Zero budget natural farming (ZBNF): A critical analysis on crop wise practices, ZBNF models and cropping systems

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Abstract

This study was conducted in Vizianagaram district of Andhra Pradesh. In Vizianagaram district, the major crops grown under ZBNF were Paddy, Maize, Cotton, Green gram, Black gram, Brinjal, Bendi, Mango and other crops were grown under small proportions. Most of the ZBNF practices were applicable to more than one crop with multiple uses of kashayams and asthrs for prevention and control of several pests and diseases in various crops. More than three fifth of the ZBNF farmers (65%) have adopted kitchen garden model in their back yard. Majority (85%) of the ZBNF farmers followed paddy, maize and pulse cropping pattern followed by paddy, maize and vegetables cropping system as expressed by 75% farmers.

Keywords: ZBNF, ZBNF models, crop wise practices under ZBNF, cropping systems under ZBNF

Introduction

Agriculture is the backbone of the Indian economy where more than 70% of population depends on agriculture directly and indirectly contributing 20.5% share to Gross Domestic Product. After green revolution, Indian agriculture changed from the state of subsistence to commercial and production of food grains increased extremely to meet the requirements of growing population needs. In other hand, after green revolution, usage of chemicals like fertilizers and pesticides are increased leading to high input cost, loss of soil fertility and increased accumulation of chemical residues in soils drastically. In this view, there is an immediacy for sustainable development of agriculture to feed the growing population. Zero Budget Natural Farming (ZBNF) is an alternative solution to above situation in current agricultural practices.

Zero Budget Natural Farming (ZBNF) practices include crop rotation, multistoried cropping, green manuring, preparation of kashayams, asthrs, biological pest control etc. Beejamrutham, jeevamrutham, acchadana/mulching, waaphasa/moisture popularly known as four pillars of ZBNF. Zero Budget Natural Farming (ZBNF) is a “triple-win opportunity as it enhances crop productivity by reducing input costs and helps farmers increase their net income inducing climate resilient agriculture” (Sathiy Raj et al., 2020). Zero Budget Natural Farming suits all crops in all agro-climatic zones. Practices mean the practices which are adopted in growing the crop in entair crop life cycle.

Materials and Methods

Ex-post facto research design was taken for the investigation. This design was considered appropriate as the phenomena in the study has already been occurred. The state of Andhra Pradesh was chosen for the study as it is a leading state in Zero Budget Natural Farming. About 5,80,000 farmers were practicing ZBNF in 2,60,000 ha. in 3011 villages throughout the Andhra Pradesh. Vizianagaram district was selected purposively as it was the prime district having ZBNF with highest area i.e., 38000 hectares and about to get saturation with this farming. Four mandals viz, Gumma Lakshmipuram (G.L. Puram), Vepada, Kurupam and Garugubilli were selected purposively in which the number of Zero Budget Natural Farming respondents were more. Two villages from each mandal, obtaining eight villages from four mandals (2 X 4 = 8) were selected by using simple random sampling technique. The details of selected villages were furnished in flow chart below. The sample includes 80 ZBNF farmers selected by employing simple random sampling method.
In Vizianagaram district, the major crops grown under ZBNF were Paddy, maize, cotton, green gram, black gram, brinjal, bendi, mango and other crops in small proportions. An open ended schedule was constructed to obtain list of crops grown under ZBNF. ZBNF model was operationally defined as the combination of different crops grown in a certain area by adopting ZBNF practices by the respondents. Different models present in ZBNF were five layered model, seven layered model, Kitchen garden model, Sun model and Annapurna half acre model. Except Annapurna model, all models were adopted by the farmers. Here frequency and percentages were used to analyse the responses of farmers.

Cropping systems under ZBNF was operationally defined as the order in which the crops were grown or cultivated on a piece of land over fixed period by ZBNF farmers. The schedule was developed to study the cropping systems followed by ZBNF farmers. The frequencies and percentages were used to analyse the responses of the farmer.

