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Zero Budget Natural Farming (ZBNF) in Vizianagaram District of Andhra Pradesh– A Critical Study

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ABSTRACT

"Zero Budget" means the cost of cultivation can be minimized using completely on-farm resources and utterly avoiding the usage of off-farm resources like purchased seeds, chemical pesticides, fungicides, and other agrochemical inputs. "Natural Farming" means farming with nature avoiding all chemical inputs in agriculture. The study was conducted in the Vizianagaram district of Andhra Pradesh to study the knowledge and adoption status of ZBNF as well as the Impact of ZBNF on farmers. An ex-post facto research design was adopted for the investigation. The results of the study revealed that the Majority of the ZBNF farmers (52.5%) had medium knowledge of ZBNF practices. Education, farm size, annual income, livestock possession, extension contact, training has undergone, Input acquisition source and risk orientation of ZBNF farmers showed positive and significant influence on knowledge whereas, family size and farming experience showed positive and significant influence on knowledge of ZBNF farmers.The majority of the ZBNF farmers showed medium adoption (62.5%) of ZBNF practices. Annual income, livestock possession, extension contact, training has undergone, input acquisition source and risk orientation of ZBNF farmers showed positive and significant influence on the adoption of ZBNF practices. Education and family size positively and non-significantly influenced the adoption whereas, farm size showed a negative and significant influence on the adoption of ZBNF practices by farmers. The majority of the ZBNF farmers had a medium impact (56.3%) and 27.3% of ZBNF farmers had a high impact (27.5%). Whereas, most of the Non-ZBNF farmers had a medium impact (46.7%) followed by low (36.6%). Education, farm size, annual income, livestock possession, extension contact, training has undergone, input acquisition source, and risk orientation of ZBNF farmers showed positive and significant associations with impact.

Keywords: *Adoption, Andhra Pradesh, Impact, Knowledge, Natural Farming, Zero Budget Natural Farming, ZBNF.*

INTRODUCTION

The impact of the use of chemical inputs in agriculture has become evident in the recent past, with the soils getting sick, waters getting polluted, production costs shooting high and the farmers being pushed into the trap of debt. Zero Budget Natural Farming, as the name suggests, without using credit for the purchase of inputs has become one of the best alternatives in these times of high input costs and volatile markets. Few practices under natural farming such as crop rotation, diversification, mulching, natural manures, and pesticides would suffice or displace the use of chemical inputs. Zero Budget Natural Farming by cutting down the purchase of off-farm chemical inputs would play a pivotal role in the success of doubling farmers' income.

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Decreasing drift in crop yield growth has been observed due to injudicious/overuse of inputs like synthetic fertilizers and pesticides [8]. There may be community-level preparation or small business opportunities at the village level are already emerging for these products [10]. Natural farming is not a technique but a view, or a way of seeing ourselves as a part of nature, rather than separate from or above it [17]. The ZBNF method is meant to reduce input costs by eliminating the need for expensive fertilizers and pesticides, and also protect soil health and conserve water resources [22]. Liquid manures like Jeevamrutha and Panchagavya along with organic and inorganic sources contributed for increased plant height [11]. Performance of ZBNF systems in more arid regions. ZBNF is the only system featured in this research that uses mulching, which can regulate soil temperature and moisture to improve crop yield [18]. The system of ZBNF is eminently suited to farmers particularly small and marginal farmers because of its simplicity, adaptability, and drastic cut in the cost of cultivation of crops. The appeal to the farming community lies in the fact that maintaining optimum levels of production and keeping the cost of cultivation to the bare minimum will substantially enlarge the profit margin [12]. ZBNF should initially be encouraged on only low-income farms, where lower inputs of nitrogen to crops can more easily be maintained [13]. According

to the present situation, the only solution is ZBNF has undoubtedly made an indelible mark on farming in India that resonates with principles of agroecology and addresses the concerns of the twin dimensions of the risk [14]. A new system of zero-budget natural farming has freed the farmers from the debt trap and it has instilled in them a renewed sense of confidence to make farming an economically viable venture [15]. The benefit-cost ratio of the ZBNF method was 1.67 which was greater than the ratio of the conventional method. Hence, zero-budget farming is profitable [16]. The possibility of scaling up ZBNF or other agroecological approaches through a similar program at the national level, our analysis of the enabling [19]. Several states throughout India have witnessed widespread adoption of ZBNF, either as a grassroots movement as in Karnataka, Kerala, and Tamil Nadu or as state-sponsored programs as in Andhra Pradesh and Himachal Pradesh, since 2016 and 2018, respective environment is especially relevant [20]. Given that the agricultural land area in Andhra Pradesh is 80 times larger than that of Sikkim [21].

MATERIALS AND METHODS

The study was conducted in the 2020–21 academic year as a PG research in Professor Jayashankar Telangana State Agricultural University (PJTSAU), Hyderabad. The detailed procedure followed to conduct the study has described below.

