

Scientific Validation of Zero Budget Natural Farming (ZBNF)



**Dr.Aasha Kampurath
Project Director , ATMA Wayanad
2018**

Acknowledgements

I express my deep and sincere gratitude to the following persons for the support, assistance and participation in this project. Directors Sri Ajith Kumar and Sri. Sunil kumar, Department of Agriculture for providing funds under researchable issues. Dr Rajasekharan ,Dr.Peethambaran, Dr.Bhaskaran, Dr.Nalinakumari, and others who were in the Project Proposal Evaluation Committee for sanctioning this project. Project Directors Smt.Lakshmi and Sri Prasad for the support given to undertake the project work. Dr. Smitha KP Senior Scientist MSSRF , for providing the material for review of literature. Dr Anil Zacharia ,Animal Husbandry Department, Deputy Project Director ATMA for providing insights and support during the formulation and implementation of this project. Dr Anilkumar Agricultural officer for the meaningful suggestions given at various stages. Ms Salini ,DTM Atma Plus at HQ who assisted me earnestly during the entire project period. My colleagues (LEADS FAs) Surya, Jisha, Jinesh, Babeesh,Deepthi, Subin and Sreeja for all the whole hearted involvement in the field work, records and observations at the concerned farmers plots. Ms Sasitha, Computer Operator ATMA at HQ for her sincere help in documentation regarding settlement of funds. ZBNF farmers association Wayanad who prompted me to undertake this Project.

**Dr.Aasha Kampurath ,
Project Director ,
ATMA Wayanad
18 February 2018**

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Introduction

Present scenario in Kerala presents a greater shift to non chemical farming due to an explosion of awareness among public about pesticide residues in food crops. The Government has rightly chosen to stand on sides, farmers and consumers as well by supporting production of safe to eat food. Going organic is gaining momentum with every passing hour. This project was undertaken in this context.

ZeroBudget Natural farming(ZBNF) is a farming method propounded by Padmashree Subhash Palekar of Maharashtra which is being practiced by farmers from all over the country. Andhra Pradesh has taken it as Government Policy to spread the practice. This is based on cow based farming (anciently called Go-Aadharita Krishi).Formulations using Cow dung, Cow Urine , Pulses flour , Jaggery and virgin soil are used here which increases the microbial content in the soil and improves soil health.

This Research Project was undertaken during the year 2015-2016 and 2016-2017 under the scheme Researchable Issues through Research Institutes & Department of Agriculture. In Wayanad there are farmers practicing organic farming in different methods. Some of them cultivate under the Zero Budget Natural Farming methods and they have formed a group called ZBNF farmers Association in the District. As part of their request to undertake feasibility studies of this technique this project was formulated in such a way to involve few of them .Hence this was done in a participatory mode in different Agroecological zones of Wayanad.

Objectives of the study

- To scientifically validate the process of Zero Budget Natural Farming Methods
- Comparison with Organic and Chemical Farming Methods
- To assess the impact of different farming methods on Soil Health
- To test the Quality of Produce through different farming methods
- To assess the productivity and Economic viability

Zero – Budget farming – An overview

Several books and videos are available on internet resources on the concept of Zero – Budget farming, an agriculture practice propounded by Padmashree Subhash Palekar of Maharashtra Padmashree . Using the cow dung and urine of Desi (indigenous)cow along with Jaggery ,pulse flour and Virgin soil he advocates the preparation of *Beejamrutham* and *Jeevamrutham* for field application. Mulching and Inter cropping are essential for natural farming methods. Improving the soil health by multiplication of microbes in soil is the key to this practice. He also records the Yield from different Crops from different farmer's fields

across the state. In Kerala farmers and researchers have shown interest in this farming method. For in Palakkad district , farmers have applied this method in vegetable and rice cultivation , and output was positive. This was found highly viable in the case of vegetable cultivation and the expense for the main crop was covered by the inter crop. As for rice whatever expense incurred for labour is being covered in the high price obtained for the processed rice they market. Farmers in Wayanad too have shown positive response to the concept of Zero-Budget farming. A survey conducted among farmers of Wayanad by MSSRF show that the results are encouraging. Farmers found ZBNF as eco-friendly requiring very less expense due to less labour than conventional farming.

Materials and Methods

Two crops Chilli (Variety-Sierra) and Amaranthus (Variety-Arun) were raised in six farmers Plots under ZBNF, Organic Farming and Chemical Farming as Control. Farmers were representative of three Agroecological Zones and progressive farmers interested in experiments. All of them had local cows in their farm. Trials could be conducted only for two seasons first season of 2015-2016 and Second season of 2016-2017.

Each treatment had one cent each thereby six cents in six plots. Six replications were also given. The crop was raised in two seasons of 2015 -2016 and 2016-2017.Split plot design was chosen with the Main treatments being the ZBNF, Organic and Chemical (as control) treatments. Sub treatment were the farmers plots .Spacing adopted as per KAU POP. Chilli in Protrays and Amaranthus in nursery was raised and transplanted.

Under ZBNF seeds and seedlings were treated with Beejamrutham, in Organic with Pseudomonas and in Control(Chemical) with Bavistin. For ZBNF mulching was provided. Pest problems were addressed in ZBNF plots with Dasaparni Kashayam(preparation from 10 leaf extract and recommended by Subhash Palekar in case of need) and in organic plots biocontrol agents (Prophylactic application of Trichoderma and Pseudomonas were used in Organic Plots .Jeevamrutam sprays for ZBNF were given at two weeks interval and for organic plots sprays of fermented Oil cake solution and Cow dung slurry was given. Sprays of 19: 19: 19 at three stages of the crop was given to control plots.

Treatments

Treatment 1	ZBNF	Seed treatment of Beejamrutham & drenching and spray of Jeevamrutham, Spray of Dashaparnikashayam for P&D
Treatment 2	Organic	Spray with fermented oil cake Cow dung slurry and Biocontrol Agents
Control (Chemical)	As per POP of KAU	Bavistin seed treatment,19.19.19 spray

Observations recorded

Main parameters studied were the Physical growth in terms of height, duration and Yield. To assess the Soil health soil microbial study was conducted including Bacteria, Fungi, Actinomycetes, Nitrogen Fixers, Pseudomonas and Trichoderma. This was done in the first season at Department of Microbiology ,KAU Vellanikkara and at IISR Kozhikode for the second season. Post harvest assessment analysis of Chilli for pungency was also done at IISR.

Split plot Design was adopted with ZBNF, Organic and Chemical (Control) as main treatments and Farmers plots as six sub treatments. Analysis was done for two seasons separately for yield parameters. For Microbial count and Plant height second season results were analysed. The following parameters were studied and recorded

- Days to flowering
- Fruits per plant
- Duration of the crop
- Shelf life of the produce
- Yield Parameters
- Root growth parameters
- Plant height
- Pest & Disease occurrence
- Total economic viability based on the prevalent market price

Results and Discussion. Yield Parameters

Significant increase in Yield was noticed in two seasons for Chilli as well as Amaranthus cultivated under ZBNF treatment when compared to Control as shown in Figures 1, 2, 3 and 4 .It was also higher when compared to Organic treatments. An increased yield than control was recorded only for first season crop of Chilli. For second crop season of Chilli it was lesser than control. As for Amaranthus, Organic treatment was at par with control during the first crop and lesser in the next season.

