p>Step 4: Bio-pesticides <i>Agniastram</i> – chilli, garlic, neem and cow urine <i>Brahmastram</i> – neem leaves, custard apple, castor, papaya, bitter gourd, and cow urine</p>	<p>Continue use of chemical fertilizers in the initial stages</p> <p>Begin use of manure &amp; compost</p> <p>Begin application of microbial formulations</p> <ul style="list-style-type: none"> <li>▪ <i>Panchagavya</i> – cow dung, cow urine, milk, ghee and yogurt</li> <li>▪ <i>Jeevamrutham</i> – jaggery, sugarcane juice, cow urine and dung</li> </ul>	<p>Crop Rotation</p>
<b>Stage 2 CMSA - Sustainable Agriculture</b>		
<p>Same as above</p>	<p>Reduce and then Replace chemical fertilizers with Soil fertility management through:</p> <ul style="list-style-type: none"> <li>▪ Application of tank silt</li> <li>▪ Green manure crops</li> <li>▪ Green leaf manure</li> <li>▪ Mulching</li> <li>▪ Vermicomposting</li> <li>▪ Inoculation with Nitrogen fixing bacteria like <i>Azospirillum</i> and <i>Azotobacter</i></li> <li>▪ Biomass plantation on bunds</li> <li>▪ <i>Azolla</i> application for rice</li> </ul>	<p>Inter-cropping &amp; Multi-cropping</p>

CMSA practices are scaled up and intensified by replacing conventional fertilizers with tank silt, green manure crops, soil inoculation with *Azospirillum* and *Azotobacter* – nitrogen fixing bacteria, and, vermicomposting. Farmers take on inter-cropping or multi-cropping to maintain soil fertility and reduce pest

incidence. By the third year of operation farmers replace all chemical fertilizers and pesticides with sustainable technologies and practices.

When these technologies and practices (CMSA) are introduced over large geographically contiguous areas, they lead to a large scale adoption of organic agriculture and involve certification, labeling and developing niche markets to satisfy consumer demands for organic products and get higher price realization compared to conventional agriculture products. The key differences between CMSA, IPM and Organic farming are shown in figure 2.

**FIGURE 2 A COMPARISON OF IPM, NPM, CMSA AND ORGANIC FARMING**



### 3. Social and Economic Mobilization and Institutions of the Poor Small Holders

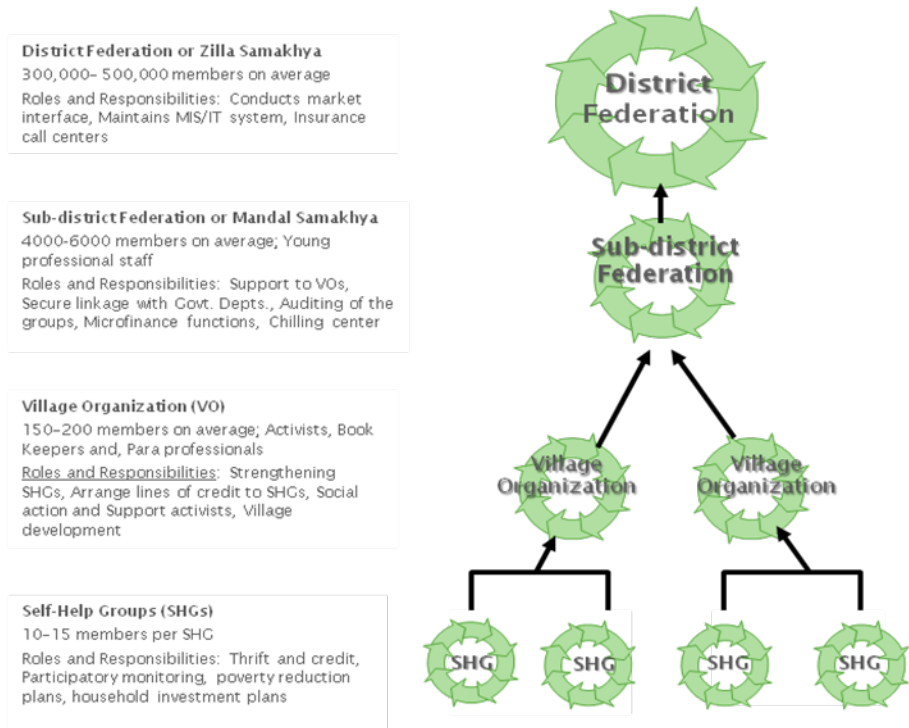
CMSA is managed entirely by community institutions – federations of self-help groups (SHGs), with knowledge and capacity building services from SERP which has supported and supported and nurtured a powerful institutional model of federations of poor women. Ten million women from poor households have been organized into 850,675 SHGs. The SHGs federate into 35,525 Village Organizations (VOs), 1100 Mandal Samakshyas (MMSs which are sub district federations), and 22 Zilla Samakshyas (district federations). It is the largest network of organization of the poor in the country. The federations of SHGs

currently own a corpus of US \$0.8 billion and provide a bundle of financial and other services to which the poor do not normally have access.

The process of mobilization starts with the poor organizing into SHGs of 10-15 members to form groups that save together and inter-lend small amounts of money to each other to stimulate household economic activity. The SHGs also collect repayment from the group members. It is this practice of collective thrift and credit that builds an asset base for the poor, disciplines them to work together and gives them confidence. The more the transactions of saving and lending, the higher social capital and trust are built in the group from repeated interactions. This provides a base for the poor to organize and work together for common goals. All S.H.Gs in a village federate at the village level to form a Village Organisation (V.O). Similarly all V.Os in a mandal (a sub-district unit of about 30 villages) federate into a sub-district federation. All such federations in a

district federate into a district federation.

