Workshop summary Hyderabad 25th-26th April 2022

Zero Budget Natural Farming in Andhra Pradesh, India

DEVELOPING AN EVIDENCE BASE TO SUPPORT ZBNF'S WIDER APPLICATION

BACKGROUND

High levels of farmer debt and the phenomenon of farmer suicides in India have made finding low-cost agricultural strategies fundamental to rural wellbeing and development. This is combined with the increasing environmental changes, particularly soil degradation, which undermines effective agricultural production. These are formidable challenges which have a disproportionately higher effect on the food security and wellbeing in lower income countries, endangering the achievement of the SDGs. Zero Budget Natural Farming (ZBNF), more recently referred to Community Managed Natural Farming in Andhra Pradesh (APCNF) acts to address these problems. It is a regenerative agricultural practice, which addresses the problem of soil degradation while being low-cost, mitigating the problem of farmer debt. The widespread adoption of ZBNF has the potential to enhance the livelihood resilience of smallholder farmers to climate and land use change, while increasing their income and food security, and improving soil fertility.

We are currently in Phase II of the successful partnership between the University of Reading (UoR) and Rythu Sadhikara Samstha (RySS). The first phase of the collaboration began in 2018 and sought to identify the biophysical processes and extension mechanisms of Zero-Budget Natural Farming (ZBNF) in Andhra Pradesh, India. This new phase builds upon this success and aims to establish the biophysical dimensions of ZBNF, particularly the impact of 365 days green cover, an innovation used largely in the low rainfall district of Anantapur. It will also further analyse farmer decision making and perspectives about this innovation using a participatory video-making approach.

FORMAT OF THE WORKSHOP

The two-day workshop, hosted in Hyderabad, was split into four parts:

1. An introduction to natural farming in Andhra Pradesh
2. An overview of research to date in Phase I of the project by both the social science and biophysical team
3. A summary of the research design and ideas for social and biophysical science elements of Phase II
4. Break-out groups to reflect on proposed research designs

INTRODUCTION TO NATURAL FARMING IN ANDHRA PRADESH – DR ZAKIR HUSSAIN (RySS)

To start, we had an introduction to the Principles of Natural Farming in Andhra Pradesh, these include:

- Soil To Be Covered With Crops 365 Days (Living Root)
- Minimal Disturbance Of Soil
- Biostimulants As Necessary Catalysts
- Use Indigenous Seed

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- Diverse Crops/Trees 15 -20 Crops
- Integrate Animals In To Farming
- Increase Organic Residues On The Soil
- Pest Management Through Botanical Extracts
- No Synthetic Fertilizers, Pesticides or Herbicides

More details of the RySS programme can be found on their website, here.

PHASE I RESEARCH TO DATE

More details of the project activities can be found on the project website, here:

SOCIAL SCIENCE – DR GRADY WALKER (UoR)

Our overarching aim was to understand the ZBNF system as whole—not just the biophysical processes but also the societal structures in which ZBNF practice was embedded. We began our initial scoping in Phase I with focus group discussions and stakeholder innovation mapping in three districts in Andhra Pradesh. We wanted to gain insight into the communication and learning dynamics of women's Self-Help Group (SHG) members to understand decision making, paths of knowledge exchange, innovation processes, and the root causes behind adoption.

To gain more insight into the perceptions of ZBNF and the subjective motivations behind adoption, we developed a participatory photography activity that was facilitated by Natural Farming Fellows (NFFs) among six SHGs spread across three districts in north, central and southern Andhra Pradesh. During the process, participants investigated themes related to natural farming, which they identified themselves and wove into stories that they crafted about their lives, or the lives of their family and community members. Using thematic collages, the process enabled participants to move beyond 'on-script' messages about ZBNF and focus on 'off-script' narratives of innovation, adoption, and change. More details on this novel methodology were published in the *International Journal of Qualitative Methods* in a paper entitled: Thematic Collages in Participatory Photography: A Process for Understanding the Adoption of Zero Budget Natural Farming in India.

Our team conducted a dialogical narrative analysis of the hundreds of individual photo responses, and we are in the process of writing an article on our findings, along with another article regarding pathways to innovation within the political economy of natural farming.

BIOPHYSICAL SCIENCE – DR SARAH DUDDIGAN (UoR)

The focus of the biophysical science study to date has been to: (i) assess how ZBNF compares to organic and conventional alternatives in terms of both soil properties and yield outcomes; and (ii) to examine the relative contribution of the different inputs used in ZBNF to soil and yield outcomes.