It can be inferred that the spray of Jeevamrutam under ZBNF treatment (T1) is better than foliar sprays of NPK (19.19.19)or Oilcake/cow dung solution /slurry sprays , boosting flowering and fruiting. This is emphasised with the observation that both Chilli and Amaranthus flowered earlier and profusely in T1(ZBNF) as physically observed from the field. Amaranthus flowering earlier is not considered good as it is being used as a leafy vegetable. But Chilli being a produce always in demand earlier fruiting is preferred by the farmers.

The root growth pattern in Chilli showed more matted growth, thickness and lateral branching with more feeder roots in ZBNF treatments (Page 40, 41). In organic Chilli also profuse root growth is seen though with less feeder root. Under the Chemical treatment root growth is neither matted nor profuse but show long taproot with little or less lateral branching. Similar pattern is seen in Amaranthus as well.

Chilli plants grown under organic treatment were taller when compared to other two treatments (Fig 5 and Page 40, 41). Also Amaranthus plants were taller under organic treatments as per data (Fig 6)

Though microbial count was analysed for both seasons interpretation and presentation of second seasons data is done because it is expected there will be build up of microbes in the soil when Jeevamrutham is given. Significant increase in the population of Actinomycetes and Trichoderma is seen in ZBNF treatment as per figure 11 and 12 (both indicators of soil fertility)

Study of shelf life indicated interesting facts. Pages 39 and 40 show very clearly the increased shelf life of chilli grown under ZBNF treatments. The Photos were taken on 14th and 20th day. The greenness in chilli is being retained even on the 20th day under ZBNF treatments. Organic treatment gives more shelf life to produce than control (Chemical treatments)

Post harvest storage of Chillies under normal room temperature in Wayanad climate (June 2017) after sun drying caused infection of Chillies in Organic treatment and Control (Chemical) after one month. But those under ZBNF treatment were free of infection (Page 40 & 41).

The pungency analysed for Chillies also showed high values for ZBNF and Organic treatment as shown below while it was mild for Control.

Sample	Scoville Heat Unit	%Capsaicin Content	Degree of Pungency
ZBNF	41,222	0.26	highly pungent
ORGANIC	35,628	0.22	highly pungent
CHEMICAL	16,433	0.10	moderately pungent

Capsaicin and dihydrocapsaicin have the same trend in contents of the capsaicinoids, and in particular capsaicin was found in higher concentration than dihydrocapsaicin. This very clearly shows high pungency level in ZBNF followed by Organic treatment. Chemical farming brings down the pungency of Chilli.

Amaranthus under ZBNF had the special aroma when steamed (which was there in olden times when the plants from the homestead were used for cooking) which could not be found with the other two treatments.

Economic viability could not be studied because of the smaller size of plots. Also because the entire produce was marketed together because the produce was only from one cent each. Most of it was used for household purposes and neighbourhood distribution. It was not possible to sell them in different markets. All the other objectives were achieved.

Conclusion

The main objective of the study was to scientifically validate ZBNF and compare it with Organic and Chemical farming. This experiment has brought out the results of microbial population build up in soil under different methods of farming. This study clearly shows the ZBNF as superior treatment in all the aspects when compared to Organic and Chemical treatments. Soil health is improved considerably as indicated by increased population trichoderma and Actinomycetes. Healthy root system with more feeder roots will improve the uptake of nutrients from soil which has increased the yield of the crops grown under ZBNF system. Pest and disease control using natural methods also maintains the health of the soil. Earlier flowering also is a factor favourable to crops except in the case of leafy vegetables. Long shelf life for chilli will help farmers store the produce and market them according to demand. High pungency is a preferred quality in Chilli which is seen in ZBNF crops.

For sustainable production and high productivity in crops improvement of soil health is essential. Only a healthy soil can produce good quality crop produce. Application of Chemical fertilisers in soil causes clodding of soil and eutrophication and the use of toxic chemicals reduces the quality of the produce. The market is now flooded with inputs labelled as organic whose ingredients are not mentioned and hence its impact on soil health and crop produce cannot be assessed. Compared to conventional organic methods as in this study, ZBNF being a standardised formula mixture of cow dung and urine proved superior in all aspects with regard to production of good quality vegetables.

The impact of different Agro Ecological Zones on crop growth under different type of farming could not be brought out in this study. More trials should be conducted in this regard. Studies regarding the impact of different types of farming on acidity /alkalinity of soil also are suggested.

First Season Chilly Yield

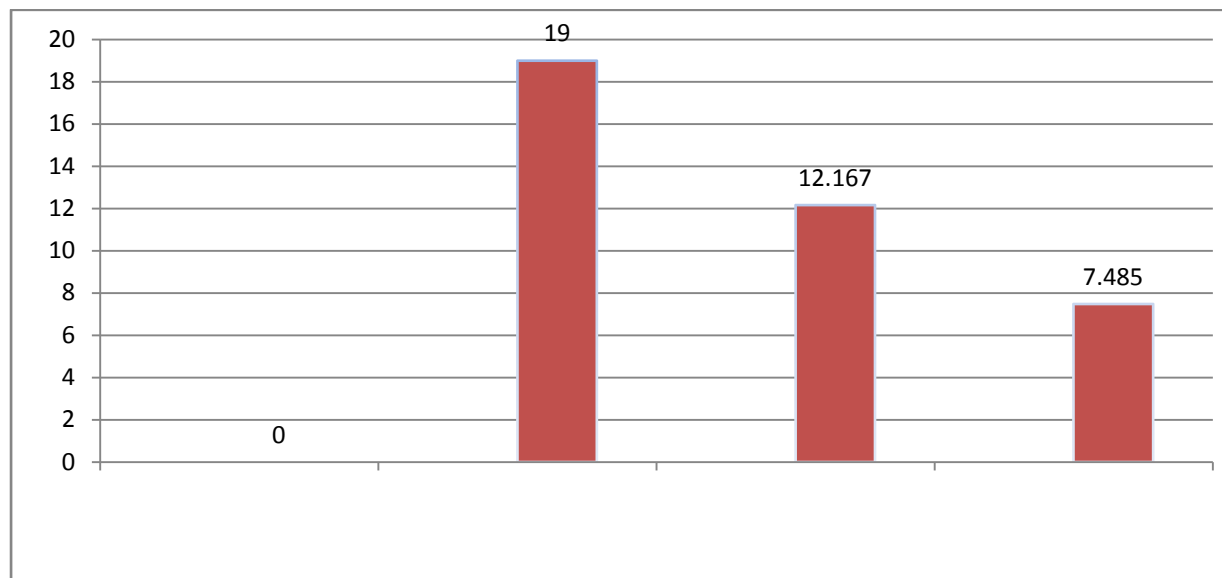


Figure 1

When compared to control (Main 3) yield per cent of Chilli in first season is significantly higher in ZBNF (Main 1) treatment as indicated by the mean values.