**FIGURE 3 THE INSTITUTIONAL MODEL**



Building on this foundation of the SHGs, the VOs lend to the SHGs from its own capital fund and in turn the SHGs lend to members. Likewise, the sub-district federations use its seed capital to lend to VOs which on lend to S.H.Gs. This process of repayment and lending is carried out by a three tier federated structure of institutions, each tier working as a financial intermediary (figure 3). This intensity of transactions helps in building positive credit history for the poorest in the community, making them bankable, and generating linkages with commercial banks for larger loans. Such

institutional architecture has enriched poor women to access US\$4.2 billion from commercial banks over the period of nine years for investing in their livelihoods including agriculture. The CMSA approach uses the institutional platform of the poor to invest in development of viable agriculture livelihoods.

This institutional platform is currently driving the CMSA programme and the approach used is described in the subsequent section.

## 4. Implementation of CMSA by Community Institutions and Their Federations

The CMSA approach is managed by community institutions which act as an end to end solution and service providers for small holders. The key elements of CMSA are:

- the leadership and participation of strong community institutions and their federations that own and manage the program;
- farmer field schools that deliver extension services;
- a menu of technologies options developed with farmer participation and experimentation;
- scaling up with practicing farmers as community resource persons [CRPs] who serve as community extensionists; and
- developing 'value chain' investments- from inputs to equipment, post harvest and marketing arrangements of produce for development of sustainable agriculture.

The roles played by each tier of the community institutions and CMSA is described below and elaborated in figure 4.

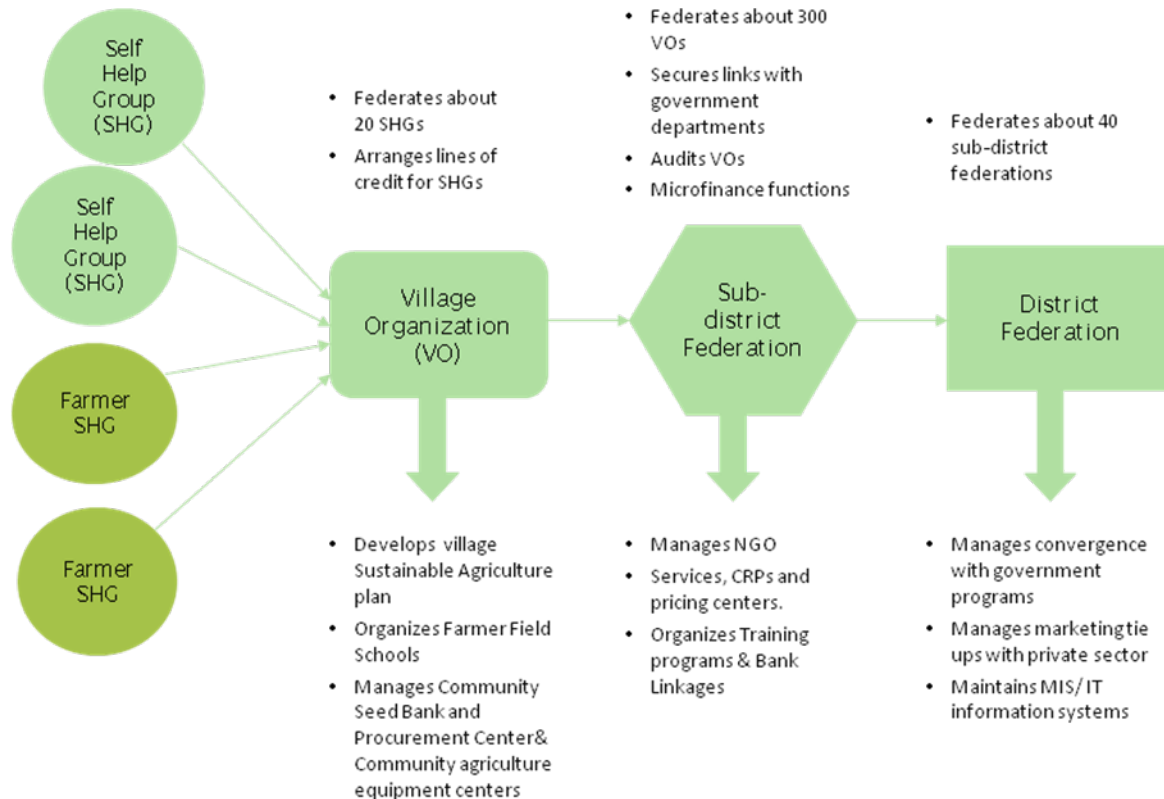
### 1. THE LEADERSHIP AND PARTICIPATION OF STRONG COMMUNITY INSTITUTIONS AND THEIR FEDERATIONS

**Village Organizations (VOs) mobilize the farmers.** It helps in formation of *Farmer Self Help Groups (SHGs)* and manages various aspects of CMSA. Village Activists, accountable to the VOs, identify a group of farmers interested in trying out CMSA. A group of 20-25 farmers form a Farmer SHG (*Sasya Mitra Sangha*), each paying a small registration fee. There are 4 -5 Farmer S.H.Gs in each village. The Farmer SHGs together with VOs develop a CMSA plan on capacity building, production, maintaining internal controls and marketing. The VO is entrusted with overall program management at the village level and is the center of all CMSA activities in the village.

**Sub-district / Mandal level federations- monitoring implementation, coordinating with NGOs.** Delivery of extension and training services are coordinated at the sub-district level by the Sub-district Federation. The Sub-district Federation hires the village activists and in some cases hire NGOs to provide technical input to the VOs. A Cluster Activist is assigned for a group of five villages to organize training programs, field visits and provide necessary technical resources to the farmer SHGs. This tier also coordinates with the department of agriculture's *Krishi Vigyan Kendras (KVKs)* which are the government's extension centers, to build synergies with relevant government programs. A sub-committee for CMSA at this level monitors implementation,

including the role of the NGOs. In this program NGOs are directly accountable to the community organizations who pay for their services.