2.1. Research design

An ex-post facto research design was adopted for the investigation. This design was considered appropriate, as the phenomena in the study were already occurred.

2.2. Sampling Procedure

2.2.1. Locale of the Study

The state of Andhra Pradesh was chosen for the study purposively as the researcher hails from the same state and based on its prime position in the country in Zero Budget Natural Farming. About 5,80,000 farmers are practicing ZBNF in 2,60,000 ha in 3011 villages throughout Andhra Pradesh. As the researcher also hails from the same state and is familiar with the local language and culture this would help to build a good rapport with the farmers during data collection.

2.2.2. Selection of the District

Vizianagaram district was selected purposively, as it was the prime district having ZBNF with the highest area i.e., 38,000 ha, and about to get saturation with this farming.

2.2.3. Selection of the Mandals

Four mandalsviz, Gumma Lakshmi Puram (G.L. Puram), Vepada, Kurupam, and Garugubilli were selected purposively based on a greater number of ZBNF practicing farmers.

2.2.4. Selection of Villages

Two villages from each Mandal, making a total of 8 villages from 4mandals (2×4=8) were selected by using a random sampling technique. The details of selected villages were furnished in Figure 1

2.2.5. Selection of the Respondents

The sample includes a total of 140 respondents comprising 80 ZBNF farmers and 60 Non-ZBNF farmers. The 80 ZBNF farmers (10 from each village) and 60 Non-ZBNF farmers were selected randomly from the 4mandals. The ZBNF farmers included the farmers practicing pure ZBNF practices and RYSS-mediated ZBNF practices.

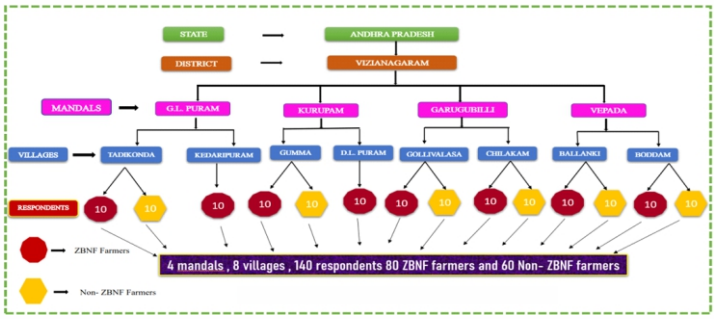

Figure 1: Sampling procedure followed in the study

2.3. Variables and their empirical measurement

The variables under study were selected based on an extensive review of the literature and in consultation with experts.

2.3.1. Independent Variables

Education, family size, farm size, annual income, livestock possession, farming experience, extension contact, training has undergone, Input acquisition source and risk orientation of ZBNF and Non-ZBNF farmers were selected as independent variables for the study.

2.3.2. Dependent Variables

Knowledge, adoption, and impact were selected as dependent variables for the study.

2.4. Operational Definitions

2.4.1. Knowledge

Knowledge was operationally defined as "believes and specific information on practices related to ZBNF and its practices known to the respondent." It was measured by using a schedule developed for the study. The schedule constructed consisted of questions on the recommended package of practices of ZBNF for paddy and cotton crops developed with experts' consultation.

2.4.2. Adoption

Adoption is a decision to continue the full use of an innovation. It was operationalized as the extent of ZBNF practices adopted by the respondents. A schedule was developed with 16 statements each for paddy and cotton crops under ZBNF. It was measured on a 3-point continuum viz, full adoption, partial adoption, and non-adoption with scores of3, 2, and 1 respectively.

2.4.3. Impact

It was operationalized as the influence of various ZBNF practices on the attainment of improved quality of human life by sequentially improving crop intensity, decrease in pests and diseases, improvement in soil health, improvement in quality of products, increase in yield and annual income leading to improvement in human health in comparison to Non-ZBNF.

2.5. Collection of Data

A structured interview schedule was developed for the investigation. The data collected through the schedule was analyzed and computed by applying suitable statistical tools like Arithmetic Mean, Class Interval, Standard Deviation, Frequency and Percentage, and Coefficient of Correlation (r).

3. RESULTS AND DISCUSSION

2.1. Knowledge

3.1.1. Knowledge of respondents on ZBNF practices

The results on knowledge of ZBNF farmers regarding ZBNF practices presented in table 1 and Figure2 show that more than half of the ZBNF farmers (52.50%) had medium knowledge on ZBNF practices. 28.75% and 18.75% of ZBNF farmers had low and high knowledge of ZBNF practices respectively.