Twenty-eight controlled field experiments were established across the state, and they were maintained for up to three seasons. More details on the experimental design, and the yield data from the first experimental season can be found in our recently published paper: 'Impact of Zero Budget Natural Farming on Crop Yields in Andhra Pradesh, SE India'. Results from our field experiments suggest that adoption of ZBNF practices provides a significant yield advantage over organic and conventional

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alternatives. However, it is important to note the long term impacts of ZBNF adoption are still unknown and will require more long-term study. Analysis of various physico-chemical properties of the soil throughout the season suggests that the yield benefits of ZBNF practices could be a result of improved moisture retention, rather than improved nutrient status. A more detailed paper of the three seasons soil and yield data is currently in progress with the hope to publish later in the year. Keep an eye on the projects news page for updates.

A further five controlled field experiments were also established across the state to examine the relative contributions of four inputs commonly used in ZBNF: bijamrita, liquid jiwamrita, soild jiwamrita and dead mulch. The experiment consisted of a 'standard ZBNF' treatment, with all inputs included compared to four 'exclusion' treatments where a single input was removed. Initial observations suggests that there is a yield penalty if any single input if removed (paper in progress, keep an eye on our news page for updates).

PHASE II RESEARCH DESIGN AND IDEAS – WITH INPUT FROM THE FOCUS GROUPS

Focusing on the low rainfall district of Anantapur, we are concentrating on farmers who have adopted '365 green cover' (live mulching/ green cover for 365 days of the year) as part of their ZBNF practice for Phase II of the project. Here we summarise our revised research design based on input from the delegates.

SOCIAL SCIENCE

Anantapur is a district within Andhra Pradesh known for its water scarcity and high rates of seasonal migration. Agricultural livelihoods are defined by higher levels of precarity when compared with other districts in the state. We aim to build on our work in Phase I by using more visual method and narrative research to understand how farmers who have adopted the 365 days green cover (365DGC) innovation are subjectively connecting their decision to impacts on nutrition, food security, and migration at the household, community, and societal levels. Because this research design requires an in-depth inquiry targeting subjective perceptions, a case study approach focusing on five individual farmers was developed (see below).

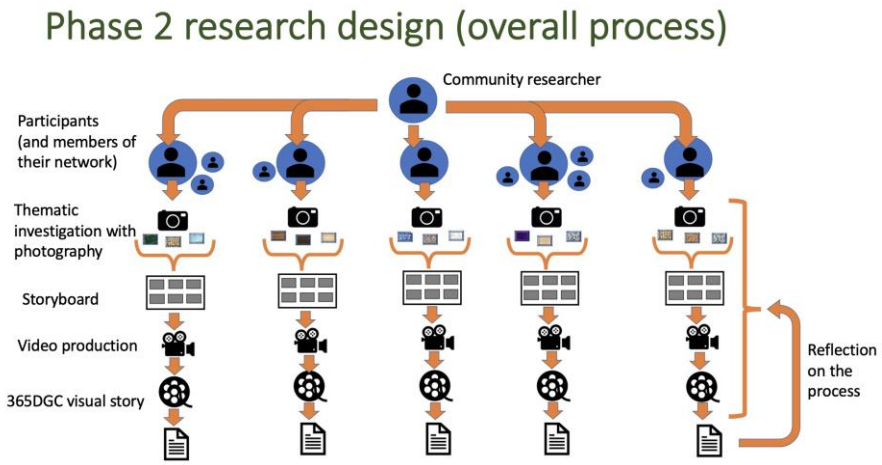

Figure 1 – Video storytelling research design for Phase II

Additionally, in Phase II we will use a survey instrument that will be distributed to a larger sample of farmers in Anantapur. The objective of this survey is to provide quantitative evidence on the relationship between adoption of the 365-day green cover

innovation and social, cultural and economic dynamics. For example, the study will reveal the gendered nature of decision making and bargaining power, the implications of land ownership and access, food culture, food security and health. Quantitative analysis will identify the level of inclusivity of the innovation and the implications for social change, for example around migration or inter-generational dynamics. With the inclusion of a participatory budget exercise it will be possible to explore whether changes in food culture, labour and income influence consumption or investment decisions.

The design of the research will be:

- The selection of 3 Mandals within Anantapur informed by the RySS data of adopter locations and numbers, and the selection process of the physical science location and logistical limitations);
- Random stratified sampling of farming households, informed by the RySS data of adopters. 75 to 100 households will be selected from each of the Mandals (providing a dataset of up N=300) and a 50/50 gender spilt of farmer respondents from the households. The stratification will be: up to 3-year experience of adoption, use of ZBNF but not 365; and conventional farming only (not 365 or ZBNF);
- The use of Kobo tool kit for data collection via tablet devices and initial processing back to UoR from the field, then use of Kobo, SPSS, and coding.