Sl No	Main Treatment	Sub Treatment means	Mean Values	CD 5%
1	Main 1	-	19*	17.62
2	Main 2	-	12.167	17.62
3	Main 3	-	7.485	17.62
4		Sub 1	4.667	15.116
5		Sub 2	11	15.116
6		Sub 3	37	15.116
7		Sub 4	5.16	15.116
8		Sub 5	6.81	15.116
9		Sub 6	12.667	15.116
10	Main x Sub			26.181

Main 1 – ZBNF Main 2 – Organic Main 3 – Chemical (Control)

Sub 1 to Sub 6 indicate 6 farmers [plots

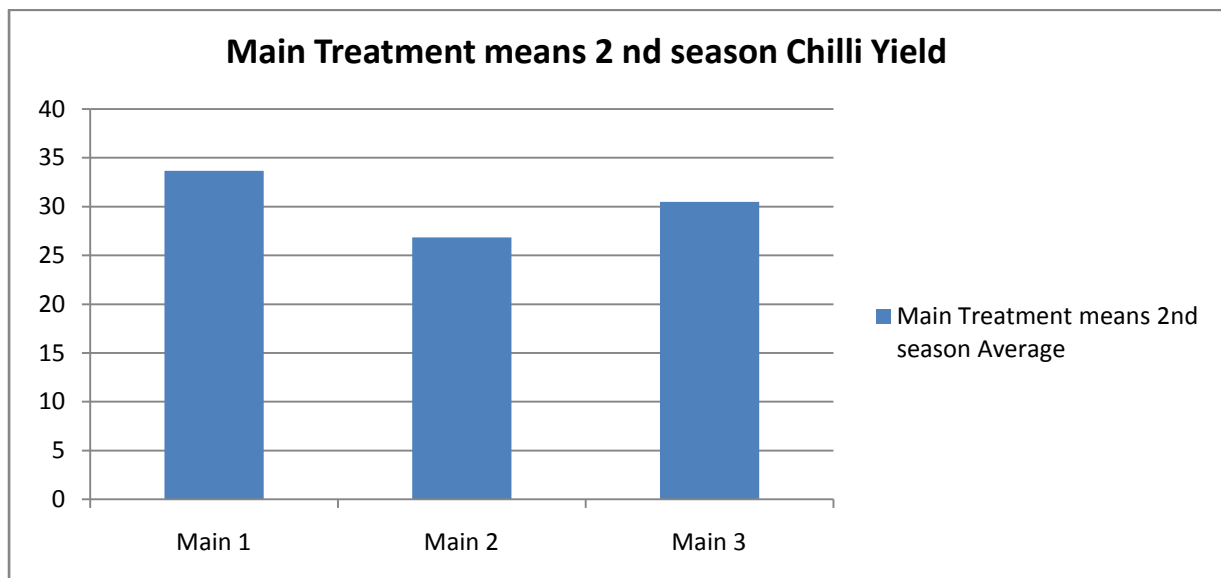


Figure 2

Chilli yield in second season also recorded significantly higher values under ZBNF treatment (Main1).Chilli yield in organic plants were lesser than control(Chemical) Plots.

Sl No	Main Treatment	Sub Treatment means	Mean Values	CD 5%
1	Main 1	-	33.667*	10.405
2	Main 2	-	26.833*	10.405
3	Main 3	-	30.5*	10.405
4		Sub 1	19.333	25.566
5		Sub 2	2	25.566
6		Sub 3	31	25.566
7		Sub 4	27	25.566
8		Sub 5	38.333	25.566
9		Sub 6	64.333*	25.566
10	Main x Sub			44.281

Main 1 – ZBNF Main 2 – Organic Main 3 – Chemical (Control)

Sub 1 to Sub 6 indicate 6 farmers [plots

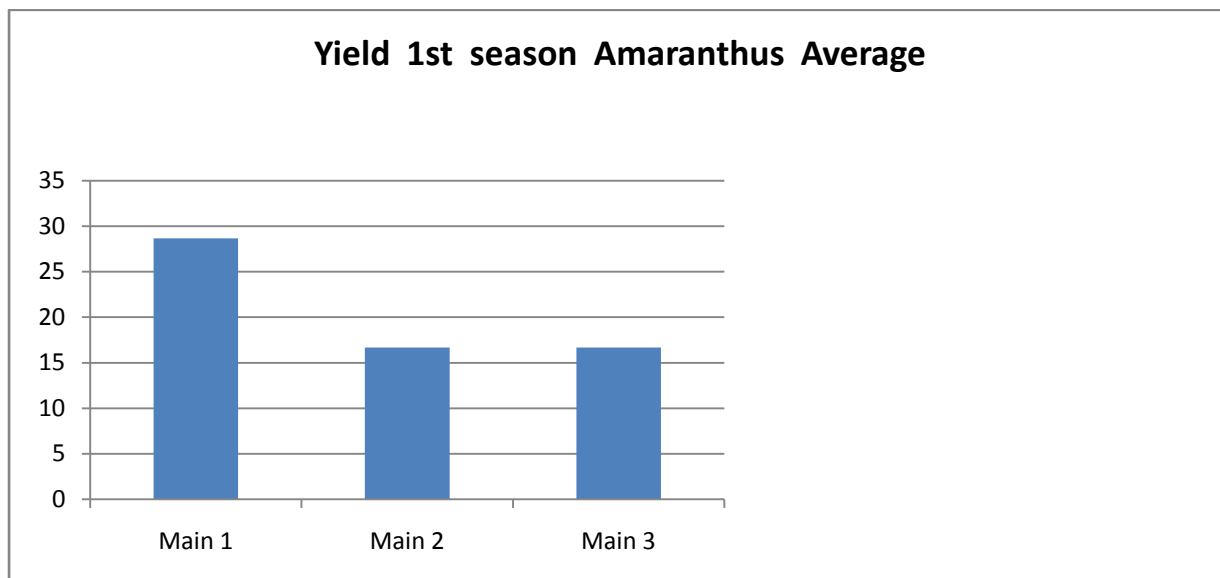


Figure 3

Amaranthus yield showed significantly higher value than control .Organic plots yielded same as the Control(Chemical)plots. All the farmer plots except 4 recorded significantly higher yields.Interaction was not significant.

Sl No	Main Treatment	Sub Treatment means	Mean Values	CD 5%
1	Main 1	-	28.663*	21.074
2	Main 2	-	16.667	21.074
3	Main 3	-	16.667	21.074
4		Sub 1	14.627	20.159
5		Sub 2	28.333	20.159
6		Sub 3	36.033*	20.159
7		Sub 4	9	20.159
8		Sub 5	23.333	20.159
9		Sub 6	12.667	20.159
10	Main x Sub			34.916

Main 1 – ZBNF Main 2 – Organic Main 3 – Chemical (Control)