Table 1: Distribution of ZBNF farmers based on their knowledge on ZBNF practices (N=80)

S.No.	Category	Class interval	F	%
1	Low knowledge	10–14	23	28.75
2	Medium knowledge	14–18	42	52.50
3	High knowledge	18–22	15	18.75
	Total		80	100.0

It could be inferred from the above results that most of the ZBNF farmers had medium knowledge of ZBNF practices. Probably medium extension contacts with low risk-orientation and exposure to less to medium training might be the reason for the above result. The demonstrations conducted by cluster resource persons, internal cluster resource persons, and impacted the knowledge of ZBNF farmers. Farmers who attended 10 days of Palekar training once or thrice, gained knowledge through fellow farmers and mass media channels and enhanced their knowledge of ZBNF practices. The results were on par with the results of Jaganathan et al. [5], Rajashekar et al. [6], and Girawale and Naik [4].

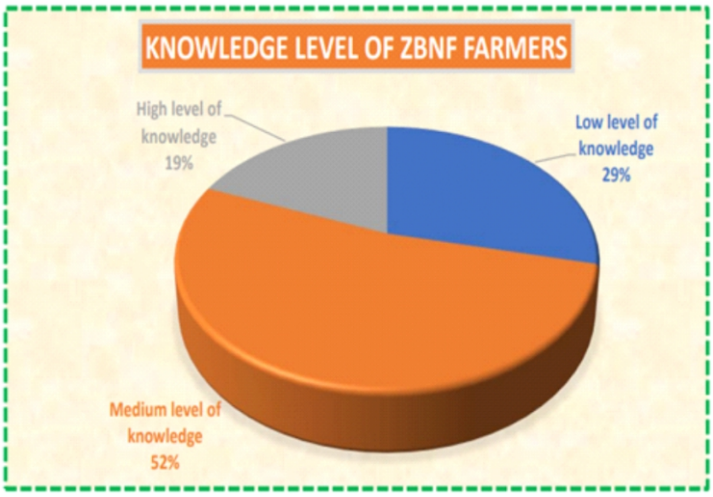

Figure 2: Distribution of ZBNF farmers based on their knowledge on ZBNF practices.

3.1.2. Influence of Profile Characteristics of Respondents on Knowledge of ZBNF Practices

To study the relationship between the profile characteristics of the respondents and their knowledge of ZBNF practices, the correlation coefficient values (r) were presented in Table 2

Null hypothesis: Profile characteristics of the respondents are not significantly associated with the knowledge of the respondents on ZBNF practices.

Empirical Hypothesis: Profile characteristics of the respondents are significantly associated with the knowledge of the respondents on ZBNF practices.

Table 2: Distribution of respondents based on their relationship between selected profile characteristics with knowledge level about ZBNF practices. (N = 80)

Sl.No.	Variable No.	Characteristics	Correlationcoefficient(r)
1	X_1	Education	0.287**
2.	X_2	Family size	0.019^{NS}
3.	X_3	Farm size	0.243*
4.	X_4	Annual income	0.341**
5.	X_5	Livestock possession	0.262*
6.	X_6	Farming experience	0.060^{NS}
7.	X_7	Extension contact	0.431**
8.	X_8	Trainings undergone	0.283*
9.	X_9	Input acquisition pattern	0.305**
10.	X_{10}	Risk orientation	0.293**

**Significant at 0.05 level of probability*
***Significant at 0.01 level of probability*
NS –Non-Significant

3.1.2.1. Knowledge Vs Education

There was a positive and highly significant association (r=0.287) between education and knowledge (table 2) stating that an increase in the educational level of ZBNF farmers led to increasing their knowledge and vice versa. Hence, the null hypothesis was rejected and the empirical hypothesis was accepted. It could be concluded that education played an important role in enhancing the knowledge of farmers on ZBNF practices. The farmers who had high education could able to read, understand and follow the content in the literature related to ZBNF including online articles compared to the farmers with high school and intermediate education.

3.1.2.2. Knowledge Vs Family size

From Table 2, it could be inferred that there was no significant association (r=0.019NS) between family size and knowledge. This showed that there was no influence of family size on the knowledge of the ZBNF farmers. Therefore, the null hypothesis was accepted and the empirical hypothesis was rejected. The family size has no association with increasing or decreasing the knowledge of ZBNF farmers.

3.1.2.3. Knowledge Vs Farm size

It could be evident from table 2, the knowledge had positive and significantly associated (r=0.243) with the farm size. Hence, rejected the null hypothesis and accepted the empirical hypothesis. It was found that the size of the farm influences the knowledge level of farmers on ZBNF practices. The possible reason might be bigger farm size allowed the farmers to try new farming practices like ZBNF, which helped them to gain more knowledge on ZBNF farming practices.

3.1.2.4. Knowledge Vs Annual income

From table 2, it could be inferred that the correlation coefficient, r value 0.341 shows a positive and significant relationship between knowledge and annual income. Hence, the null hypothesis was rejected and the empirical hypothesis was accepted. If the annual income of the ZBNF farmers increases, farmers' knowledge also increases. An annual income of the farmers positively influences the knowledge of ZBNF farmers. High annual income, evoked the farmers to purchase, newspapers, radio, TV, literature, and the internet to 96 access information and technologies that could enhance their knowledge on ZBNF practices.