**FIGURE 4 THE FEDERATION OF SELF HELP GROUPS PROVIDES THE FOUNDATION FOR CMSA ACTIVITIES**



**District level federations –oversee implementation, form tie-ups for marketing.** The *Zilla Samakhya* (District Federation) oversees implementation, partnerships with NGOs, and negotiates with private sector for marketing arrangements. The District Federation also coordinates with the District Rural Development Agency to link up with relevant government programs. For example, CMSA activities have been synchronized with the National Rural Employment Guarantee Scheme which funded the preparation of compost pits and digging of village tanks as a part of the public work program.<sup>17</sup> A sub-committee for CMSA makes regular visits to FFSs, and farmer fields to monitor progress and potential bottlenecks, and monitors district-wide progress.

<sup>17</sup> The NREGA is a national program of the Government of India that provides a legal guarantee for one hundred days of employment in every financial year to adult members of any rural household willing to do public work related to unskilled manual work at the statutory minimum wage.

**State level- strategic oversight.** Strategic issues are managed by the SERP's state project management unit. The SPMU unit alongwith resource NGOs, the district federation members, C.R.Ps, and district project managers constitutes the thinktank for this programme. They provide training, resource materials, technical support and monitoring to the Farmer SHGs.

## 2. EXTENSION THROUGH FARMER FIELD SCHOOLS

Farmer Field Schools (FFSs) are the main channel for delivery of extension services. Village Activists bring together all the farmers to attend weekly workshops in their own fields and training programs to discuss issues related to sustainable agriculture practice. The training is provided to units of farmer S.H.Gs. Each such S.H.G is a homogenous group, usually with contiguous land parcels, and participates in FFSs, facilitated by the VOs, for the delivery of extension services by Village Activists and Cluster Activist. In the first year of implementation, the focus is on replacing pesticide application and maintaining the yield. With success at this stage farmers move on to intensify sustainable practices and reduce external inputs. These FFSs create a local platform for experimenting and generation of localized technology solutions which are internalized by the participating farmers.

## 3. TECHNOLOGY RESEARCH AND DEVELOPMENT

The third step in the strategy is the development of a menu of technology options for pest and soil fertility management, based on the demonstrations and trials in farmers' fields. Farmers develop some of the technologies in situ, on their farms. After wider discussion with other farmers and with technical specialists at district and state level, the technologies are standardized and included in the training and resource material that is developed for the CMSA program. A generic list of some of the technologies and practices being followed is given earlier in table 1.

## 4. SCALING UP WITH COMMUNITY RESOURCE PERSONS

The role of Community Resource Persons (CRPs) is critical for the expansion of CMSA and making it popular. CRPs are farmers who practice CMSA and demonstrate that it is profitable and practicable to other farmers. Each CRP adopts 3 villages where they provide expertise on sustainable practices and initiate new practioners of CMSA. They spend 15 days in a month in the 3 villages. The CRPs also identify farmers who show interest in practicing sustainable agriculture. Some of these farmers are shortlisted as CRPs after they gain first- hand experience and demonstrate effectively all the best practices. These new CRPs then start working with new groups of farmers expanding the network of CMSA farmers. This practice has led to a rapid scaling up of the program at a lower transaction cost and helped the program acquire "social movement" characteristics.



## 5. PROVIDING SUPPORT ON THE “VALUE CHAIN”

The CMSA approach enables bundling of various services including credit, inputs, aggregation and value addition along the value chain at the farmers’ doorsteps. Ultimately, the approach involves facilitating development of micro-credit plans for sustainable agriculture and linking farmers to commercial banks. CMSA approach also facilitates the farmer’s access to high quality inputs through a network of community seed banks and agricultural implements from community centers. Enabling community organizations to conduct activities on value chain ensures higher quality and better prices of the produce.

Institutional platform of the poor is used to invest in development of various livelihoods and manage enterprises along the value chain. These include investments in procurement centers for various agricultural commodities and milk, enabling small farm holders to grade their produce, aggregate them, and undertake quality control and doing localized value addition. Likewise, at the sub-district level, federations invest in enterprises such as chilling centers for milk to increase shelf life of the produce. Meanwhile the district level federation manages a number of support functions including running an insurance scheme for members through a network of call centers. All these activities together have resulted in higher price realization at doorstep for small farmers and created a favorable eco system for profitable agriculture.

## 5. THE BENEFITS AND IMPACTS

CMSA is based on the premise that ecologically sustainable agriculture makes sound economic sense. This section presents some of the results of preliminary field surveys carried out by SERP on yield, cost of cultivation, income and provide evidence of benefits that farmers are reaping from sustainable agriculture (table 2). It is anticipated that if this program is implemented over a large contiguous areas, it would lead to significant adaptation to climate change including lowering carbon footprint from reduced use of inorganic fertilizers and other ecologically sustainable practices. However, the increase in benefits through sustainable agriculture is accompanied by a trade-off in the form of increased investment in labor as some of the pest and soil fertility management methods recommended are more labor intensive. This aspect of C.M.S.A makes it very attractive to small and marginal farmers, as they do not have to search for work outside their farm. Farmers are also able to meet this requirement by working together in groups as reduced pest infestation benefits all farms in a village.

