Ind. Jn. of Agri. Econ.
Vol.74, No.3, July-Sept.2019

Potential and Constraints of Zero Budgeted Natural Farming (ZBNF): A Study of Andhra Pradesh

B. Guruva Reddy*, V. Ratna Reddy and M. Srinivasa Reddy†**

ABSTRACT

This paper assesses the potential of ZBNF in addressing farm distress and in the process identifies constraints for its scaling up in the context of Andhra Pradesh (AP). The assessment is based on field visits, key informant interviews (including farmers, institutions and officials of DPMs, Agriculture Department, Scientists and NGOs), and case studies spread across 11 districts of AP. It is argued that while the environmental benefits of ZBNF are clear at the farm level its economic benefits are far from the promises made. Of the three economic benefits promised (reduced costs, increased yields and higher prices), ZBNF could meet the expectations only in the case of reduced costs. Yield rates decline during the initial years and farmers have to wait for more than three years to achieve normal yields, let alone increased yields. And there is no price advantage. As a result, net farm incomes are not encouraging even during the third year of adaptation. Substantial losses were reported during the initial years requiring lot of withstanding capacity and persuasion to continue the practices. Consequently, dis-adoption rates are high and rising. Our analysis and observations do not give any indication that ZBNF will be adopted widely or sustained in the near future. ZBNF is likely to remain as an ideal farming approach. It is suggested that residue free farming could be an ideal middle path between organic and chemical intensive farming. Residue free farming has the potential to reduce degradation without compromising on production / income and quality.

Keywords: Zero budget natural farming, Climate risks.

JEL: O13, Q15, Q54

I

INTRODUCTION

Zero Budget Natural Farming (ZBNF) integrates the sustainable farm intensification practices with a focus on minimising the costs. ZBNF originated in Maharashtra in the early 2000s initiated by Mr. Palekar through his on farm experiments. Zero budget means zero cost, i.e., 'no need for market based inputs'. Mr. Palekar propagates that only 1.5 per cent of the nutrients required by the plants are provided by the soil and the remaining 98.5 per cent comes from air, water and solar energy. Even the 1.5 per cent required is available in plenty in every type of soil, albeit in an unavailable form. Thus, micro-organisms in the soil can be increased with the application of *desi* (country) cow dung and no fertiliser or pesticide is needed. ZBNF is based on 4 wheels/non-negotiable guidelines/principles or package of farming practices that would increase soil health and crop yields at zero external inputs or costs. These include: (i) *Jiwamrita* (life tonic); (ii) Bijamrita *(seed protection tonic); (iii). Acchadana* (mulching) and (iv). *Waaphasa* (soil aeration/

*Freelance Activist, Hyderabad, **Livelihoods and Natural Resource Management Institute, Hyderabad and †Centre for Economic and Social Studies, Hyderabad, respectively.

moisture); (Palekar, 2005; 2006; 2016; Devarinti, 2016; Bishnoi and Bhati, 2017). *Jivamrita* acts as a catalytic agent that enlivens the soil, increasing microbial activity and organic matter. *Jivamrita* also helps to prevent fungal and bacterial growth and increases earthworm activity. *Bijamrita* protects seedlings from seed or soil borne diseases, as well as young roots from fungus. *Acchadana* enhances decomposition and humus formation through the activity of the soil biota activated by *jivamrita* (Palekar, 2006). *Whapasa* (moisture) is the condition in which there are both air molecules and water molecules present in the soil. ZBNF encourages reducing irrigation and recommends irrigating only at noon in alternate furrows. There are also a number of pest management measures such as *neemastra*, *agniastra* and *brahmastra* – which are homemade preparations used for insect and pest control (Palekar, 2005).

While the scientific credentials of ZBNF are being tested, Andhra Pradesh (AP) is promoting it on a large scale. In fact, the AP government is aiming to cover all the 6 million farmers and 8 million hectares in the state under the initiative of Climate Resilient Zero Budget Natural Farming (CRZBNF) by 2027. Assessments of ZBNF impacts in Karnataka and AP states are positive (Khadse *et al*., 2018; Tripathi *et al*., 2018). In AP it was observed that yields of various crops have gone up ranging between 9 per cent (paddy) to 40 per cent (ragi); net incomes have gone up substantially ranging between 25 per cent (ragi) and 135 per cent (groundnut) (RySS, 2018).