3.1.2.5. Knowledge Vs Annual income

From the table 2, it could be inferred that the correlation coefficient, r value 0.341 shows a positive and significant relationship between knowledge and annual income. Hence, the null hypothesis was rejected and the empirical hypothesis was accepted. If the annual income of the ZBNF farmers increases, farmers' knowledge also increases. The annual income of the farmers positively influences the knowledge of ZBNF farmers. High annual income, evoked the farmers to purchase, newspapers, radio, TV, literature, and the internet to 96 access information and technologies that could enhance their knowledge of ZBNF practices. Knowledge Vs Farming experience

The correlation coefficient, r value 0.060, depicted a positive and non-significant association between farming experience and knowledge of ZBNF farming practices (Table 2). The null hypothesis was accepted and the empirical hypothesis was rejected. The farming experience had no direct influence on the knowledge of farmers on ZBNF practices. This might be due to most of the ZBNF farmers being young, having medium to low farming experience and showing high interest towards the ZBNF farming practices leading to an increase in farmers' knowledge.

3.1.2.6. Knowledge Vs Extension contact

From table 2, it was inferred that the correlation coefficient r value was 0.431 showed a positive and significant influence of extension contact on knowledge with the rejection of null hypothesis and acceptance of the empirical hypothesis. The farmers with high extension contact increased their knowledge. The CRPs and ICRPs the ZBNF extension workers always make available themselves within the villages with whom villagers met frequently and discussed their problems to gain sound knowledge on ZBNF practices.

3.1.2.7. Knowledge Vs Training undergone

It could be revealed from the table 2, that the correlation coefficient, r value was 0.283 showing the positive and significant influence of training on the knowledge of the farmers. Hence, the null hypothesis was rejected and the empirical hypothesis was accepted. Farmers who attended more training programs on ZBNF, had high knowledge on 97 ZBNF farming practices. The farmers in the study attended minimum of two training programs on ZBNF, resulting in acquiring enough knowledge on ZBNF practices.

3.1.2.8. Knowledge Vs Input acquisition source

It was observed from the table 2, that the correlation coefficient, r value was 0.305, which showed that there was a positive and significant influence of Input acquisition source on the knowledge of the farmers. Hence, the null hypothesis was rejected and the empirical hypothesis was accepted. The possible reason for the above result might be that the inputs in ZBNF were prepared by the farmers by themselves and applied to the fields. Hence, farmers had sufficient knowledge on the preparation and application of kasha yams as well as other ZBNF practices.

3.1.2.9. Knowledge Vs Risk Orientation

It could be inferred from the Table 2, that the correlation coefficient, r value was 0.293 representing that there was a positive and significant influence of risk orientation of ZBNF farmers on knowledge of the ZBNF practices. Hence, the null hypothesis was rejected and the empirical hypothesis was accepted. The probable reason for this might be farmer had to take risk in new farming practices like ZBNF and try to develop knowledge on ZBNF practices by collecting information from friends, newspapers, extension agents, opinion leaders, radio, T.V., and the internet etc. Adoption

3.1.1. Adoption of ZBNF practices by the respondents

The results on the adoption of ZBNF farmers regarding ZBNF practices presented in table 3 and Figure 3 clearly depict that 62.50% of farmers had medium adoption and 21.25% of farmers had high adoption. Only 16.25% of farmers had low adoption of ZBNF practices.

Table 3: istribution of ZBNF farmers based on their adoption of ZBNF practices. (N=80)

S. No.	Category	Class interval	F	%
1	Low adoption	19–27	13	16.25
2	Medium adoption	27–35	50	62.50
3	High adoption	35–43	17	21.25
	Total		80	100.0

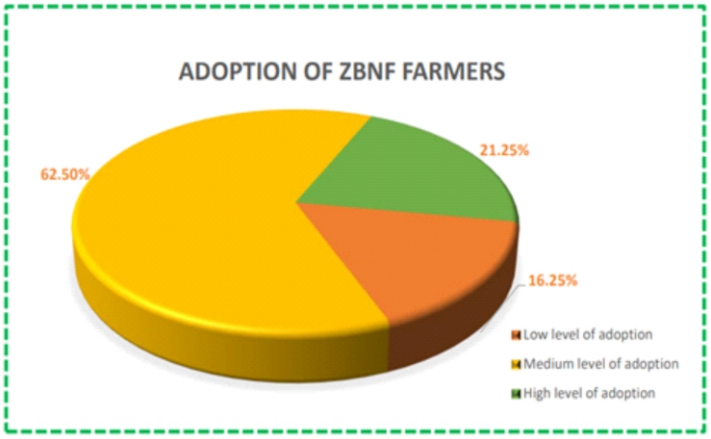

Figure 3.2 Distribution of ZBNF farmers based on their adoption of ZBNF practices

From the above results, it could be inferred that the medium adoption of ZBNF practices was due to their medium knowledge, medium extension contact, and medium possession of livestock especially cows providing dung and urine as the basic raw materials in preparation of any ZBNF bio-formulations, low to medium training in ZBNF and their medium to high risk-orientation behavior. The results were on par with the results of Salunkhe and Chouhan [7].