**TABLE 2 THE BENEFITS FROM SUSTAINABLE AGRICULTURE**

Economic Benefits	Environmental Benefits
<ul style="list-style-type: none"> <li>▪ Lower Cost of Production &amp; Substantial statewide savings</li> <li>▪ Yield Maintained or Increased</li> </ul>	<ul style="list-style-type: none"> <li>▪ Better Soil health, water conservation</li> <li>▪ Conservation of agro-biodiversity</li> </ul>

Economic Benefits	Environmental Benefits
<ul style="list-style-type: none"> <li>▪ Higher Household Income</li> <li>▪ Lower Debt</li> <li>▪ Higher Cropping Intensity</li> <li>▪ Lower Risk perception &amp; Higher Investment in Agriculture</li> <li>▪ Business Innovation &amp; New Livelihood opportunities</li> </ul>	<ul style="list-style-type: none"> <li>▪ Fewer Pesticide related health problems</li> <li>▪ Smaller Carbon footprint as a result of reduced use &amp; production of inorganic fertilizers</li> </ul>

## ECONOMIC BENEFITS

**Maintaining Productivity.** The yield of principal crops raised through CMSA has been compared to that of conventional agriculture through SERP surveys. SERP field staff have also closely monitored 400 farmers’ fields in five districts to track changes in the yield of paddy crop after they switched over to CMSA. Yield in all cases has remained the same or increased slightly, ranging from 1900kgs to 2200 kgs per acre for paddy.<sup>18</sup> Thus, there are no significant drops in yield for crops raised through CMSA as shown in table 3.

**TABLE 3 COMPARISON OF AVERAGE YIELD OF PRINCIPAL CROPS\***

Crop	NPM- Average Yield [Quintals*/Acre]	Conventional Agriculture - Average Yield [Quintals/Acre]
Chilli pepper	17.5	17.5
Groundnut	11	11
Red gram	5.5	5
Cotton	9	9
Rice	22	20

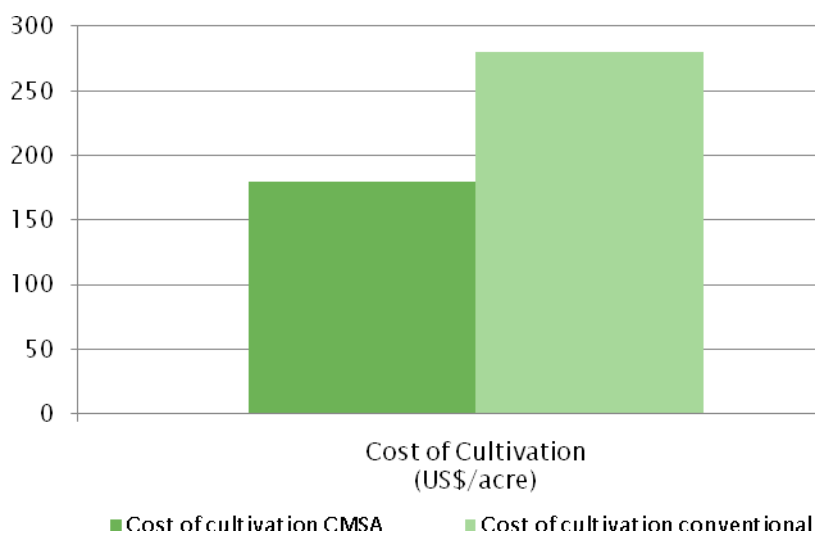
\*1 Quintal= 100kilograms  
 \*\*SERP estimates based on data from at least 100 farmers for each crop.

## LOWER COST OF CULTIVATION

The cost of cultivating rice is much lower under CMSA as evidenced by data from the field. In a survey of 141 farmers, the cost of cultivation per acre under CMSA was found to be lower by 33 percent as compared to the costs under conventional agriculture (figure 5).

<sup>18</sup> District Project Management units maintain this database.

**FIGURE 5 PER ACRE COST OF CULTIVATION OF RICE IN KHAMMAM DISTRICT OF ANDHRA PRADESH**



## SAVINGS AT FARM AND STATE LEVEL

A statewide survey of farmers practicing CMSA has found that farmers on average save US\$ 33 on the cost of cultivation of Rice, which is the principal crop in the state. These savings are as a result of savings on the cost of conventional pesticides and fertilizer.<sup>19</sup> Savings for other principal crops are presented in table 4.

**TABLE 4 AVERAGE SAVING ON COST CULTIVATION THROUGH CMSA**

Crop	Average Saving on cost of Cultivation [US \$/Acre]
Rice	33
Chilli Peppers	326
Cotton	120
Groundnut	24
Red gram	31
Others [fruits, vegetables, cereals, etc.]	24

\*Based on SERP data from at least 100 farmers for each crop from across the state

On the basis of the savings of individual farmers, a statewide estimate of cumulative savings made by farmers practising CMSA stands at US\$52.0million for the year 2008-09 (table 5). This is a substantial amount and is nearly 0.54

<sup>19</sup> Conventional pesticides are generally synthetic materials that directly kill or inactivate the pest.

percent of the agriculture GDP for the state of Andhra Pradesh.<sup>20</sup> Savings could be higher with increased geographical coverage of farmers adopting CMSA.