Results and Discussion

Documentation of crops and crop wise ZBNF practices

In Vizianagaram district, the major crops grown under ZBNF were Paddy, Maize, Cotton, Green gram, Black gram, Brinjal, Bendi, Mango and other crops were in small proportions. In this study major crops grown under ZBNF and major crop wise ZBNF practices followed by the farmers were documented, listed and analysed in table 1.

A clear perusal from the table 1, shows that 96.66% ZBNF Paddy farmers were following seed treatment with beejamrutha and jeevamrutham followed by 93.33% spraying of neem oil, buttermilk solution and giving two light irrigations and 82.61% applying 1 percent neem oil. Majority of the farmers (96.3%) who were growing Black gram, practiced seed treatment with beejamrutha followed by 92.59% applied 1 percent neem oil; 88.89% spraying 5 percent neem oil, buttermilk solution and giving two light irrigation and 83.33% spraying asafoetida and gobar solution. Majority of the farmers growing Brinjal shown cent percent implemented seed treatment with beejamrutha, applied agniasthra and 5 percent neem oil solution; 93.33% given irrigation before harvesting and installed pheromone traps and 80% farmers applied neem powder in their brinjal field.

Table 1: Crops and crop wise pure ZBNF practices and RYSS mediated ZBNF practices (N=80)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the Practice</th>
<th>Remarks</th>
<th>F (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Seed treatment with Beejamrutha</td>
<td>Helps to increase the resistance capacity of seedlings towards pests and diseases.</td>
<td>58</td>
</tr>
<tr>
<td>2.</td>
<td>Application of pond soil</td>
<td>Fifteen to twenty cart loads of pond soil per acre to the main field once in three years. If applied, it helps to increase the soil moisture holding capacity</td>
<td>40</td>
</tr>
<tr>
<td>3.</td>
<td>Incorporation of green manure crops</td>
<td>Helps to increase the soil organic matter and soil fertility.</td>
<td>50</td>
</tr>
<tr>
<td>4.</td>
<td>Growing azolla</td>
<td>Application of Azolla 4 kg/acre helps to fix 30-40 kg nitrogen per acre.</td>
<td>46</td>
</tr>
<tr>
<td>5.</td>
<td>Application of Jeevamrutham</td>
<td>Application of 500 lts/acre helps to increase the number of microorganisms in the soil.</td>
<td>58</td>
</tr>
<tr>
<td>6.</td>
<td>Application of Asafoetida solution</td>
<td>Helps to correct nutrient deficiencies of Iron, Zinc and Potassium.</td>
<td>48</td>
</tr>
<tr>
<td>7.</td>
<td>Application of Neemasthra</td>
<td>Twice in 15 days intervals. If applied, it controls sucking pests.</td>
<td>56</td>
</tr>
<tr>
<td>8.</td>
<td>Application of Agniasthra</td>
<td>Twice in 7 days intervals as a precautionary measure for stem borer.</td>
<td>56</td>
</tr>
<tr>
<td>9.</td>
<td>Application of Neem oil</td>
<td>One to two lbs per acre for the control of Brown plant hopper.</td>
<td>52</td>
</tr>
<tr>
<td>10.</td>
<td>Application cow urine and buttermilk solution</td>
<td>Application of 10% buttermilk solution for the control of rice blast disease.</td>
<td>48</td>
</tr>
<tr>
<td>11.</td>
<td>Application of Maredupatra kashayam</td>
<td>Helps for rice blast control.</td>
<td>42</td>
</tr>
<tr>
<td>12.</td>
<td>Application of Asafoetida and gobar solution</td>
<td>As a precautionary measure to control Stem rot, Blast, Bacterial leaf blight.</td>
<td>40</td>
</tr>
<tr>
<td>13.</td>
<td>Application of Panchagavya</td>
<td>For higher yields and improvement of grain quality</td>
<td>56</td>
</tr>
</tbody>
</table>

RYSS mediated ZBNF practices

Maize and its practices followed by the farmers under ZBNF: (N=50)