Sub 1 to Sub 6 indicate 6 farmers [plots

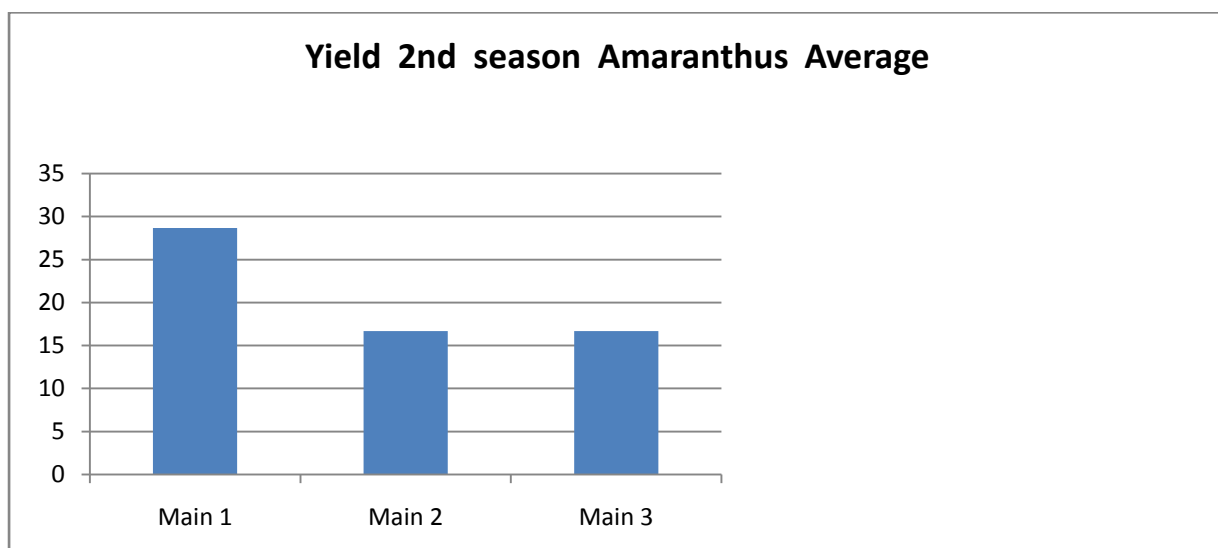


Figure 4

The yield of Amaranthus in the second season also was significantly higher than Control in ZBNF treatment(main 1).Organic plots yielded lesser than control (Chemical).Farmer plot 6 recorded significantly higher value.

Sl No	Main Treatment	Sub Treatment means	Mean Values	CD 5%
1	Main 1	-	28*	17.062
2	Main 2	-	17.333	17.062
3	Main 3	-	19.667	17.062
4		Sub 1	36.333	23.079
5		Sub 2	0	23.079
6		Sub 3	0	23.079
7		Sub 4	22.333	23.079
8		Sub 5	33	23.079
9		Sub 6	38.333*	23.079
10	Main x Sub			39.975

Main 1 – ZBNF Main 2 – Organic Main 3 – Chemical (Control)

Sub 1 to Sub 6 indicate 6 farmers [plots

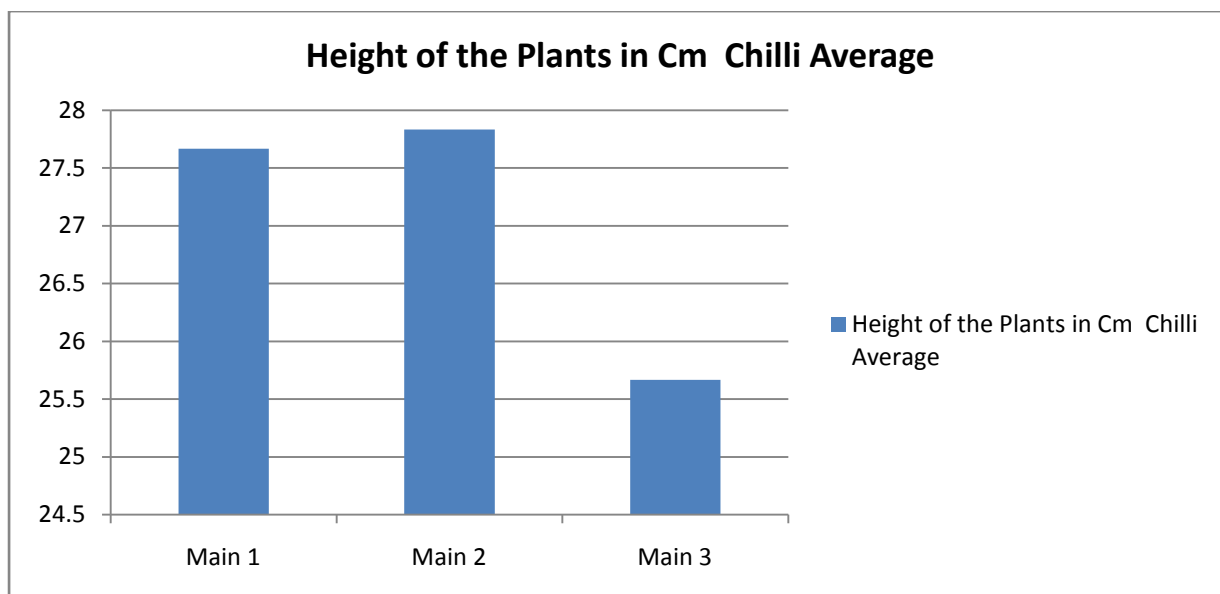


Figure 5

Height of the plants were significantly higher in organic treatment than control(chemical) in Chilli. Farmer plot 4 had the higher value.

Sl No	Main Treatment	Sub Treatment means	Mean Values	CD 5%
1	Main 1	-	27.667*	3.669
2	Main 2	-	27.833*	3.669
3	Main 3	-	25.667*	3.669
4		Sub 1	28.667	14.22
5		Sub 2	32.667	14.22
6		Sub 3	29	14.22
7		Sub 4	44*	14.22
8		Sub 5	17.667	14.22
9		Sub 6	10.333	14.22
10	Main x Sub			24.63

Main 1 – ZBNF Main 2 – Organic Main 3 – Chemical (Control)

Sub 1 to Sub 6 indicate 6 farmers [plots

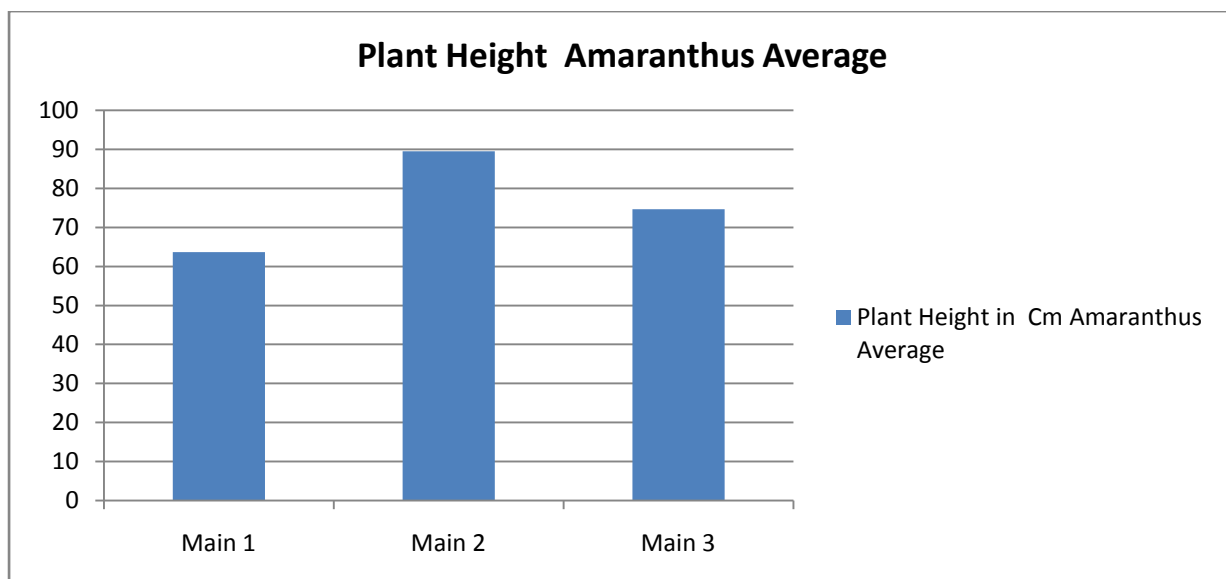


Figure 6

In Amaranthus also plant height was significantly high under Organic treatment(Main2) than control(Main3 Chemical)