**TABLE 5 ESTIMATE OF STATEWIDE SAVINGS ON COST OF CULTIVATION THROUGH CMSA IN 2008- 09\***

Crop	'000Acres under CMSA	Total Saving (million US\$)
Cotton	64	7.7
Rice	552	18.2
Red gram	105	3.2
Groundnut	267	6.3
Chilli pepper	24	7.8
Others	369	8.8
<b>Total</b>	<b>1381</b>	<b>52.0</b>

\*based on SERP data

## MORE HOUSEHOLD INCOME

Higher net incomes are being realised as a result of lower cost of cultivation and good yield. The savings through CMSA are very significant for farmer households. The average annual income from agriculture and other sources for a farmer with 1.0-2.0 hectares<sup>21</sup> of land is US \$441 in Andhra Pradesh.<sup>22</sup> If a farmer raises cotton on 1.0ha of land through sustainable agriculture, he could potentially save US\$ 250 a year on the cost of pesticides alone. This is 56% of the farmer's annual income and is a significant amount. Table 6 below lays out the potential savings for farmer households for different landholding classes:

**TABLE 6 POTENTIAL SAVINGS FOR FARMERS IN DIFFERENT LAND HOLDING CLASSES**

	Land holding Class [ha.]		
	0.01-0.4	0.4-1.0	1.0-2.0
Area sown under Cotton [ha]	0.4	1	1
Average Annual Income from Agriculture and Other Sources [US\$]	274	337	441
Average Saving on cost of cultivation of Cotton with CMSA methods @ US \$250 /ha [US\$]	100	250	250
Saving on cost of cultivation as a % of annual income	37	74	56

<sup>20</sup> Department of Economics and Statistics, Hyderabad. Updated Advance estimates for 2007-08 of State Gross Domestic Product at current prices is US\$15,509million. Agriculture contributes to about 25% of the state GDP. FT exchange rate of US\$ = 50 Rupees.

<sup>21</sup> 1.0ha =2.5acres

<sup>22</sup> Survey of Farmer Income, Expenditure and Productive Assets of Farmer Households: Report No.497, National Sample Survey Organisation, Government of India. December 2005. Income figures for the year 2002-03.

Savings under CMSA provide immediate relief to farmer households' that are under the stress of high interest debt and could potentially bring households above the poverty line. This is also illustrated by the case study in Box 2.

## IMPACT ON FOOD SECURITY

One of the critical economic impacts of CMSA is on food security both at the household level and village level. Data collected by SERP from 22,000 farmers practicing CMSA in Khammam district presents compelling evidence that sustainable agriculture has significant positive impacts on food security at the household level.

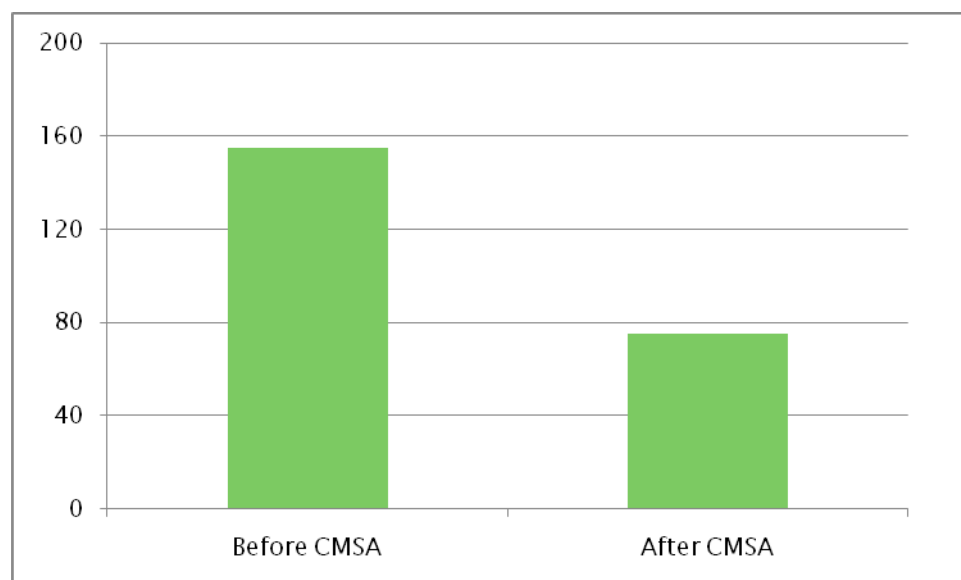
### Box 2 CMSA TRANSLATES INTO HIGHER HOUSEHOLD INCOME

Venkataiah, 30, has one acre of cultivable land. He irons clothes to supplement his meager and seasonal farm income. His dream is to have his own kiosk by the main road, where customers are aplenty. In 2004-05, he says he spent Rs.2,660 [US\$53] on pesticides for his redgram crop. (He spent more than the market price as he bought them on credit). He got 200kg of pulses that sold for Rs.3.200 [US\$64], earning him Rs.500 [US\$10]. While he made a loss, his neighbor Bugappa had a good crop without using any pesticides. Bugappa was one of 20 farmers who had registered for the NPM program the first year. When the women's group of his village was registering NPM farmers in 2005, Venkataiah's mother got him enrolled among the 50 new entrants. They got extension advice from Krishnaiah, the village NPM coordinator who gets a monthly honorarium of Rs.700 [US\$14] for rendering extension advice. "He taught me the life cycle of insects and how to use pheromone traps and dung-urine sprays. This year the pest incidence on my field was lower than neighboring farms. My total cost of cultivation was down to Rs.300 [US \$6]," he says. Untimely rains affected his crop but he still got 300kg, which got him Rs.5,325 [US \$106]. The profit was unprecedented. "This *Sankranti*, we bought meat and prepared biryani," beams his mother. "Another year like this, and I'll make my kiosk. There will be work and money through the year then," hopes her son.

[Source: 'No Pesticides' in *Down To Earth*, May 20, 2006. By Soumya Misra]

As illustrated in figure 6, household expenses on food grains were reduced by half for farmer households that adopted CMSA. The reason for this reduction was two fold—farmers realised better yield of food grain crops like paddy through sustainable practices; and, they also began harvesting a second crop every year, which was earlier inconceivable due to the higher cost of cultivation through conventional methods. Families now buy smaller quantity of food grains (44 per cent lower) from the market as they have a surplus from their farms. The positive impact on food security at the village level is illustrated by the case of Billalapalem village (box 3).