As is the case with most sustainable practices[1] the spread of CRZBNF is slow. If the claims of increased yields at reduced (if not nil) costs are true CRZBNF should have spread much faster than green revolution technologies where high yields are associated with high costs.[2] It is true that sustainable practices need support and promotion, especially when environmental or/and social benefits outweigh immediate economic benefits. The promotional strategies need to be designed accordingly rather than based on false expectations. The strategies ought to integrate policies and institutions at central and state levels. The success of green revolution technologies lies in such coordinated efforts, viz., input supply chains fostered with input subsidies along with promotional activities. Moreover, the benefits (impacts) of adaption are dramatic in the case of green revolution technologies setting an effective demonstration effect. This may not be the case with CRZBNF as the process of realising the impacts is slow and hence would require direct support in terms of demonstration, awareness building, market infrastructure, etc.

Government of Andhra Pradesh has taken up in mission mode since 2015-16 and claims to have covered 83, 744 hectares (10 per cent of the total area) till 2017-18. Of these only 10,000 farmers are full adapters and the remaining are partial adapters. Besides, dis-adaption rates are quite high. The reasons behind the slow progress needs to be understood in order to promote it on a large scale. Some of the important questions in this regard include: (i) what are the constraints of CRZBNF adaption at farm level; (ii) does CRZBNF has the real potential of enhancing farm profits, as

reported from the pilots?; and (iii) is the existing policy environment conducive for promoting CRZBNF?. This paper makes an attempt to address these questions through assessment and understanding of the ground realities in various districts of AP. The paper also examines the implementation strategy of the state government critically. The aim is to assess the potential of CRZBNF in enhancing farm incomes, identify the gaps and indicate alternative approaches to address farm distress. The assessment is based on field visits, focussed group discussions (FGDs); key informant interviews (including farmers and officials) and case studies spread across 11 districts of AP. In all, the study covered 60 villages; 15 FGDs; 100 farmers and number of official and NGO interviews and 15 case studies. Detailed cost of cultivation data along with output information on various crops are drawn from FGDs with farmers in the absence of sufficient number of seed to seed farmers (S2S) at the village level.

II

CONCEPT AND APPROACH

The main objective of CRZBNF is to make agriculture viable, sustain agrarian livelihoods and reduce agrarian distress through cost reduction and sustainable agricultural practices that are climate resilient. It aims to reduce costs of cultivation and climate risks, enhance yields and soil fertility through adoption of agro-ecology framework. Extension support is led by farmers (including women) and through farmer-to-farmer learning. The state government's target is to reach out to all farmers in the state (6 million including tenants) and achieve 100 per cent chemical-free agriculture by 2027. This is an unprecedented transformation towards sustainable agriculture on such a massive scale. It focuses on the poorest of the poor farmers (bottom 30 per cent - above 1.5 million families) with nutrition and livelihoods security. This transformation is expected to be achieved through providing support for each farmer family for at least 5 years till they attain sustainable and viable livelihoods. CRZBNF also aims to create human and social capital necessary for vibrant and inclusive agricultural production. CRZBNF is led by Rythu Sadhikara Samstha (RySS) – a not-for-profit organisation established by the Government of AP to implement the programme. It is also supported by the Sustainable India Finance Facility (SIFF) with the partnership of UN Environment, BNP Paribas, and the World Agroforestry Centre (ICRAF). The CRZBNF programme was initiated on a pilot basis in 704 villages covering 48, 565 farmers during 2016 by RySS.

It is proposed to achieve reduction in cost of cultivation through (i) elimination of chemical pesticides usage and practicing non-pesticidal management (NPM), (ii) reduce/minimise usage of chemical fertilisers and adopt natural means of soil fertility management and enhancement and (iii) promote village seed banks. Climate risks are addressed by treating each holding as a watershed, summer ploughing, participatory groundwater management (PGM) and diversified crop models in each holding.

Frequency of income from farming is ensured through vertical harvesting of sunlight – 7 layers model; integrated farming systems (IFS: incorporating trees, forest produce, livestock, birds and fish); and develop model farms that generate Rs.50,000 per annum net income from 0.50 acre irrigated land on lease/on dry lands. Farm mechanisation and custom hiring centers (CHCs) are promoted for timely agricultural operations (cost and drudgery reduction). CRZBNF suite of practices include:

- Seed treatment through liquid microbials (*Bijamrita*);
- Soil treatment and soil fertility enhancement through locally made liquid microbials and Farm Yard Manure (FYM) based formulations (*Dhrava/Ghana/Jeevamrita*);
- Soil protection. Taking all crop residues back to the soil using live mulch and crop residues (Mulching);
- Keeping the ground covered all the time through poly-cropping;
- Intercropping, multilayer farming, etc.,
- Soil enrichment for trees (Waaphasa);
- Botanical extracts for insect and pest management (*Agniastra, Neemastra, Bramhastra*); and
- Use of local seeds.