Sl No	Main Treatment	Sub Treatment means	Mean Values	CD 5%
1	Main 1	-	63.667	39.445
2	Main 2	-	89.5*	39.445
3	Main 3	-	74.667	39.445
4		Sub 1	75.333	40.347
5		Sub 2	136.667*	40.347
6		Sub 3	53.333	40.347
7		Sub 4	67	40.347
8		Sub 5	32.333	40.347
9		Sub 6	91	40.347
10	Main x Sub			69.883

Main 1 – ZBNF Main 2 – Organic Main 3 – Chemical (Control)

Sub 1 to Sub 6 indicate 6 farmers [plots

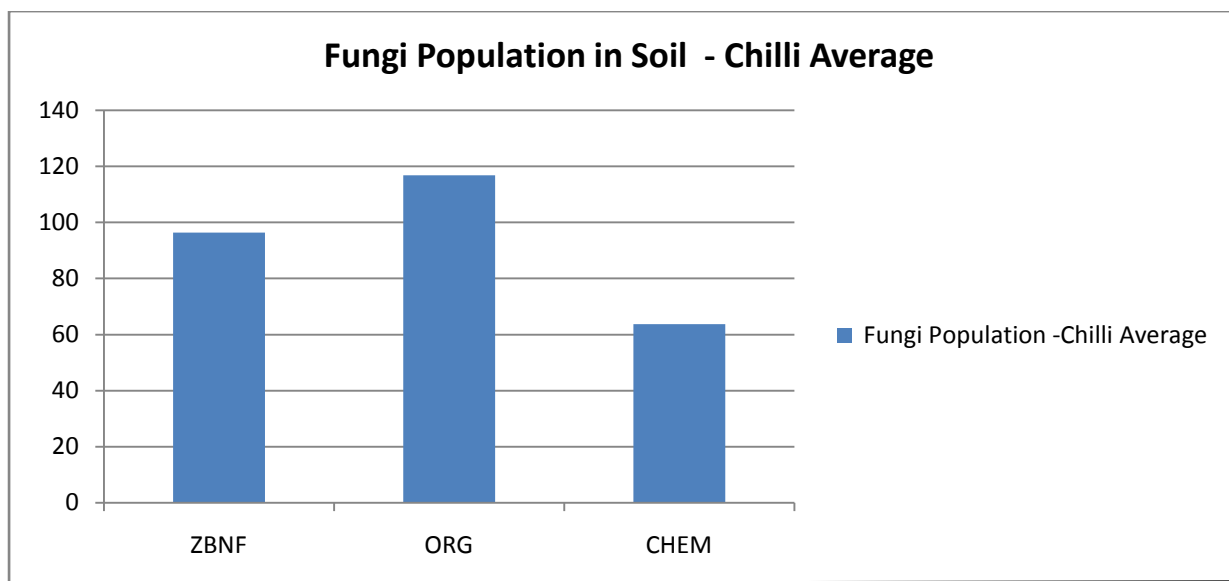


Figure 7

Fungal Population was significantly higher in the Organic Treatments followed by ZBNF treatment.

Sl No	Main Treatment	Sub Treatment means	Mean Values	CD 5%
1	Main 1	-	96.33*	74.312
2	Main 2	-	116.833*	74.312
3	Main 3	-	63.667	74.312
4		Sub 1	109.667	65.992
5		Sub 2	128.667	65.992
6		Sub 3	185.667*	65.992
7		Sub 4	68.667	65.992
8		Sub 5	47.667	65.992
9		Sub 6	13.333	65.992
10	Main x Sub			114.302

Main 1 – ZBNF Main 2 – Organic Main 3 – Chemical (Control)

Sub 1 to Sub 6 indicate 6 farmers [plots

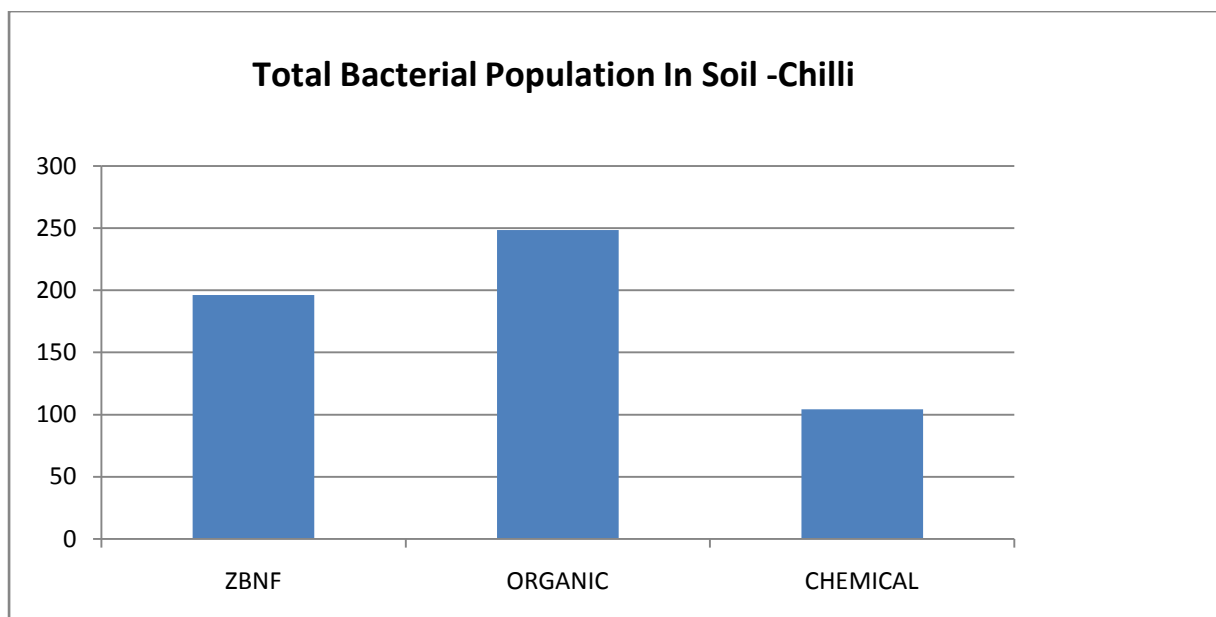


Figure 8

Total bacterial population was significantly higher in the Organic treatment followed by ZBNF, It was not significant in Chemical treatment.