The participants discussed a range of important considerations, around labour, power, food culture, health and wellbeing, and the selection of indicators. For example, selection of cultivators driven by perceptions and memory/food culture, like the use of millets or integration of kitchen garden produce can influence health indicators (pre/post adoption and public health data) and also labour capacity. Another example was the discussion of competing current discourses about agricultural transitions in India, and how these may be manifested in the evidence collected in the project. The popularised 'back to land' narrative has politically and socially seen an interest in particular farming interests, such as organic or family farming, but also the potential for elite capture when we consider who can afford to take risks and explore other livelihood options. The survey data will be able to identify social change and the gendered nature of this, with the analysis providing a quantitative underpinning of the narratives from the participatory photography and video.

BIOPHYSICAL SCIENCE

The biophysical research aims to address a number of hypotheses around the adoption of 365 green cover, compared to conventional techniques (detailed in Figure 2). To test these we propose to work on 110 pairs of sites that are available for sampling across Anantapur. These consist of a farm that has adopted 365 green cover and an adjacent conventional farm.

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Hypotheses

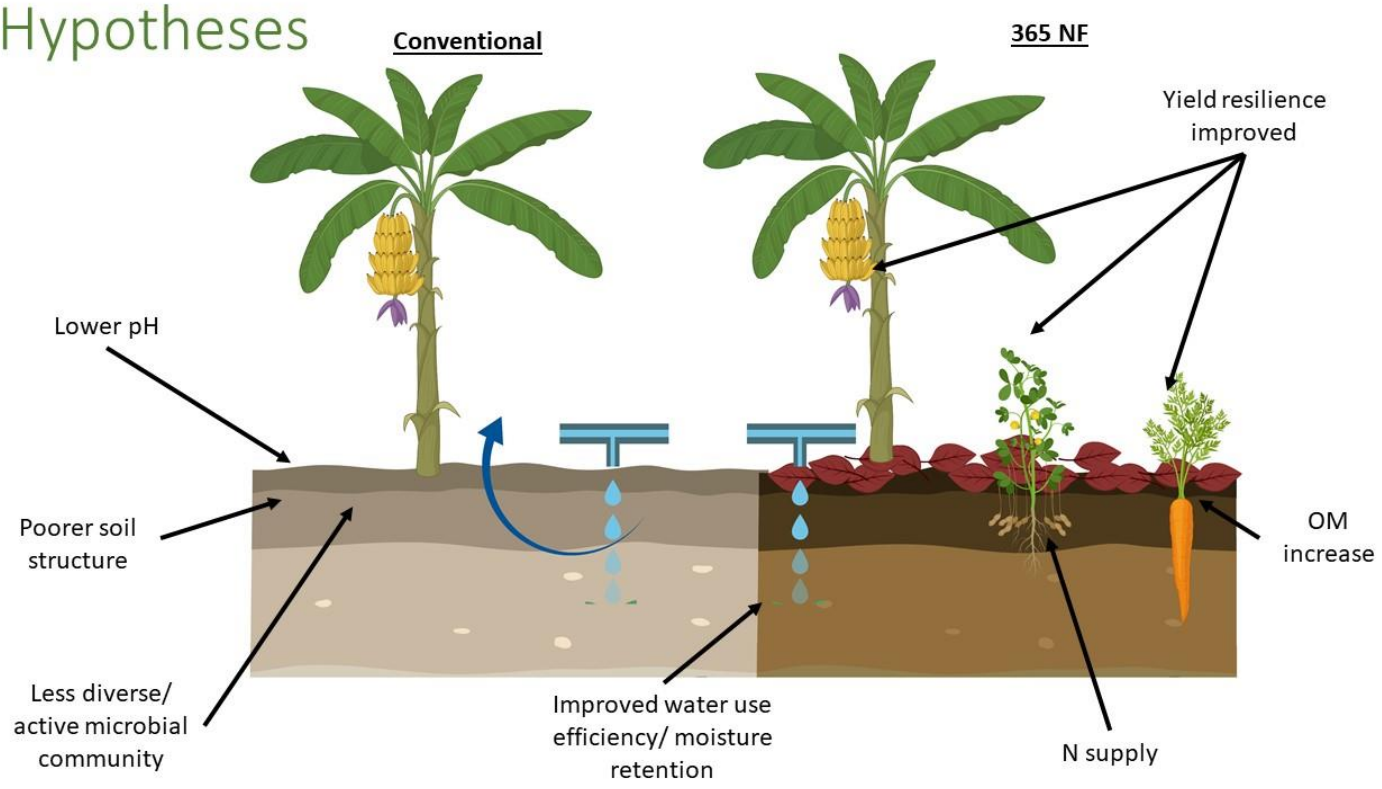

Figure 2 – Hypothesized benefits of 365 Green Cover (365 NF) compared to conventional farming

We propose a series of simple, quick low cost measurements taken on all of the farms as part of routine visits. Of the 110 paired sites, 10 of them have been selected, spread across the district, for more in depth study.