The CRZBNF practices are modified version of the ZBNF practices recommended by Mr. Palekar. CRZBNF is more flexible in using bio-fertilisers and pesticides, where as Mr. Palekar insists on using *desi* (country) cow dung and urine along with a few natural ingredients like jaggery (gur), besan (pulse flour), etc., Farmers may adopt the CRZBNF practices for: (i) full season cycle; (ii) part season cycle, and (iii) adopt for part of their land.

Institutional and Financial Support

A three-tier structure of grassroots institutions (farmer Self Help Groups (SHGs), village federation of farmers and Farmer Producer Organisations (FPOs) are set up to implement and achieve the transformation and sustain it. Credit and risk management along with value chain benefits to farmers are addressed through the institutions evolved around aggregation, mediation and facilitation. For instance, Marginal Farmers (MFs) are offered incentives to set up and run NPM shops to sell local seeds, NPM inputs like bio-pesticides. NPM shops will receive Rs. 1 lakh for setting up a shop on a business model. CHCs are being set up for hiring tractors and farm machinery. Institutions such as farmer's self- help groups (FSHGs) and *Rytu Mitra* Groups (RMGs) are federated into village farmer's federations (VFF). VFFs are further federated as cluster farmer's federations (CFFs) at the cluster level and district level district farmer's federations (DFFs). Some of these federations may form as FPOs. These institutional structures converge with government programmes and schemes and are expected to establish the backward and forward linkages with farm

production, viz., inputs, marketing, storage, value addition, savings, credit, crop insurance and subsidies.

Andhra Pradesh Rhytu Sadikaraka Samstha (APRySS) took lead role to promote CRZBNF in all the 13 districts of AP in a big way. CRZBNF is modified both conceptually and administratively to suit the ambitious objective of covering the entire state by 2027. Conceptually it incorporated NPM and non-chemical soil management practices that still require external inputs and administratively it depends on extensive human resources from within and outside the existing system, whereas Palekar's model propagates negligible budget and mutual help to spread the programme. In villages usually farmers extend voluntary help to others and it is free. Instead of structuring CRZBNF through similar approach, APRySS designated them as Internal Community Resource Persons (ICRPs) with monthly salary. Initially financial support was provided to set up NPM shops and also to buy cows. These subsidies were withdrawn later in favour of capacity building approach.

The institutional and human resource requirements per Gram Panchayat (GP) of 465 farmer families (with a target of covering 400 families) include: (i) 40 FSHGs; (ii) 2 VFFs; (iii) 2 active/lead farmers (1 man, 1 woman) per 10 farm families; (iv) 1L2 CRP, 5L3 CRPs and 2L3IB CRPs (total 8); and (v) 2 ZBNF input/output enterprises. Each GP is divided further into 5 zones with 80 farm families in each zone. One ICRP (L3 CRP) is positioned in each zone. There will be 2 IB CRPs (L3) in every village for building farmers institutions and for convergence with women SHGs. On an average, 5 GPs constitute a cluster. One NFF is employed in each cluster. NFFs are qualified (B.Sc Agriculture/Horticulture) and trained in CRZBNF. Their main role is to demonstrate the potential of CRZBNF and observe the progress and improvements due to the programme. They take up CRZBNF practices on a small piece of land in the village. It is expected to take five years to saturate all 5 GPs in a cluster. There will be a cluster level federation of men farmer federations and village level federations of women SHGs (RySS, 2018).

It is estimated that a total funding to the tune of Rs.16,452 crores (USD 2.3 billion) is required to cover 6 million farmers and 8 million hectares by 2027 (RySS, 2018). That is about Rs.27,000 per farm household and Rs.20,000 per hectare. APRySS is trying to raise over Rs.16,000 crores loans. As of now CRZBNF is being implemented under Government of India programme "*Paramparagata Krishi Vikas Yojana*" (PKVY) along with state government funding of Rs.1250 crores.