3.1.4 Influence of Profile Characteristics of Respondents on Adoption of ZBNF Practices

Null hypothesis: Profile characteristics of the respondents are not significantly associated with the adoption of ZBNF practices. Empirical Hypothesis: Profile characteristics of the respondents are significantly associated with the adoption of ZBNF practices

Table 4: Relationship between independent variables and extent of adoption of ZBNF practices by the farmers

Sl. No.	Variable No.	Characteristics	Correlationcoefficient(r)
1	X_1	Education	0.20^{NS}
2.	X_2	Family size	0.061^{NS}
3.	X_3	Farm size	-0.248^{*}
4.	X_4	Annual income	0.301^{**}
5.	X_5	Livestock possession	0.308^{**}
6.	X_6	Farming experience	0.195^{NS}
7.	X_7	Extension contact	0.240^{*}
8.	X_8	Trainings undergone	0.344^{**}
9.	X_9	Input acquisition pattern	0.394^{**}
10.	X_{10}	Risk orientation	0.352^{**}

** Significant at 0.05 level of probability*
*** Significant at 0.01 level of probability*
NS –Non Significant

3.1.4.1. Adoption Vs Education

It could be revealed from the table 4, that the correlation coefficient r value was 0.20 which represents a positive and non-significant association of ZBNF farmer's education and their adoption of ZBNF practices. It means education had a positive and nonsignificant influence on adoption hence, the null hypothesis was accepted and the empirical hypothesis was rejected. The probable reason might be the farmers with less education or illiteracy, also adopted the ZBNF practices realizing the benefits from fellow farmers who adopted the ZBNF.

3.1.4.2. Adoption Vs Family size

The coefficient r value 0.061 represented a positive and non-significant association of the family size of the ZBNF farmers with the adoption of the ZBNF practices (table 4). It means the family size had a positive and non-significant influence on adoption. Hence, the null hypothesis was accepted and the empirical hypothesis was rejected. This could be due to the majority of the farmers having small and medium size families having high interest in ZBNF practices for adoption.

3.1.4.3. Adoption Vs Farm size

The table 4 inferred that the coefficient r value was -0.248, which represented a negative and significant association of farm size of the ZBNF farmers with the adoption. The farm size of the ZBNF farmers had a negative and significant influence on the adoption of the ZBNF practices. Therefore, the null hypothesis was rejected and the empirical hypothesis was accepted. The probable reason for the above result might be due to the majority of the ZBNF farmers being small and marginal suffering the high cost of cultivation in conventional farming and realized the cost-effectiveness of ZBNF practices. Besides, farmers also realized ease in the application of ZBNF practices in small holdings with more net returns. Hence, most of the small and marginal farmers showed interest in adoption of ZBNF practices.

3.1.4.4. Adoption Vs Annual income

From the table 4, it could be observed that the coefficient r value was 0.301, which represented a positive and significant association of annual income with the adoption. The annual income of the ZBNF farmers had a positive and significant influence on the adoption of ZBNF practices. Hence, the null hypothesis was rejected and the alternate hypothesis was accepted. The possible reason might be the farmers with high annual income could access T.V., radio, internet, and literature related to ZBNF besides attending various workshops and exhibitions, which inspired them to adopt the ZBNF practices.

3.1.4.5. Adoption Vs Livestock possession

It could be revealed from the table 4, that the correlation coefficient r value was 0.308, which represented a positive and significant association of livestock with adoption. The livestock possession by the farmers had a positive and significant influence on the adoption of ZBNF practice. Hence, the null hypothesis was rejected and the alternate hypothesis was accepted. Most of the farmers possessed livestock, especially cows which supplied the dung and urine required in all ZBNF bio-solutions preparation viz. effective usage of on-farm resources and elimination of off-farm resources to decrease the cost of cultivation. Hence, most of the farmers adopted the ZBNF.

3.1.4.6. Adoption Vs Farming experience

A perusal of table 4, revealed that the correlation coefficient r value was 0.195, which represented a positive and non-significant association between farming experience and adoption. The farming experience of the farmer had a positive and significant influence on the adoption of ZBNF practices. Therefore, the null hypothesis was accepted and the empirical hypothesis was rejected. These results might be due to most of the young to middle-aged farmers had low farming experience and showing interest in the innovative farming methods like ZBNF practices instead of regular conventional methods of farming. Hence, the adoption of ZBNF practices was high among the farmers with medium to low farming experience.