Pure ZBNF practices

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the Practice</th>
<th>Remarks</th>
<th>F (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Seed treatment with Beejamrutha</td>
<td>Helping to increase the resistance capacity towards pests and diseases.</td>
<td>50</td>
</tr>
<tr>
<td>2.</td>
<td>Application of manure</td>
<td>Application of FYM @ 5 t/ac, NADEP 2500 kg/ac, (at the time of ploughing). Application of Ghana jeevamrutham @250 kg/ac twice (125kg/ac each) in 30 days interval and application of dravajeevamrutham twice (200 lts /ac each).</td>
<td>30</td>
</tr>
<tr>
<td>3.</td>
<td>Spraying of Datura kashayam</td>
<td>Thirty DAS if there is high incidence of sucking pests.</td>
<td>42</td>
</tr>
</tbody>
</table>
4. Application of Panchagavya  
   Thirty DAS for higher yields and improvement of grain quality.  
   50 100
5. Spraying of Brahmastra  
   Three lts/ac for control of stem borer.  
   48 96
6. Spraying of Agniasthra  
   At the rate of 3 lts/ac 40 DAS for the control of Fall army worm.  
   46 92

**RYSS mediated ZBNF practices**

7. Inserting sticky traps  
   At the rate of 15-20 per acre. For the control of maize stem borer.  
   These traps were made by the farmers themselves by used oil cans with castor oil covering.  
   40 80
8. Sowing Sorghum as trap crop  
   Sowing sorghum crop and removal of it 45 DAS for the control of maize stem borer.  
   42 84

**Cotton and its practices followed by the farmers under ZBNF: (n=40)**

**Pure ZBNF practices**

1. Application of Ghana jeevanrumtham  
   At the rate of 125 kg/ac in last puddling and 125 kg/ac at 60 DAS. Helps to increase the number of microorganisms in the soil, improves earthworm activity and enhances nutrient content in the soil.  
   40 100
2. Application of NADEP compost  
   Two thousand five hundred kg/ac, (at the time of ploughing) improves soil properties, provides nutrients in a stable organic form.  
   30 75
3. Application of Dhavajeervamrumtham  
   Two hundred lts/ac at 30 DAS and 200 lts/ac at 75 DAS.  
   40 100
4. Application of Panchagavya  
   At the rate of 3 lts/ac at 15 days interval helps to prevent the dropping of flowers and improves the yields and quality too.  
   36 90
5. Spraying of asafoetida and gobar solution  
   Spraying of asafoetida and gobar solution @100 lts per acre for the control of bacterial and fungal diseases in cotton.  
   30 75
6. Sowing sorghum seedlings  
   Sowing sorghum seedlings for the control of boll worms and Spodoptera.  
   40 100
7. Spraying of Brahmastra/ Agniastra  
   Spraying of brahmastra/ agniastra @ 3 lts/ac for the control of boll worms and Spodoptera.  
   30 75

**Green gram and its practices followed by the farmers under ZBNF: (n=46)**

**Pure ZBNF practices**

1. Seed treatment with Beejamrutha  
   Helps to increase the resistance capacity of seedlings towards pests and diseases.  
   46 100
2. Application of FYM  
   Application of FYM 5t/acre, NADEP compost 2500 kg/ac and 100 kgs/ac of ghanajeevamrumtham.  
   20 43.48
3. Giving two light Irrigations  
   First irrigation at 25-30 DAS and second irrigation at 45-50 DAS.  
   40 86.95
4. Spraying of 5% neemasthra  
   Twice in a week interval for the control of Flea beetles and white flies.  
   46 100
5. Spraying of 1% Neem oil  
   Twice in one week interval for the control of thrips.  
   38 82.61
6. Spraying fermented butter milk  
   Spraying buttermilk solution @ 6 lts/ac for the control powderly mildew and cercospora leaf spot.  
   40 86.95
7. Vavilaku kashayam  
   Spraying of 5% vavilaku kashayam for the control of thrips.  
   26 56.5

**RYSS mediated ZBNF practices**

8. Pheromone traps  
   Installation of pheromone traps @ 5 per acre to control the spodoptera.  
   26 56.5
9. Sowing Rhizobium treated seeds  
   Sowing Rhizobium treated seeds @ 200 gms for 10 kg seed for high yields.  
   28 68.87