Data from the 110 paired sites:

- Questionnaire on land use history
- Check list/ tick box of what has been applied since last visit (mulch, jiwamrita, irrigation etc.)
  - To develop an index of adoption
- In field measurements (across the field):
  - Soil temperature
  - Soil moisture
  - pH
  - Infiltration rate
  - Bulk density
  - Field spectroscopy
- Soil sampling (at 2 depths)
  - Nutrients (NPK, micro nutrients)
  - Soil Carbon
  - Enzyme activity
  - Root exudates?

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Additional data from the 10 paired sites:

In addition to what's listed above:

- Establish a quadrat on each site
    - Record how many plants, species etc.
    - Mulch thickness and material
    - Canopy cover using Canapeo app/ Image J
- Met stations (rainfall, wind speed, RH, radiation, temperature)
- Evaporimeter
- In situ probes with data loggers (air temperature, soil temperature, soil moisture)
- Soil samples
    - Targeted microbiology analysis e.g. qPCR or PLFA, bacterial:fungal
    - Lab based spectroscopy
- Determination of the water budget – use of electricity/ water metres to quantify irrigation rates
- Land equivalent ratio – compare to district average yields
- Nutrient use efficiency with tissue analysis? (requires pairs of sites that are growing the same crop)

Additional possible areas for investigation

- Role of pelletization in germination – blind pot experiment/ piece of land divided into small sections. Comparison of pelletized seeds, seed treated with bijamrita, conventional seed treatment and untreated seed.
- Is it possible to maintain 365DGC ? (dry spells for 15 years out of 20 years) Does growing all year round put more pressure on water resources?
- Different water/nutrient needs of different crops? Will one application rate be an excess for some species? Cropping models dictate irrigation practice - Lease with Corecarbonex
- Lab study/ controlled field experiment on the effects of jiwmrita application, mulch, polycrop etc.
- Examine the role of the ZBNF inputs (jiwamrita etc.) to the 365 system – possible field experiments of 365 with and without the other ZBNF amendments
- Characterization of the ZBNF amendments

NEXT STEPS

- Submission of further academic publications from Phase I.
- Series of training, data collection and analysis activities between June and December 2023 for Phase II.
- Consolidation of collaborative working for research, such as through joint publications.
- Further engagement events with Indian universities and organizations to establish joint working opportunities.

For more information visit: research.reading.ac.uk/zbnf
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DELEGATES

#	Name	Organisation
1	Achuthan Rajeevan	RySS
2	Bhargavi Reddy	RySS
3	Bhavana Boppana	RySS
4	Chris Collins	University of Reading
5	Chubamenla Jamir	The Energy and Resources Institute (TERI)
6	Dharmendar Gogu	RySS
7	Haripriya Gundimeda	Indian Institute of Technology Bombay
8	Haripriya Vattikuti	RySS
9	Henny Osbahr	University of Reading
10	Himabindu Anisetti	RySS
11	Kamlesh Jangid	National Centre for Microbial Resource
12	Kodeboyina S Varaprasad	IIOR (previously)
13	Laxman Naik	RySS
14	Maheswari Mandapaka	ICAR-Central Research Institute for Dryland Agriculture
15	Muralidhar G.	RySS
16	Pratap Kumar	Acharya N. G. Ranga Agricultural University
17	Pushpa Karamala	RySS
18	Raja Shekar	Centre for Sustainable Agriculture
19	Ram A Jat	Directorate of Groundnut Research
20	Ravindra Kumar Vemula	English and Foreign Languages University
21	Rujuta Dilip Nalavade	University of Aberdeen
22	Sahadeva Reddy	Acharya N. G. Ranga Agricultural University
23	Samanpreet Kaur	Punjab Agricultural University
24	Sarah Cardey	University of Reading
25	Sarah Duddigan	University of Reading
26	Srivanthi Ponnolu	RySS
27	Sushmitha Gangisetty	RySS
28	Tom Sizmur	University of Reading
29	Usha Raman	University of Hyderabad
30	Vijay Thallam	RySS
31	Zakir Hussain	RySS
Online Delegates		
32	Amanda Caine	University of Reading
33	Francesco Carnevale Zampaolo	System of Rice Intensification 2030
34	Liz Shaw	University of Reading

We would like to thank you all for participating, your contributions are much appreciated and will be used to refine our research plans for Phase II. We look forward to building our working relationships with you all in our future work.

For more information visit: research.reading.ac.uk/zbnf

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