III

ECONOMICS OF CRZBNF

The rationale for such a huge fund requirement is provided through a cost-benefit analysis with a B:C ratio of 13.36:1, i.e., benefits are 13 times more than costs (RySS, 2019). Such high B:C ratios put any technology or enterprise to shame and no rational financier can forego the opportunity to fund. These benefits are at the farm level, i.e., net benefits to farmers when CRZBNF is practiced. More importantly,

farmers do not need any incentive to adopt such a profitable intervention and it should spread like a wild fire, as our farmers proved many times in the past. Does CRZBNF, with such a favourable B:C ratios and its natural farming approach of inbuilt traditional Indian practices require huge loans? If such benefits are achievable and spread over, the existing or a slightly improved extension network could help promoting CRZBNF without any external funding.[3] Keeping the past experiences of various programmes, the CRZBNF programme design, staffing pattern, interface with other agencies, etc., are to be relooked before thinking about scaling up the programme through external funding. Of the total costs capacity and institutional building accounts for 71 per cent, while 4 per cent is towards subsidy and the remaining is for marketing (including certification), technical and research support (RySS, 2019).

The mismatch between the claimed potential and the scaling approach raises questions about its real potential at the farm level and the constraints to adopt and spread in a natural way. In order to assess the real situation at the field level, a comparative assessment of costs and returns of CRZBNF are compared with Non-CRZBNF. The information is gathered from the farmers rather than from the Natural Farming Fellows (NFF)[4] employed by RySS or the lead farmers. Besides, key informant interviews were conducted with farmers and officials across the districts. Information is collected from the S2S (full adaptation) farmers only. Detailed cost of cultivation data was collected from the farmers adopting CRZBNF over the last 2-3 years from different districts. These include 4-5 individual farmers and one FGD for each crop.

It is clear from the data that the cost of cultivation of CRZBNF crops is substantially low when compared to non-CRZBNF (control) crops. The costs are lower by 3 to 41 per cent for CRZBNF crops even after including family labour costs (Table 1). At the same time yield rates are lower for the same crops ranging from 6 to 20 per cent. Note that these yields are of the third year. In the absence of any price differential between CRZBNF and non-CRZBNF produce, CRZBNF crops show higher net returns in the case of paddy (10 per cent), banana (5 per cent) and groundnut (1 per cent) and lower net returns in the case of sunflower (18 per cent) and cotton (3 per cent). In any case, the differences in net returns between CRZBNF and control plots may not be statistically significant in most crops. The net returns due to CRZBNF practices are not substantial even after three years of adaptation and far from the claims made by RySS. The net returns are much less for CRZBNF plots during the first and second years as the decline in yields are much higher, i.e., 24 to 43 per cent in the first year and 8 to 31 per cent during the second year (Table 2).

The high B-C ratios reported by RySS are mainly due to the fact that the data was provided by the staff of RySS who are fully supported by the programme facing no constraints. And the size of the demonstration plots are very small, sometimes 10 to 20 cent, which tend to exaggerate the values.[5] Besides, the imputed cost of family

TABLE 1. COSTS AND RETURNS OF DIFFERENT CROPS UNDER CRZBNF (S2S) AND NON-CRZBNF

	Paddy (Nellore)		Groundnut (Anantapur)		Banana (Kadapa)		Cotton (Prakasam)		Sunflower (Anantapur)	
Component	CR ZBNF	Control	CR ZBNF	Control	CR ZBNF	Control	CR ZBNF	Control	CR ZBNF	Control
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Seeds/saplings	1100	1100	8000	8000	13200	13200	2000	2000	1000	1000
Preparatory work	3700	3700	1750	1750	15000	15000	3000	3000	1900	1900
Transplantation /sowing	4500	4500	1500	1500	1500	1500	1000	1000	1000	1000
Weeding (labour /weedicides)	2200	1250	3250	2750	18000	22000	3000	2000	2000	1500
Fertilisers	0	10650	0	3000	0	100000	0	6000	0	2200
Pesticides	0	4020	0	3000	0	5000	0	6000	0	800
Bio-Inputs (including labour)	1880	0	2750	0	39730	0	14700	6000	2000	0
Harvesting	1800	1800	4750	4750	18000*	18000*	10000	12000	1500	1500
Transportation	1500	1500	750	750	0	0	0	0	2000	2000
Electricity charges	1500	1500	2000	2000	0	0	0	0	1850	1850
Total cost of cultivation (Rs./acre)	18180 (-41)	31020	24000 (-10)	26750	105430 (-33)	157000	33700 (-11)	38000	13250 (-03)	13750
Yield (quintals /acre)	28 (-20)	35	7.7 (-9)	8.3	29 (-17)	35	11 (-8)	12	7.5 (-6)	8
Price / quintal (Rs.)	1512	1512	4343	4343	10500	10500	5000	5000	4500	4500
Gross value of output (Rs./acre)	42336	52920	33441	36046	304500	367500	55000	60000	33750	36000
Net profit (Rs./ acre)	24156 (10)	21900	9441 (01)	9296	199070 (05)	21500	21300 (-03)	22000	20500 (-08)	22250