3.1.4.7. Adoption Vs Extension contact

The table 4, depicts that the correlation coefficient r value was 0.240, which showed that there was a positive and significant association of farmers' extension contact with adoption. The extension contacts of the farmers had a positive and significant influence on the adoption of the ZBNF practices. Hence, the null hypothesis was rejected and the alternate hypothesis was accepted. The possible reasons for this result might be that the farmers who had high extension contact with the agricultural extension officers and ZBNF CRP'S and ICRP's obtained first-hand information by attending demonstrations and field days and were convinced to adopt ZBNF practices.

3.1.4.8. Adoption Vs Training undergone

From the table, 4, it could be observed that the correlation coefficient r value was 0.344, which represented a positive and significant association of training with the adoption. The training undergone by the farmers had a positive and significant influence on the adoption of ZBNF practices. Hence, the null hypothesis was rejected and the alternate hypothesis was accepted. The probable reasons might be due to the fact that farmers who had undergone training programs related to ZBNF realized the benefits of gaining sufficient knowledge on ZBNF practices and skills on the preparation of ZBNF inputs leading to adopt in ZBNF practices in their farms.

3.1.4.9. Adoption Vs Input acquisition source

The correlation coefficient r value was 0.394, which inferred a positive and significant association between Input acquisition source and adoption (table 4). The Input acquisition source of the farmers had a positive and significant influence on the adoption of ZBNF practices. Therefore, the null hypothesis was rejected and the alternate hypothesis was accepted. All the

ZBNF inputs were available within the farm or within the village at low or free of cost to the farmers, they adopted the ZBNF.

3.1.4.10. Adoption Vs Risk Orientation

From the table 4, it could be observed that the correlation coefficient r value was 0.352 which represented a positive and significant association of risk orientation of farmers with adoption. The risk orientation of the farmers had a positive and significant influence on the adoption of ZBNF practices. Hence, the null hypothesis was rejected and the alternate hypothesis was accepted. These results might be due to the fact that ZBNF farmers had medium to high-risk orientation behavior leading to taking a calculated risk to adopt ZBNF practices.

3.2. Impact

3.2.1. Impact of ZBNF Practices on ZBNF Respondents in Comparison to non-ZBNF Respondents

The results on the impact of ZBNF on farmers were presented in table 5 and Figure4 The results indicated that more than half of the ZBNF farmers had a medium impact (56.25%) followed by high impact (27.50%). Only 16.25% of ZBNF farmers had a low impact. Whereas, most of the Non-ZBNF farmers had a medium impact (46.67%) followed by low (36.67%) and high (16.67%) impact.

Table 5: Distribution of farmers based on impact of ZBNF (N = 140)

S. No.	Category	Class interval		ZBNF (n=80)		NON-ZBNF (n=60)	
		ZBNF	Non -ZBNF	F	%	F	%
1	Low Impact	18 – 27	15 – 22	13	16.25	22	36.67
2	Medium Impact	27 – 36	22 – 29	45	56.25	28	46.67
3	High Impact	36 – 45	29 – 36	22	27.5	10	16.67
	Total			80	100	60	100

Most of the ZBNF farmers had medium to high impact as their income was raised from other enterprises in their farm (e.g.: dairy and poultry etc.). Reduced drudgery in farming led them to do other work in villages that generated more income, increased cropping intensity, and improved their health due to the consumption of chemical-free food. Most of the Non-ZBNF farmers had medium to low impact, it might be due to an increase in the cost of cultivation with external inputs and a decrease in net returns that increased their dependency on credit.

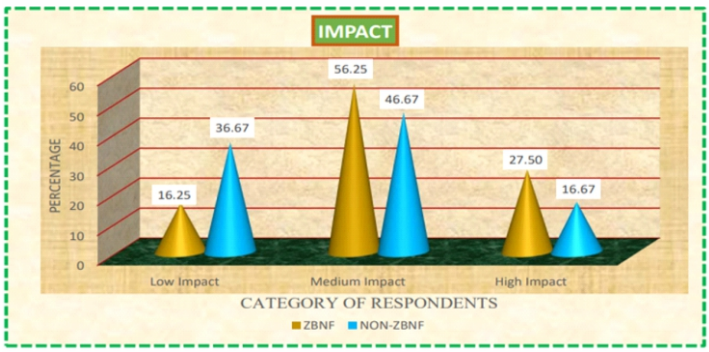

Figure 4: Distribution of farmers based on impact of ZBNF

3.2.2. Influence of Profile Characteristics of Respondents on the Impact of ZBNF Farmers Compared to Non-ZBNF Farmers

Null hypothesis: Profile characteristics of the respondents are not significantly associated with the impact of ZBNF practices.
Empirical Hypothesis: Profile characteristics of the respondents are significantly associated with the impact of ZBNF practices.