Sl No	Main Treatment	Sub Treatment means	Mean Values	CD 5%
1	Main 1	-	196.167*	159.899
2	Main 2	-	248.5*	159.899
3	Main 3	-	104.167	159.899
4		Sub 1	173.333	99.794
5		Sub 2	207.333	99.794
6		Sub 3	295.333*	99.794
7		Sub 4	233	99.794
8		Sub 5	48.333	99.794
9		Sub 6	140.333	99.794
10	Main x Sub			172.849

Main 1 – ZBNF Main 2 – Organic Main 3 – Chemical (Control)

Sub 1 to Sub 6 indicate 6 farmers [plots

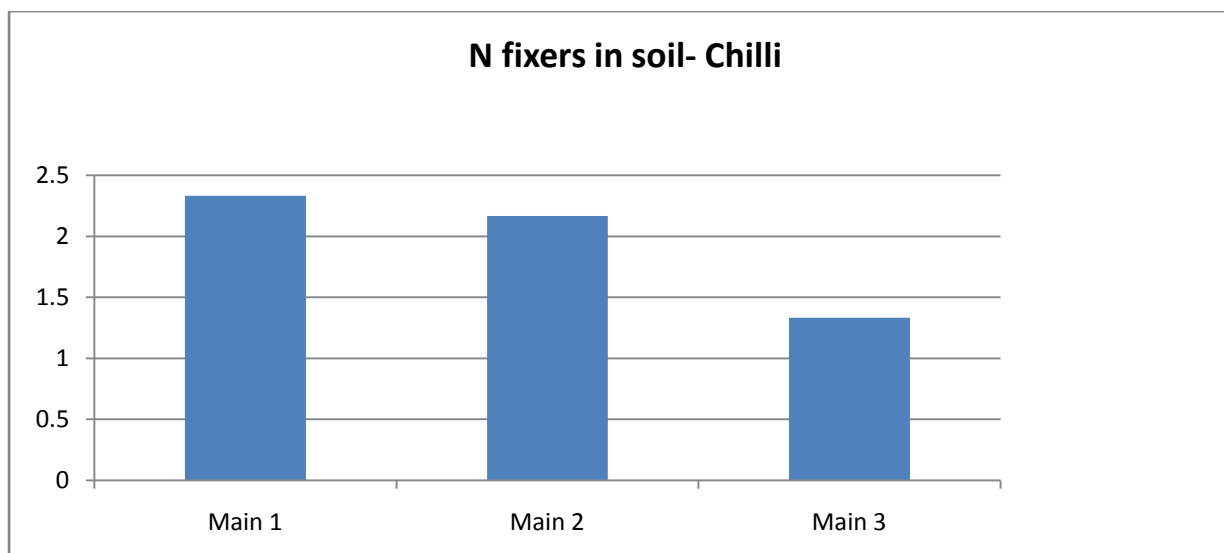


Figure 9

Nfixers in soil is significantly higher in ZBNF treatment followed by Organic treatment

Sl No	Main Treatment	Sub Treatment means	Mean Values	CD 5%
1	Main 1	-	2.333*	1.276
2	Main 2	-	2.167*	1.276
3	Main 3	-	1.333	1.276
4		Sub 1	3.667	1.025
5		Sub 2	4	1.025
6		Sub 3	2	1.025
7		Sub 4	1	1.025
8		Sub 5	0	1.025
9		Sub 6	1	1.025
10	Main x Sub			1.776

Main 1 – ZBNF Main 2 – Organic Main 3 – Chemical (Control)

Sub 1 to Sub 6 indicate 6 farmers [plots

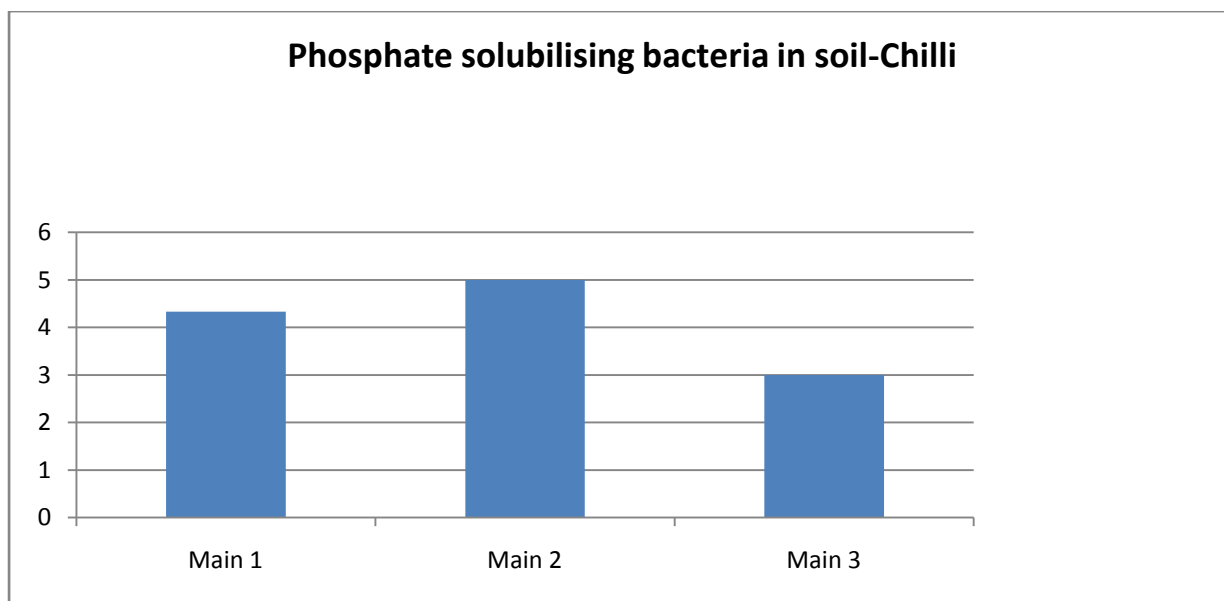


Figure 10

Phosphate solubilising bacteria is significantly higher in organic soils.

Sl No	Main Treatment	Sub Treatment means	Mean Values	CD 5%
1	Main 1	-	4.333	4.648
2	Main 2	-	5*	4.648
3	Main 3	-	3	4.648
4		Sub 1	4.333	2.201
5		Sub 2	7.667	2.201
6		Sub 3	3.667	2.201
7		Sub 4	4.667	2.201
8		Sub 5	4	2.201
9		Sub 6	0.333	2.201
10	Main x Sub			3.812

Main 1 – ZBNF Main 2 – Organic Main 3 – Chemical (Control)