Source: Based on farmer interviews i.e., 4-5 individual farmers and one FGD for each crop.

Note: *In case of Banana buyer will take care of harvesting. These costs are towards supporting poles. + old plantations, which were adopted to CRZBNF and hence initial costs are not given.

TABLE 2. YIELD RATES OVER THE YEARS

(*qtls/acre*)

Year	Paddy (Nellore)		Groundnut (Anantapur)		Banana (Kadapa)		Cotton (Prakasam)		Sunflower (Anantapur)	
	CR ZBNF	Control	CR ZBNF	Control	CR ZBNF	Control	CR ZBNF	Control	CR ZBNF	Control
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
2016-2017	22 (-33)	33	5.6 (-32)	8.3	--	--	8 (-43)	14	6.1 (-24)	8
2017-2018	24 (-31)	35	6.6 (-24)	8.4	28 (-20)	35	10 (-17)	12	7.4 (-08)	8
2018-2019	28 (-20)	35	7.7 (-07)	8.3	29 (-17)	35	11 (-08)	12	7.5 (-06)	8

Source: Based on farmer interviews i.e., 4-5 individual farmers and one FGD for each crop.

Note: Figures in parantheses indicate decline in yield in percentages.

labour component is not included in the costs. A more realistic assessment carried out here clearly indicates that there is no economic incentive (substantial) for farmers to adopt CRZBNF practices. At the same time, farmers face number of constraints

ranging from availability of inputs, labour, markets, etc. More importantly, farmers are now used to easier farming practices and averse to toiling in the activities like preparing natural forms of fertilisers and pesticides, weeding, etc. Non-availability of inputs in the market forces farmers to prepare these inputs at home using family or hired labour. As a result, labour has become a major constraint and participation of family labour has become critical for adopting CRZBNF practices. As the labour costs are going up, expecting the farmers to adopt more labour intensive farm practices may not be an attractive proposition. CRZBNF products fail to get premium prices in the markets, as the consumer preferences for quality food have not changed much. Besides, the low ability of the majority consumers to pay premium prices for quality food. These constraints resonate in the narrations of CRZBNF farmers across the districts.

IV

CRZBNF: POTENTIAL AND CONSTRAINTS

Even the capacity building approach (linked through SHG model) has failed to show results on the ground. Apart from setting the targets to the field staff, there is no systematic approach to achieve the targets and monitoring of the impacts in a systematic manner. As a result, the field staff comes under pressure to report high achievement figures irrespective of the ground realities (Box 1). The field realities of SHGs and their capacities to carry forward CRZBNF is critical for success of the programme. It appears that the capacities of SHGs are over played.

Box 1. Scaling up of CRZBNF: A Reality Check

APRySS took up ZBNF in 170 villages from 26 clusters in Guntur Dist. In Kollipara Mandal 2 clusters (Athota and Annavaram) are formed covering 10 villages in each cluster. As for records, 1200 farmers as part- time (partial adopters) and 200 farmers as full time (S2S) are engaged in ZBNF in this Mandal. On ground only 20 to 25 farmers with paddy and 5 to10 farmers in commercial crops are engaged in ZBNF. For 2 Mandals, one Divisional Anchor (non-Agriculture with capacity building experience) and for each cluster one Natural Farm Fellow (B.Sc., Agriculture) on contract terms are placed in addition to regular Mandal staff. In Kollipara Mandal, for 2 clusters there are 4 Cluster Resource Persons (CRPs), 2 Cluster Activists, and 20 ICRPs with decent monthly payments are present. As these staff are not able to find potential ZBNF practitioners, they are showing any farmer having cow as practising ZBNF farmers in records. It is informed that these staff are not getting salaries regularly.