Table 6: Relationship between independent variables and impact of ZBNF on the farmers (N = 140)

Sl. No.	Variable No.	Characteristics	Correlationcoefficient(r)	
			ZBNF (n=80)	Non-ZBNF (n=60)
1	X_1	Education	0.397**	0.258*
2	X_2	Family size	-0.271*	0.029^{NS}
3	X_3	Farm size	0.441**	0.296*
4	X_4	Annual income	0.486**	0.280*
5	X_5	Livestock possession	0.421**	0.186^{NS}
6	X_6	Farming experience	-0.261**	0.086^{NS}
7	X_7	Extension contact	0.527**	0.255*
8	X_8	Trainings undergone	0.358**	0.121^{NS}
9	X_9	Input acquisition pattern	0.606**	0.098^{NS}
10	X_{10}	Risk orientation	0.253*	0.186^{NS}

** Significant at 0.05 level of probability*
*** Significant at 0.01 level of probability*
NS –Non Significant

3.2.2.1. Impact Vs Education

It was revealed from the table 6 that the correlation coefficient r values for ZBNF was 0.397 and Non-ZBNF was 0.258 showing the positive and significant association with impact. Education had a positive and significant influence on the impact of both ZBNF and Non-ZBNF farmers. Hence, the null hypothesis was rejected and the alternate hypothesis was accepted. The reasons for the above results might be the farmers with high education led them to acquire more knowledge on new practices and technologies in agriculture that increased their farm income and farm sustainability too.

3.2.2.2. Impact Vs Family size

From the table 6, it was observed that the family size of ZBNF farmers (r=-0.271) was negative and significant whereas, positively significant in the case of ZBNF farmers (r=0.029). The size of the family negatively and significantly influenced 103 the impact of ZBNF farmers i.e. smaller the family size, the higher the impact. This was due to less family size, less expenditure, and increased savings for the farmers. Hence, the null hypothesis was rejected and the empirical hypothesis was accepted. For Non-ZBNF farmers, the family size positively and non-significantly influenced the socio-economic conditions of the farmers. Hence, the null hypothesis was rejected and the empirical hypothesis was accepted.

3.2.2.3. Impact Vs Farm size

It was inferred from table 6 that the correlation coefficient r values were 0.441 for ZBNF and 0.296 for Non-ZBNF showing positive and significant association with impact on both ZBNF as well as Non-ZBNF farmers. The farm size showed a positive and significant influence on impact. Hence, the null hypothesis was rejected and the alternate hypothesis was accepted. The probable reason behind these results might be that farmers with large size of land holdings, and knowledge of various market channels had better income, and the capacity to try cost-effective and new innovative farming methods increased their income and living standards.

3.2.2.4. Impact Vs Annual income

From the table 6, it could be clear that the correlation coefficient r values (0.486 for ZBNF and 0.280 for Non-ZBNF farmers) showed a positive and significant association on impact for both ZBNF and Non-ZBNF farmers. The annual income had positively and significantly influenced the impact on socioeconomic and living standards of the respondents. Hence, the null hypothesis was accepted and the empirical hypothesis was rejected. The possible reasons might be due to an increase in annual income raising socio-economic, health, and living standards of the farmers.

3.2.2.5. Impact Vs Annual income

From the table 6, it could be clear that the correlation coefficient r values (0.486 for ZBNF and 0.280 for Non-ZBNF farmers) showed a positive and significant association on impact for both ZBNF and Non-ZBNF farmers. The annual income had positively and significantly influenced the impact on socioeconomic and living standards of the respondents. Hence, the null hypothesis was accepted and the empirical hypothesis was rejected. The possible reasons might be due to an increase in annual income raising socio-economic, health, and living standards of the farmers.

3.2.2.6. Impact Vs Livestock possession

It could be observed from the table 6, the correlation coefficient r values of livestock possession by the farmers were 0.421 for ZBNF and 0.186 for Non-ZBNF farmers representing that livestock possession had a positive and significant association with the impact on ZBNF farmers. Hence, the null hypothesis was rejected and the empirical hypothesis was accepted. Whereas, positive and non-significant association with Non - ZBNF farmers was observed. Hence, the null hypothesis was accepted and the empirical hypothesis was rejected). The above results were due to the use of main inputs of ZBNF like cow urine and dung which improved the soil health status and the kasha yams prepared by using these inputs to control pests and diseases. The livestock also provided subsidiary income to the farmers. Whereas, Non-ZBNF farmers didn't use cow dung-based inputs, adopting chemical-based inputs which increased the cost of cultivation.