Sub 1 to Sub 6 indicate 6 farmers [plots

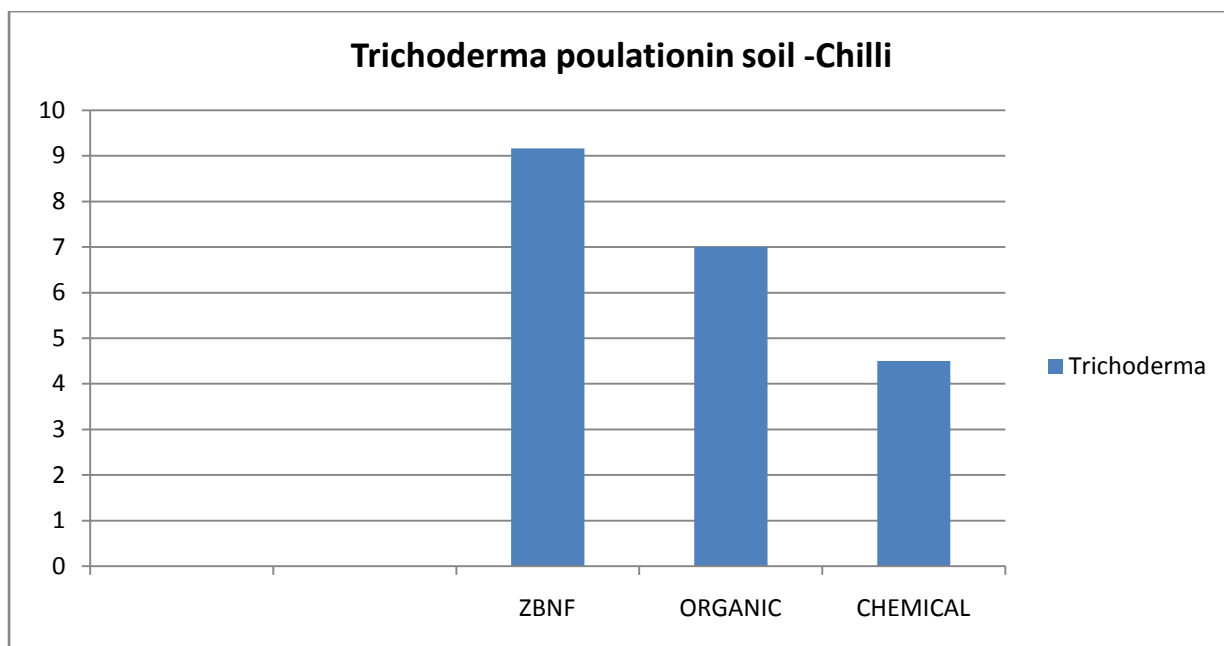


Figure 11

Trichoderma population in soil is significantly higher only in ZBNF treatment where as it is lesser in other two treatments.

Sl No	Main Treatment	Sub Treatment means	Mean Values	CD 5%
1	Main 1	-	9.167*	8.399
2	Main 2	-	7	8.399
3	Main 3	-	4.5	8.399
4		Sub 1	25.333	4.487
5		Sub 2	1.667	4.487
6		Sub 3	5.333	4.487
7		Sub 4	3.333	4.487
8		Sub 5	4.333	4.487
9		Sub 6	1.333	4.487
10	Main x Sub			7.772

Main 1 – ZBNF Main 2 – Organic Main 3 – Chemical (Control)

Sub 1 to Sub 6 indicate 6 farmers [plots

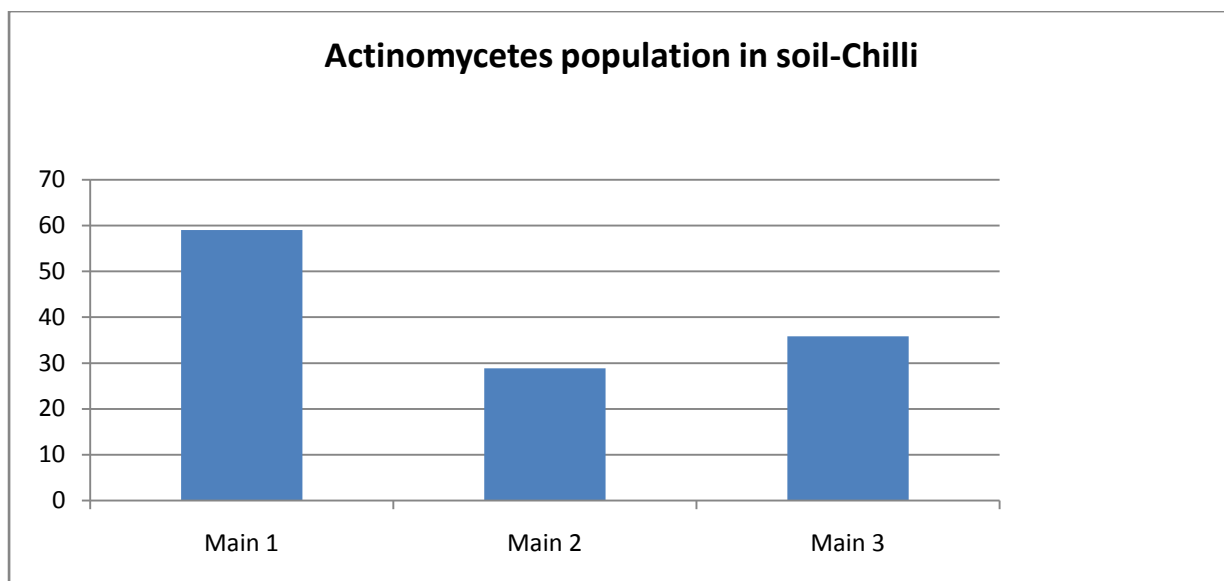


Figure 12

Actinomycetes is significantly higher in ZBNF followed by control

Sl No	Main Treatment	Sub Treatment means	Mean Values	CD 5%
1	Main 1	-	59*	24.741
2	Main 2	-	28.833	24.741
3	Main 3	-	35.833*	24.741
4		Sub 1	36.333	18.43
5		Sub 2	44.333	18.43
6		Sub 3	66.333	18.43
7		Sub 4	65	18.43
8		Sub 5	33.667	18.43
9		Sub 6	4.667	18.43
10	Main x Sub			39.122

Main 1 – ZBNF Main 2 – Organic Main 3 – Chemical (Control)

Sub 1 to Sub 6 indicate 6 farmers [plots

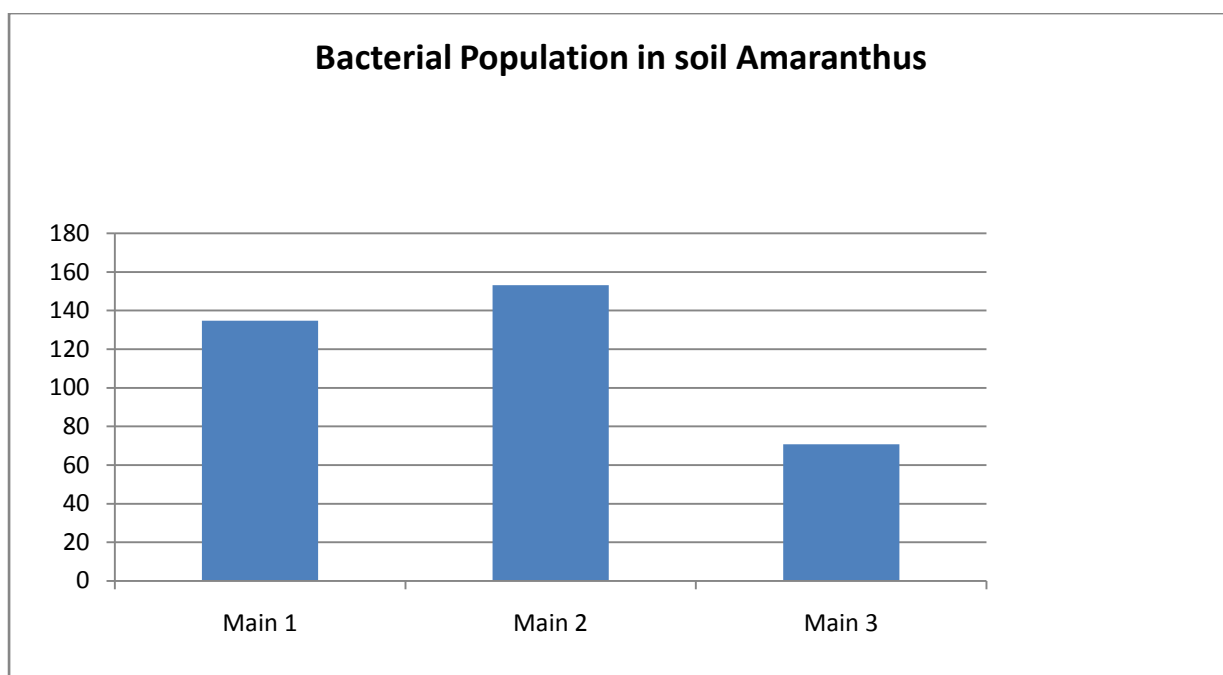


Figure 13

Bacterial Population in soil is significantly higher in Organic .