**FIGURE 6 AVERAGE HH EXPENDITURE ON FOOD GRAINS/YEAR, BEFORE AND AFTER ADOPTING CMSA**



Based on data from 22,000 HHs in Khammam District. SERP Survey 2008-09

**BOX 3 INCREASING CROPPING INTENSITY AND SUPPLY OF FOOD GRAINS: THE CASE OF BILLALAPALEM VILLAGE**

Billalapalem is a tribal village in Vishakapatnam district. There are 65 Farmers and total cultivable land in the village is 75 acres. Prior to the initiation of CMSA farmers in this village cultivated only one crop during Kharif season. The productivity levels were very low at 10-12 quintals/acre as compared to the district average of 20 quintals/acre. Food grains produced in the village were not sufficient to meet their annual requirement. To increase productivity farmers tended to apply more fertilizers and pesticides, which did not affect the yield significantly.

In 2006-07, 65 farmers in started sustainable agriculture on 60 acres. They replaced pesticides with botanical extracts and reduced the use of inorganic fertilizers. Instead, they used Azolla as a bio-fertilizer in Paddy. In 2007, farmers attended System of Rice Intensification (SRI) Paddy cultivation training organized by Zilla Samakhya and realized that they can grow Rabi (winter season) crop with the little water available to them. They started practicing SRI Paddy cultivation. In 2008-09 Rabi, 15 farmers were cultivating two crops a year on 20 Acres. Prior to adopting CMSA, farmers were spending Rs.15,300/-[US \$306] per year on food grains from the market. Now they spend only Rs.2,160[US \$43] per year.

**HIGHER SALE PRICE**

In addition to reducing the cost of production, crops raised without the use of pesticides and fertilizers are commanding higher prices in the market. Although CMSA produce is not certified as 'organic', there is a growing recognition of the

benefits of pesticide and fertilizer-free vegetables, lentils and cereals, especially in the urban retail market. The increase in prices is currently in the range of 14 - 33 percent for vegetables, red gram (lentils),chilli peppers, cotton and rice. And this price realisation comes to the producer without the hassle of middlemen, as marketing operations are handled by the District and Sub-district Federations.



Tomato with border crop

## GREATER CROPPING INTENSITY

Cropping intensity in the state has been stagnant or very low since the nineties. With the rising cost of cultivation and unpredictability of returns, only a single crop in a year has become the norm for small and marginal farmers. Demonstrations of different models for multi-cropping and inter cropping are helping more farmers realise the benefits of diversified cropping. Inter cropping is currently being followed in nearly 319,000 acres where farmers plant one or two crops in addition to the main crop. The benefits of multi-cropping are demonstrated by the case study in Table 7 which presents data for one farmer with six acres of land who realised a substantial gain in income. From a single crop system where she was earning a net income of Rs. 5,000[US\$ 100] this farmer realised a net income that was nearly nine times higher- rare, but nevertheless possible. This practice is being replicated across the state. Box 3 presents impacts at the village through increased cropping intensity.

**TABLE 7 BENEFITS OF MULTI- CROPPING\***

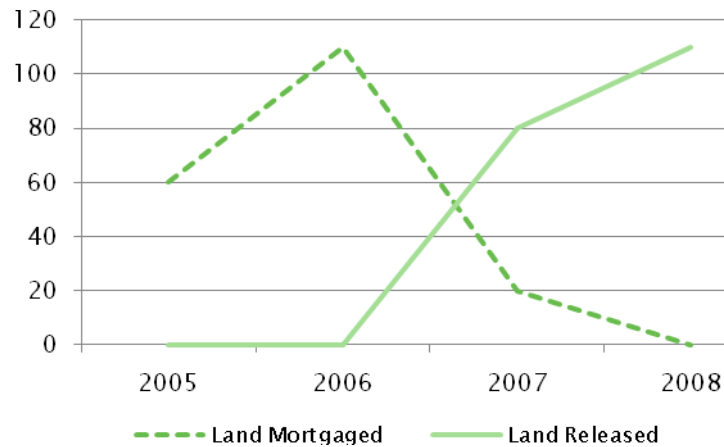
Before CMSA			
Crop	Expenses on Pesticides	Expenditure on Other inputs	Net income
Rice or Tomato	280	520	100

After switching to CMSA with multi-cropping:			
S.No	Type of the crop	Name of the crop	Income (US\$)
1	Main crop	Chrysanthemum	657
2	Border crop	Maize	16
3	Border crop	Red gram	33
4	Trap crop	Marigold	6.6
5	Inter crop	Chillies	208
6	Inter crop	Drum stick(vegetable)	43
7	Inter crop	Onion(vegetable)	15
8	Inter crop	Beans (failed due to rains)	0
9	Inter crop	Okra(vegetable)	6
10	Inter crop	Eggplant(vegetable)	2
Gross Income in			986
Expenditure on Pest management			11
Other expenses			100
Net income			875