Source: Based on field observations (PRA/FGD methods) in Guntur district.

CRZBNF is being promoted on its potential to increase farm viability and resource degradation, which are the main policy concerns. While the environmental benefits of CRZBNF are clear at the farm level its economic benefits are far from the promises made. From the resource conservation point of view its contribution would be substantial, as soil degradation alone is denting up to 2 per cent of the annual GDP in India (Reddy, 2003). And the quality of produce is naturally better. On the other hand, of the three potential economic benefits promised (reduced costs, increased yields and higher prices), CRZBNF could meet the expectations only in the case of

reduced costs. Yield rates decline during the initial years and farmers have to wait for more than three years to achieve normal yields, let alone increased yields. And there is no price advantage, whatsoever. As a result, net farm incomes are not encouraging even during the 3rd year of adaptation. This requires lot of withstanding capacity and persuasion to continue the CRZBNF practices. In fact, a number of farmers have incurred losses as they could not contain pests incurring huge losses and these farmers go back to chemical farming. Dis-adaption of CRZBNF practices are widely observed in the case of vegetable crops like beans and brinjal as reported from Chebrolu Mandal of Guntur district.

Farmers are in pursuit of sustainable solutions to agrarian crisis. Unless their expectations are met they may not be able to sustain. Given that some of the expectations (increased yield and prices) are not realistic on ground, farmers get disillusioned. Therefore, setting realistic expectations is very critical for sustaining any initiative. Promotion of system of rice intensification (SRI) method is a clear case in point. Unless farmers are aware and prepared to withstand the lag in yield increases, it is not possible to sustain. Farmers feel that yields are much below the expectations and they are mis-informed about the yields (Table 3). Such false expectations may prove detrimental for scaling up.

TABLE 3. FARMERS PERCEPTIONS ON CRZBNF VIS-À-VIS NON-CRZBNF

CRZBNF (1)	Non-CRZBNF (Control) (2)
1. Farmers see lot of benefits in terms of soil quality and water conservation.	1. Business as usual. Soil degradation is a major concern. Increased use of FYM/organic matter.
2. Yields are much lower than expectations. Wrong or mis-information about yield rates.	2. Yield fluctuations are often related to climate.
3. Timely availability of inputs. Not very convenient to practice.	3. Easy and convenient due to readymade availability of inputs.
4. Only hardworking farmers with family labour only could practice.	4. Minimum involvement of family labour.
5. Difficult to practice in irrigated areas (canal command) due to sea-page of chemicals.	5. Climate resilient land use practices are limited to dryland areas.
6. Some farmers adopt only for self-consumption, as they don't see much advantage in terms of net economic benefits.	6. Apart from higher costs, it is more convenient with established set of practices.

Source: Drawn from the discussions with farmers (PRA/FGD methods) who are more aware of CRZBNF.

The high profile promotional campaign adopting the capacity building approach goes against the spirit of natural farming and the basic objectives of CRZBNF. The self-learning and farmer to farmer spreading of the methods are bypassed in their urge to scale up in a hurry. Besides, the externalities of scaling up are already being felt by the farmers even in early stages (with an area coverage of 1-2 per cent) in terms of timely availability of inputs, especially to those farmers who do not have enough labour to prepare the inputs at home (Table 3).

The increased demand for natural inputs has encouraged the existing chemical/pesticide companies to expand their operations into bio-pesticides, bio-herbicides, bio-fertilisers, etc., and charging exorbitant prices with tall claims on

international technologies, patents, etc.[6] This, in no time, would nullify the low cost advantage of CRZBNF. The private companies are also taking advantage in the case of seeds, especially cross pollinated seeds like maize, cotton, chillies and vegetable crops. If this is allowed to spread, it may lead to another unwarranted situation of crop failures, which is already evident in the case of commercial crops. State governments, for the reasons best known to them, are not able to regulate input supply chains and ensure quality instead of leaving farmers at the mercy of these companies/dealers.