3.2.2.7. Impact Vs Farming experience

From the table 6, it could be inferred that the correlation coefficient r values of farming experience were -0.261 for ZBNF farmers, and 0.086 for Non-ZBNF farmers, which showed that farming experience had a negative and significant influence on the impact of ZBNF farmers (the null hypothesis was rejected and empirical hypothesis was accepted) and positive and non-significant association with the impact of Non-ZBNF farmers. Hence, the null hypothesis was accepted and the empirical hypothesis was rejected. The probable reasons might be most of the ZBNF farmers were young and middle-aged having less farming experience and high awareness and knowledge on new farming techniques and practices adopting those new cost-effective, eco-friendly practices like ZBNF practices to improve soil health, human health, and obtained good net returns per acre. Whereas, most of the Non-ZBNF farmers were preferring conventional farming methods showing resistance towards new farming practices.

3.2.2.8. Impact Vs Extension contact

It could be clear from the table 6, that the correlation coefficient, r values (0.527 for ZBNF and 0.255 for Non-ZBNF) represented that farmers' extension contact had a positive and significant influence on the impact on both ZBNF and Non-ZBNF farmers. Hence, the null hypothesis was accepted and the empirical hypothesis was rejected. The reasons might be the majority of the farmers with high extension contact got benefited by timely extension services, regular information (market-related, weather forecast, and information related to crop management practices) and clarification of doubts related to agriculture, which in turn increased their crop productivity and returns.

3.2.2.9. Impact Vs Input acquisition source

From the table 6, it could be inferred that the correlation coefficient r values 0.606 for ZBNF and 0.098NS for Non-ZBNF farmers conveyed that the Input acquisition source had a positive and significant influence on the impact of ZBNF farmers (The null hypothesis was rejected and the empirical hypothesis was accepted). Whereas, positive and nonsignificant influences with the impact on Non-ZBNF farmers (Null hypothesis was accepted and empirical hypothesis was rejected). The possible reasons might be most of the ZBNF inputs were easily available within farm and villages free of cost and decreased the dependency of farmers on costly off-farm resources reflecting increased net returns to the ZBNF farmers with sustained use of resources. Whereas, Non-ZBNF inputs were costly and these chemical-based inputs spoiled both soil and human health disrupting the ecological balance.

3.2.2.10. Impact Vs Risk orientation

It could be observed from the Table 6, the correlation coefficient, r values of risk orientation 0.253 for ZBNF and 0.186NS for Non-ZBNF farmers reflects that the risk orientation was positive and significant with the impact on ZBNF farmers (Null hypothesis was rejected and empirical hypothesis was accepted). Whereas, positive and 106 non-significant on Non-ZBNF farmers (Null hypothesis was accepted and empirical hypothesis was rejected). The possible reasons for the above results might be the farmers with high riskorientation and interest to try new practices like ZBNF led to increased farm income, improvement in soil and human health by consuming chemical free food, thereby, increasing their standard of living.

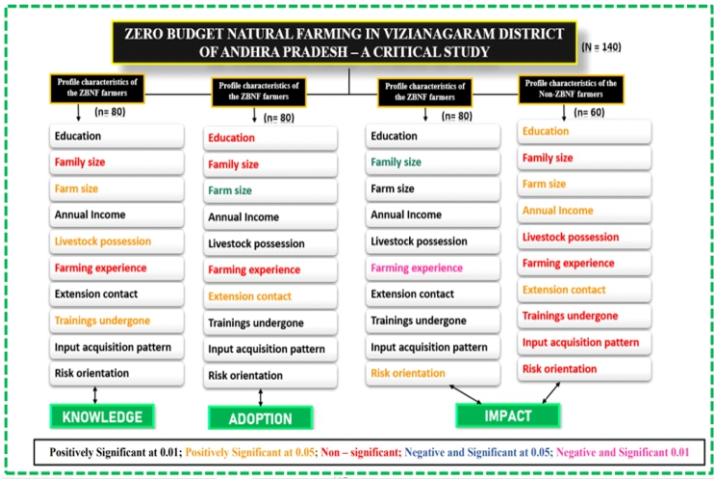

Figure 5: Empirical model of the study

4. Conclusion

The ZBNF farmers eliminated the usage of agrochemicals 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 even though the quality is enhanced. To compensate the loss with relatively low yields in the 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.

5. Future Scope of the Study

The study would throw light on the relationship as well as direct and indirect effect of profile characteristics associated with the level of knowledge and extent of adoption. The findings of the study would help to understand the factors, which are contributing to large scale adoption of the ZBNF in Andhra Pradesh, which would help the planners, policy makers, scientists and administrators to direct the farmers to adopt ZBNF. Further, an appropriate strategy formulated would be useful for the successful implementation of the ZBNF in Telangana state also.

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7. Data Availability Statement

Legal restrictions are imposed on the public sharing of raw data. However, authors have full right to transfer or share the data in raw form upon request subject to either meeting the conditions of the original consent and the original research study. Further, access of data needs to meet whether the user complies with the ethical and legal obligations as data controllers to allow for secondary use of the data outside of the original study.

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9. Conflict of interests

The authors have declared no conflict of interest exist.

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