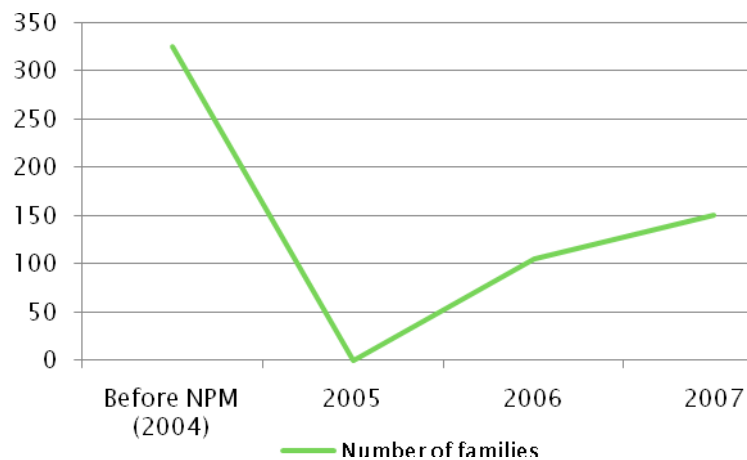
## RELIEF FROM DEBT AND MORTGAGE

The high cost of conventional agriculture and falling incomes forced farmers to mortgage their land and work as tenant farmers or laborers for moneylenders. In a survey of five districts, of the 467 families who had mortgaged their farm land to borrow money, the project could verify that 386 families had their land released in two years, after paying back with savings from CMSA (figures 7 and 8). The social empowerment associated with getting their land back from moneylenders and farming on their own land is very significant for farmers, perhaps as important as the economic relief it provides. In Ramachandrapuram, a village in Khammam district, all 75 farmers had mortgaged their land to local moneylenders before the introduction of CMSA. However, within two years of practicing CMSA all the farmers in the village paid their mortgages and got back ownership of their land.

**FIGURE 7 FARMLAND MORTGAGED BY FARMERS PRACTISING CMSA SINCE 2005 (ACRES)**



**FIGURE 8 FAMILIES WHOSE LAND WAS RELEASED BY MONEYLENDERS, ADILIBAD DISTRICT, ANDHRA PRADESH (2005 ONWARDS)**

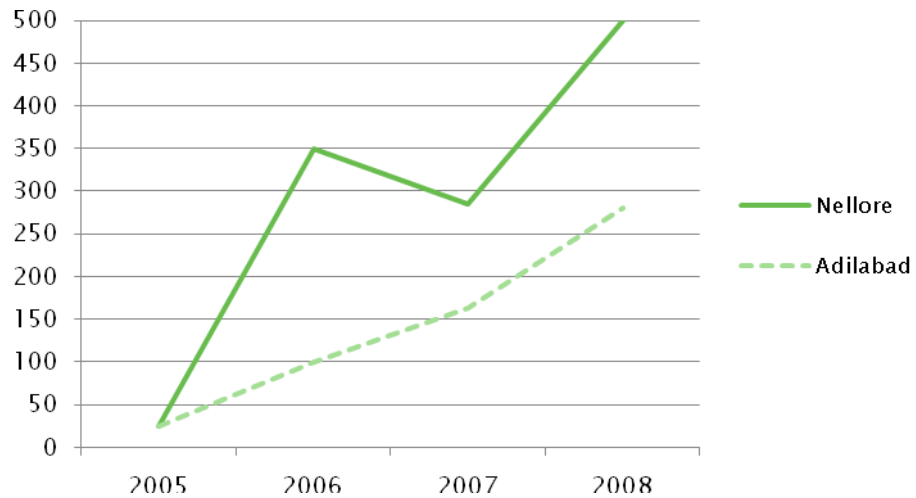




## LOWERING OF RISK PERCEPTION, INCREASING INVESTMENT IN AGRICULTURE

Investment in productive assets has risen for families practicing CMSA. As a result of lower production costs and improving net incomes farmers are less risk averse. Primary surveys by SERP show that families are now taking additional farm land on lease for cultivation which has resulted in additional income for households (figure 9). In other developments, farmers are bringing in fallow lands and government assigned lands under cultivation.

**FIGURE 9 NUMBER OF FAMILIES TAKING ADDITIONAL LAND ON LEASE WITH SAVINGS FROM CMSA**



\*Based on a SERP Survey during 2007-08 in 3 Districts

## BUSINESS INNOVATION AND NEW LIVELIHOOD OPPORTUNITIES

Village communities have begun to benefit from jobs and enterprises catering to inputs for sustainable agriculture and by providing services like quality control and procurement of CMSA produce. At least 2000 jobs have been created in villages through the establishment of shops for supply of bio-pesticides and organic nutrients, seed banks and agricultural implements hiring centers. In addition, about 5400 small and marginal farmers are generating additional income through the operation of vermi-composting units.

## POSITIVE IMPACTS ON HEALTH

Farmers report a noticeable drop in pesticide related health problems. Women who have traditionally performed the task of spraying the crops and suffered numerous health problems due to the resultant high exposure to pesticides are now strong advocates of the NPM/CMSA movement. A quick survey of three districts has shown that the number of cases of hospitalization due to pesticide

poisoning has reduced from 242 cases per year before adoption of NPM to 146 cases per year—a 40 percent drop. Farmers who have adopted non-pesticide management agriculture have been totally free of pesticide related hospitalization.

## **IMPROVED SOIL ECOLOGY AND ENVIRONMENT**

Villages are also seeing an increase in sustainable soil and water management practices that benefit the entire community—over 10,000 composting pits and 1200 farm ponds have been dug and fertile tank silt has been applied in over 13,000 acres of farm land. An important positive impact on the environment is pesticide-free groundwater and soil in villages which have completely stopped pesticide application. Further, farmer-friendly insects and birds are coming back to the fields as they are no longer targeted by broad-spectrum pesticides.

## **6. KEY LESSONS FOR DESIGN AND IMPLEMENTATION**

The following are some of the key lessons emerging from implementation of CMSA over the last four years. These provide a useful starting point for scaling up of community managed sustainable agriculture programs in other parts of India and South Asia region. They also provide a foundation for dialogue on alternative paradigms for agriculture development for resource poor rain-fed regions and smallholders.