Farmers also observed that only the hardworking households with commitment and family labour could venture into CRZBNF (Table 3). It is labour intensive for making the inputs at home and weeding. It also requires intensive supervision. Unless there is substantial incentives, farmers are not willing to trade off their time for harsh farm work. For instance, farmers refused to replace traditional/conventional paddy cultivation (flooding) with SRI method for the same reason. Such shifts require substantial economic incentives (increased income) and disincentives (paying for resource use) backed by state and national policies. As long as water, chemical fertilisers and pesticides are available conveniently and cheap (subsidised), why should a farmer chose to adopt alternatives that are inconvenient and yield less. Though farmers are very much concerned with resource degradation they are trying to overcome it through alternative ways (increase organic matter, etc.).

While higher market prices are expected for the CRZBNF produce, these prices are not realised in the absence of certification, market support or procurement from government agencies. A few farmers manage to get better prices due to trust or having contacts with organic stores in the cities. As the demand for organic or natural foods in India is not high at present, the price advantage may vanish as the area under CRZBNF expands. Market or assured prices is a major constraint which the farmers are facing, irrespective of what and how they produce. Getting remunerative prices are what farmers often demand rather than subsidies or other freebies. This calls for a more systematic approach viz., organising the produce from Small and Marginal Farmers (SMFs), quality certification, identifying export markets (within and outside India), etc.

V

WAY FORWARD

CRZBNF/NF is not new to Indian agriculture. The number of farmers have attempted to practice natural farming on their own with good success. Inspired by the book '*One Straw Revolution*' of Masanobu Fukuoka, a pioneer in natural farming in Japan, some enlightened farmers turned to natural farming much before Mr. Palekar. These include, Bhaskar Save (Gujarat); Sripada Achyuta Dabholkar (Maharashtra), Narayan Reddy and Kailash Murthy (Karnataka). Though their success stories have been heralded (Nadkarni, 1988; Goswami, 2017), they remain as one farm/man wonders even after 30 years. For instance, it is observed that Kailash Murthy from

Karnataka switched to natural farming in 1988 on his 22 acres of land. He has not used chemical fertilisers or pesticides over the past 30 years. He follows no-tilling and no-weeding approach. "For cultivation, I don't even use organic manure like *panchagavya* and *jeevamrita*. I am only using photosynthesis" (Goswami, 2017). But these practices are not adopted by the neighbouring farmers. However, studies have not reported the time they have taken (lag period) to achieve the present yield rates and the support they received. And most of these farmers are large farmers with good economic background and hence they could not be models for majority of our SMFs, who cannot withstand losses. The same reasons hold back the scaling up of CRZBNF even with huge support from state government. Our analysis and observations do not give any indication that CRZBNF will be adopted widely or sustained in the near future with the kind of support (capacity building) it is receiving.

Organic farming is being promoted under the national programme of 'PKVY' through farmer groups. Viability of organic farming is becoming a problem in the absence of input availability and output markets. It is argued that organic farming is suitable only for horticultural crops, given the poor soil conditions (in terms of corban) in India. Even in the case of horticultural crops organic farming is constrained by the availability of inputs. Studies have clearly shown that crop yields suffer in the high input intensive regions/crops to the extent of facing food insecurity (Halberg *et al*., 2006; Ciccarese and Silli, 2016). Sikkim, which has been declared as 100 per cent organic, has reported halving of its food grain production between 1995-96 and 2015-16 and started importing (Ganesan and Nair, 2018).

Thus, chemical intensive farming and natural/organic (CRZBNF) farming represent two extreme approaches of farming. Chemical intensive farming is not only proving detrimental to the natural system but also in increasing the cost of production and making farm sector unviable. On the other hand, CRZBNF is not able to attract farmers in a natural way due to various constraints discussed above. There is need for identifying a middle path in order to effectively address the agrarian crisis. Precision farming could be the middle path between organic and chemical intensive farming, which has the potential to reduce degradation without compromising on production/income and quality (Chand, 2017). Though CRZBNF may be an ideal approach, it's naïve to expect farmers to jump from one extreme to another so quickly, that too when gains are not much. It could be achieved in a phased manner protecting the interests of farmers as well as the nation.

NOTES

1) In recent years System of Rice Intensification (SRI) failed to take off despite the claims of 40 percent on water savings and 30 percent yield increase due to various constraints at the farm level (Reddy *et al*., 2005).

2) A more recent example is of Bt cotton, which spread like wildfire across states despite the warnings of adverse long run impacts.

3) That is how green revolution technology was spread. No state used any additional funding to promote it.

4) Input and output information provided by NFFs don't reflect the reality due to the scale and attention crops get on small piece of land. Besides, their information could be biased, as they are paid by the programme (conflict of interest). Even among them only the success stories are reported by the RySS.