**Black gram and its practices followed by the farmers under ZBNF: (n=54)**

**Pure ZBNF practices**

1. Seed treatment with beejamrutha  
   Helps to increase the resistance capacity of seedlings towards pests and diseases.  
   30 100
2. Application of FYM  
   Incorporation of 8-10 t/acre while ploughing.  
   18 60
3. Irrigation before harvesting  
   Providing 1-2 irrigations before harvesting of brinjal in summer for prevention of sour taste in fruits.  
   28 93.33
4. Application of neem powder  
   Application of 1-2 quintals of neem powder per acre for controlling of nematodes in soil.  
   24 80
5. Vavilaku kashayam  
   Spraying vavilaku kashayam @ 5 lts/ac for the control of spodoptera and aphids.  
   22 73.33
6. Spraying agniasthra  
   Spraying agniasthra @ 3 lts/ac for the control of fruit and shoot borer.  
   30 100
7. Application of 5% neemasthra  
   Spraying of Neemasthra at every 20 days interval for the control of epilachna beetle and sucking insects.  
   30 100

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Image with text: "107"
The farmers were growing Bendi, cent percent practiced seed treatment with beejamrutha followed by 93.33% applied agnaiasthra and neemasthra, 80% applied fermented buttermilk; 73.33% given irrigation and 66.67% farmers were applied milk solution in their base of the each tree.

Majority of the farmers growing Mango shown cent percent implemented the practice of application of ghana and dhrava jeemavrumath; 92.3% practicing mulching materials like straw, dry leaves, rice bran and ground nut shells at the base of the each tree and 84.62% applied panchagavya, asafoetida and gobar solution or neemasthra or fermented buttermilk.

The practices which ZBNF farmers were practicing in different crops include not only pure ZBNF practices but also IPM practices. Pure ZBNF practices in addition to IPM practices led to enhance efficacy of ZBNF crop protection practices which were popularized by RYSS through their grass root level extension workers.

From table 2, It is clear that though the investigator initiated the study on ZBNF hypothesizing no cost involvement in preparation of bio-solutions in adopting various ZBNF practices from seed to seed. The study revealed that most of the farmers following 68.42% pure ZBNF practices in above eight crops only 31.58% RYSS mediated ZBNF practices (IPM) like sticky traps, pheromone traps and alley ways etc.

From the above documentation, it was clear that the most of the ZBNF practices were applicable to more than one crop and multiple uses of kashayams and ashras for prevention and control of several pests and diseases in various crops. This documentation was similar to the findings of Niti et al. (2020) [2] and Saikat (2020) [3].

**ZBNF Models**

The ZBNF models adopted by farmers were presented in the table 2 and fig 1 clearly states that more than three fifth of the ZBNF farmers (65%) were adopted kitchen garden model in their back yard. Thirty five percent of the farmers did not adopt any ZBNF model. Only 20% and 10% of ZBNF farmers had seven - layered model and five - layered model respectively.

**Table 3: Distribution of ZBNF farmers based on their adoption of ZBNF models (N=80)**

<table>
<thead>
<tr>
<th>S. No</th>
<th>ZBNF Models</th>
<th>F</th>
<th>%</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Kitchen garden Model</td>
<td>52</td>
<td>65</td>
<td>I</td>
</tr>
<tr>
<td>2.</td>
<td>Five - layered model</td>
<td>10</td>
<td>10</td>
<td>IV</td>
</tr>
<tr>
<td>3.</td>
<td>Seven - layered model</td>
<td>20</td>
<td>20</td>
<td>III</td>
</tr>
<tr>
<td>4.</td>
<td>Sun model</td>
<td>1</td>
<td>1.25</td>
<td>V</td>
</tr>
<tr>
<td>5.</td>
<td>Not adopted any ZBNF model</td>
<td>35</td>
<td>35</td>
<td>II</td>
</tr>
</tbody>
</table>

* Multiple responses

It could be inferred that from the table 2 and fig 1, majority of the ZBNF farmers adopted the kitchen garden model in their back yard for family consumption but not for commercial purpose. This consumption of vegetables from their own

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**Table 2: Distribution of pure and RYSS mediated ZBNF practices**

| No. of pure ZBNF Practices | :   | 26  |
| No. of RYSS mediated ZBNF practices (IPM practices) | : 12 |
| Total No. of practices | : 38 |
| Percentage of pure ZBNF practices | : 68.42% |
| Percentage of RYSS mediated ZBNF practices (IPM practices) | : 31.58% |
kitchen garden made them feel highly satisfied and helped in gaining good health, expressed by the ZBNF farmers. ZBNF farmers also expressed that they did not market the vegetables. The seeds for kitchen garden were distributed by the government of A.P. through Community Resource Persons to the farmers at free of cost.