### **CREATING AND NURTURING A STRONG FARMER-COMMUNITY INSTITUTIONAL PLATFORM FOR SUSTAINABLE AGRICULTURE**

Investing in an institutional platform involving ten million women and creating an organizational structure like the federation of women's self-help groups (SHGs) has resulted in achieving large scale transformational impact on small holders. Small holders have no chance of creating the demand side stimulus for sustainable agriculture if they do not aggregate their voice, capacity and leadership. Creation of social capital on a large scale with associations and federations leads to change in rules of the game and the nature of interaction between small holders, and the market. This social capital should be considered a core investment as it helps in transforming human, natural and economic capital. These institutions take up planning, management, monitoring and scaling up responsibilities at much lower transaction cost and also lead to development of sustainable approaches.

## INNOVATION IN MANAGEMENT AND DELIVERY OF AGRICULTURAL EXTENSION SERVICES

*Communitization of service delivery:* Practicing farmers should be the main extension agents and their presence in the village makes them easily accessible. The Village Activists are practicing farmers from the village hired by V.Os. They are responsible for knowledge dissemination within the village. They are accountable to the farmers and the V.Os as they are paid by V.Os.

For scaling this programme and taking to new villages, Community Resource Persons (CRPs), farmers who have successfully applied and benefited from C.M.S.A, play a critical role. They spend 15 days in a month in the new villages. The CRPs' own experience gives their messages greater credibility among farmers. NGOs can play a facilitation role to deliver extension related services but eventually CRPs take over this role as they are better equipped to understand farmers' needs. This farmer to farmer extension has helped in rapid scaling up of the program.

*Targeting* entire village or a group of farmers rather than individuals for extension is more effective. This gives farmers an advantage to negotiate when they deal with traders in a collective manner. Sustainable agriculture technologies are also more effective when deployed on several, contiguous parcels of land. The group extension approach also creates a ripple effect in terms of scaling up.

## INNOVATION IN AGRICULTURE TECHNOLOGY GENERATION AND EXPERIENTIAL LEARNING THROUGH FARMER FIELD SCHOOLS

Imparting knowledge of pest life cycles, diseases and agro-ecology better equips farmers to address pest management problems, and aids innovation in the field. Farmers are able to experiment and develop technologies for pest management and cropping systems on their fields. Several such technologies have been standardized to disseminate to a wider audience through training workshops. The menu of technology options available to farmers continues to expand and they no longer have to rely on limited options available through external research and other sources in the market. This increases the extent of in situ availability of technologies and helps farmers to test and evaluate various technical options. Farmers are also encouraged to look at cost effectiveness of various options and not focus just on yields. The process enables small holders to look at both productivity and profitability.

Technologies recommended are based on local resources - for example, cow dung, cow urine, garlic extract, Neem extract, chili pepper extract, etc., and are easy to procure and also help in development of new local bio-enterprises.

Crop diversification is essential to sustainable agriculture, and inclusion of perennial crops ensures sustained long-term benefits; Multi-cropping and inter-cropping are critical to counter pest infestation and to ensure income all year round.

Helping farmer households raise kitchen gardens with multi-tiered fruit and vegetable crops demonstrates the benefits of multi-cropping systems to farmers while enhancing nutritional security of the household.

## PROVISION OF A END TO END SOLUTIONS TO SMALL HOLDERS ALONG THE VALUE CHAIN

The smallholders need a *single window approach* for delivery of services and these should be delivered by their own institutions at their doorstep. Provision of a complete package of 'end-to-end' services through linking up farmers with the SHG federations provides farmers access to a complete package of options – from credit, insurance and inputs, to procurement, value addition and marketing of produce. This ensures that the farmers are not only able to produce at low cost but are also able to maximize returns. Normally these services are only accessible to medium and large farmers through large cooperatives. The federated approach allows small holders access package of services at a low transaction cost and leaves them free to diversify their livelihoods and take advantage of opportunities in the non farm sector.

## MOVING FROM CMSA TO ORGANIC AGRICULTURE AND NICHE MARKETS FOR SMALL HOLDERS

Branding and certification for CMSA produce needs to be worked out in future, keeping in view the unique requirements of a community based program and the fact that small and marginal farmers cannot pay large sums of money to procure certification services.

Agreements with large organizations for bulk purchase of produce in the domestic markets and retail sales space at key urban locations are being worked out. Increasing tie-ups are being arranged for export of Fair Trade and organic products. Currently agreements are underway for organic coffee, and with Dutch organization Solidaridad for export of organic fair trade cotton and with the Spices Board for export of pesticide-free chili peppers.

## TIE UP WITH LARGE PUBLIC WORKS AND SAFETY NET PROGRAMS.

Tie-ups with other government programs such as the National Rural Employment Guarantee Scheme (NREGS) and the Rashtriya Krishi Vikas Yojana (RKVY) which enable smallholders to develop land and water resources, are required to enable the resource poor to make sustainable agriculture more profitable.

## 7. The Road Ahead

This approach is being looked at with great interest by many rural livelihood programs in India and other countries of South Asia which are promoting community management of natural resources, agriculture and microfinance. A systematic immersion of the scientific community, policy makers and implementers on CMSA approaches is being organized to ensure more experimentation and dialogue on this issue affecting many smallholders and development programs.

CMSA approach is currently under scrutiny and observation by many agencies. National Mission on Sustainable Agriculture being set up by Government of India is looking at the CMSA approach as one of the key strategies to be replicated at the national level. Many farmer organizations in Andhra Pradesh and other states of India who are facing similar issues and had similar experiences on smaller scale are interested in how to convert CMSA into a people's movement. However, mainstream agricultural research and extension institutions and other programs providing subsidies to farmers for usage of chemical fertilizers and pesticides are still skeptic and more dialogue is needed between the farmers and scientific community practicing sustainable agriculture. The current dialogue on role of agriculture in adaptation to climate change and reduction of carbon footprint through reduction in usage of chemical fertilizers has also started. This augurs for a possible second 'green' revolution, particularly for rain fed areas.

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