5) These estimates don't adhere to the NSSO standards of crop cutting estimates. Crop cutting estimates are based on the yield from a 10*10-meter area from the north east corner of a plot, which is randomly selected from a village.

6) Based on our discussion with fertiliser dealers and companies.

REFERENCES

Bishnoi, Ruchi and Aksaya Bhati (2017), "An Overview: Zero Budget Natural Farming", *Trends in Biosciences,* Vol.10, No.46.

Chand, Ramesh (2017), "Doubling Farmers' Income: Strategy and Prospects", *Indian Journal of Agricultural Economics*, Vol.72, No.1. January-March.

Ciccarese, Lorenzo and Silli Valerio (2016), "The Role of Organic Farming for Food Security: Local Nexus with a Global View", *Future of Food: Journal on Food, Agriculture and Society*, Vol.4, No.1, Spring.

Devarinti, S.R. (2016), Natural Farming: Eco-Friendly and Sustainable? Agrotechnology, 5: 147. (doi: 10.4172/2168-9881.1000147).

Goswami, Subhojit (2017), "No Fertilisers, No Pesticides, this Karnataka Farmers Uses only Solar Energy", *Down to Earth*, 30 March.

Ganesan, S. and Archana Nair (2018), "Sikkim's Organic Farming Delusions", *Sunday Gaurdian*, Vol.9, No.26, 24-30 June.

Halberg, N.; Timothy Sulser, Henning Hogh Jensen, M.W. Rosegrant and M.T. Knudsen (2006); "The Impact of Organic Farming on Food Security in a Regional and Global Perspective", April (DOI: 10.1079/9781845930783. 0277)

Khadse, Ashlesha; Peter Michael Rosset, Helda Morales and Bruce G. Ferguson (2018), Taking Agroecology to Scale: the Zero Budget Natural Farming peasant movement in Karnataka, India, *The Journal of Peasant Studies*, 45:1, 192-219, (DOI: 10.1080/03066150.2016.1276450).

Nadkarni, M.V. (1988), "Crisis of Increasing Costs in Agriculture: Is There a Way out?" *Economic and Political Weekly*, Review of Agriculture, Vol.23, No.39, 24 September.

Palekar, S. (2016), Zero Budget Spiritual Farming (online), *http://bit.ly/1Pk3a8p*.

Palekar, S. (2005), *The Philosophy of Spiritual Farming I* (2nd Ed.) Amravati: Zero Budget Natural Farming Research, Development & Extension Movement, Amravati, Maharashtra.

Palekar, S. (2006), *The Principles of Spiritual Farming II* (2nd Ed.) Amravati: Zero Budget Natural Farming Research, Development & Extension Movement, Amravati, Maharashtra.

Reddy, V. Ratna (2003), "Land Degradation in India: Extents, Costs and Determinants", *Economic and Political Weekly*, Vol.38, No.44, 1-7 November, pp.1-7.

Reddy, V. Ratna; P. Prudhvikar Reddy, M. Srinivasa Reddy and Sree Rama Raju (2005), Water Use Efficiency: A Study of System of Rice Intensification (SRI) Adoption in Andhra Pradesh, *Indian Journal of Agricultural Economics*, Vol. 60, No.3, July-September, pp.458-472.

Rythu Sadhikarika Samastha (RySS) (2018), "Universalization of ZBNF in AP: Comprehensive Action Plan to cover all 60 lakh Farmers in the State by 2025-26", Rythu Sadhikara Samstha, Zero-Budget Natural Farming, Department of Agriculture, Government of Andhra Pradesh, Amaravati, July.

Rythu Sadhikarika Samastha (RySS) (2019), Andhra Pradesh Zero Budget Natural Farming: Mainstreaming Natural Farming at State Level: All 60L Farmers, 80L Hectares, 12924 Gram Panchayats, Presentation by T. Vijayakumar, Vice-Chairman, *Rythu Sadhikarika Samastha*, Government of AP, National Conclave on Food, Centre for Science and Environment, 15 March, New Delhi.

Tripathi, Sausabh; Shruti Nagabhushan and Tauseef Shahidi (2018), "Zero Budget Natural Farming for the Sustainable Development Goals? Andhra Pradesh, India", CEEW Issue Brief, Council on Energy, Environment and Water (The Council), January, New Delhi.