It was also observed that very less number of farmers adopted the seven - layered and five - layered models. These models were adopted partially by the farmers with no maintenance of exact proportion of plot and number of plants. Only one farmer adopted the sun model since three years in exact proportions. He reported that this model is very economically profitable as well as ecologically sustainable. Thirty five percent of ZBNF farmers did not adopt any ZBNF model because they had no knowledge and skills in laying of plots for ZBNF models, no training with respect to ZBNF models and no time due to their busy engagements in other farm enterprises, the extension officers giving less importance to the ZBNF models by extension of them. These findings were similar to the findings of Khadse and Rosset (2019)[1].

Cropping systems followed by the respondents

Regarding cropping systems followed by the ZBNF farmers presented in the table 3, it was clear that majority (85%) of the ZBNF farmers followed paddy, maize and pulse cropping system2 followed by paddy, maize and vegetables cropping system as expressed by 75% farmers.

Table 4: Distribution of ZBNF farmers based on cropping systems followed by them (N=80)

<table>
<thead>
<tr>
<th>S. No</th>
<th>Cropping Systems</th>
<th>F</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Paddy→ Maize→ Fallow→ Green manure</td>
<td>50</td>
<td>62.5</td>
</tr>
<tr>
<td>2.</td>
<td>Paddy→ Maize→ Pulses (GG/ BG/ HG)</td>
<td>68</td>
<td>85</td>
</tr>
<tr>
<td>3.</td>
<td>Paddy→ Maize→ Sesamum→ Green manure</td>
<td>32</td>
<td>40</td>
</tr>
<tr>
<td>4.</td>
<td>Paddy→ Maize→ Sesamum</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>5.</td>
<td>Paddy→ Maize→ Vegetables</td>
<td>60</td>
<td>75</td>
</tr>
<tr>
<td>6.</td>
<td>Paddy→ Sesamum→ Pulses (GG/ BG/ HG)</td>
<td>6</td>
<td>7.5</td>
</tr>
<tr>
<td>7.</td>
<td>Paddy→ Ragi→ Green manure</td>
<td>32</td>
<td>40</td>
</tr>
<tr>
<td>8.</td>
<td>Paddy→ Paddy→ Pulses</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>9.</td>
<td>Cotton + Red Gram→ Green manure</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>10.</td>
<td>Cotton + Red Gram→ Fallow</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>11.</td>
<td>Cotton→ Fallow</td>
<td>8</td>
<td>10</td>
</tr>
</tbody>
</table>

GG = Green gram, BG = Black gram, HG = Horse gram
* Multiple responses Vegetables = (Tomato, Chilli, Cabbage, Cucurbits, Brinjal, Bendi and leafy vegetables)

Conclusion

On the basis above findings, we can conclude that the practices followed by the most of the ZBNF farmers were pure ZBNF practices like application of ZBNF bio-solutions and also practicing IPM practices like traps, intercropping and sowing boarder crops for effective crop protection and some ZBNF farmers were practicing ZBNF practices along with organic farming practices like application of FYM and NADEP compost. However the ZBNF farmers were eliminated the usage of agro-chemicals like insecticides, pesticides and fungicides from their regular farming practices. The fact that complete dependence on pure ZBNF practices leads to relatively low yields in initial years in ZBNF comparison to Non-ZBNF farmers though quality is high. To compensate the loss with relatively low yields in initial years farmers were using RYSS mediated ZBNF especially taking plant protection measures to enhance yield and income.

Farmers were inclined to use RYSS mediated Zero Budget Natural Farming namely APCNF.

References