Sl No	Main Treatment	Sub Treatment means	Mean Values	CD 5%
1	Main 1	-	134.833*	98.317
2	Main 2	-	153.167*	98.317
3	Main 3	-	70.833	98.317
4		Sub 1	141	100.167
5		Sub 2	82.667	100.167
6		Sub 3	160.667	100.167
7		Sub 4	159.333	100.167
8		Sub 5	100	100.167
9		Sub 6	74	100.167

Main 1 – ZBNF Main 2 – Organic Main 3 – Chemical (Control)

Sub 1 to Sub 6 indicate 6 farmers [plots

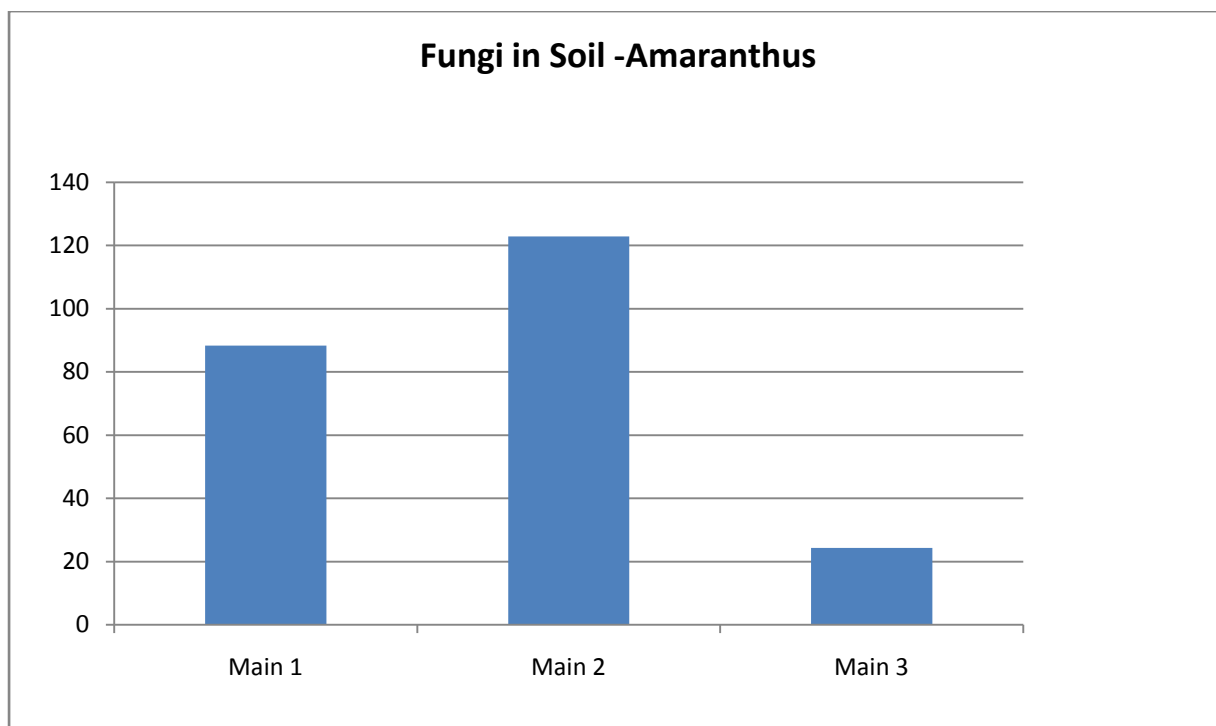


Figure 14

Fungi is significantly higher in Organic soils.

Sl No	Main Treatment	Sub Treatment means	Mean Values	CD 5%
1	Main 1	-	88.333	23.978
2	Main 2	-	122.833*	23.978
3	Main 3	-	24.333	23.978
4		Sub 1	102.667	43.417
5		Sub 2	32.667	43.417
6		Sub 3	48.667	43.417
7		Sub 4	28.333	43.417
8		Sub 5	152.667	43.417
9		Sub 6	106	43.417
10	Main x Sub			75.201

Main 1 – ZBNF Main 2 – Organic Main 3 – Chemical (Control)

Sub 1 to Sub 6 indicate 6 farmers [plots



Field Preparation



Organic Amaranthus



Organic Chilli



Chemical Control Plot – Chili



ZBNF Amaranthus before Mulching



ZBNF Amaranthus after Mulching



Recording the height of the plants



First Harvest of Amaranthus



ATMA Documentation by KSFD



Second Season Chilli In Vegetative Stage ZBNF



Second Season Chilli In flowering Stage ZBNF - 2



Second Season Chilli In harvest Stage ZBNF



Organic Amaranthus - Harvest Stage



ZBNF Amaranthus - Harvest



ZBNF Amaranthus & Chilli - Farmers with the Harvest



Harvest of Amaranthus



Chilly- Harvest from ZBNF



Chilly – Harvest from Organic Farming



Chilly – Harvest from Chemical Farming



Chilly – Vegetative Stage - ZBNF



Chilly – Harvest Stage - ZBNF



Sample Plot – Mananthavady



Sample Plot – Chemical Farming - Thirunelly



Amaranthus in Vegetative stage – ZBNF - Thirunelly



Amaranthus in flowering stage – ZBNF - Thirunelly



Chilli - Organic farming – Harvest stage



Chilli - Harvesting e stage – ZBNF - Thirunelly



Amaranthus Harvest – ZBNF , Organic and Chemical



Chilli Harvest –Organic



Chilli Harvest –ZBNF



Chilli Harvest – Chemical



Amaranthus Plot - Organic



Amaranthus Plot - Chemical



Chilli Plot – Organic



Amaranthus Plot – Organic



Amaranthus Plot - ZBNF



Chilli Plot – Organic



Chilli Harvest – ZBNF



Chilli Plot – ZBNF



Chilli Plot - ZBNF



Amaranthus Plot - ZBNF



Amaranthus Plot - ZBNF



Field Visit



ZBNF and Organic grown plants have more matted growth



Matted Growth in ZBN



Matted Growth in Organic



Less matted Growth in Chemical



Plant height more for organic



ZBNF Plot in Vellamunda in Mananthavady



ZBNF Plot in Vellamuda - Mananthavady



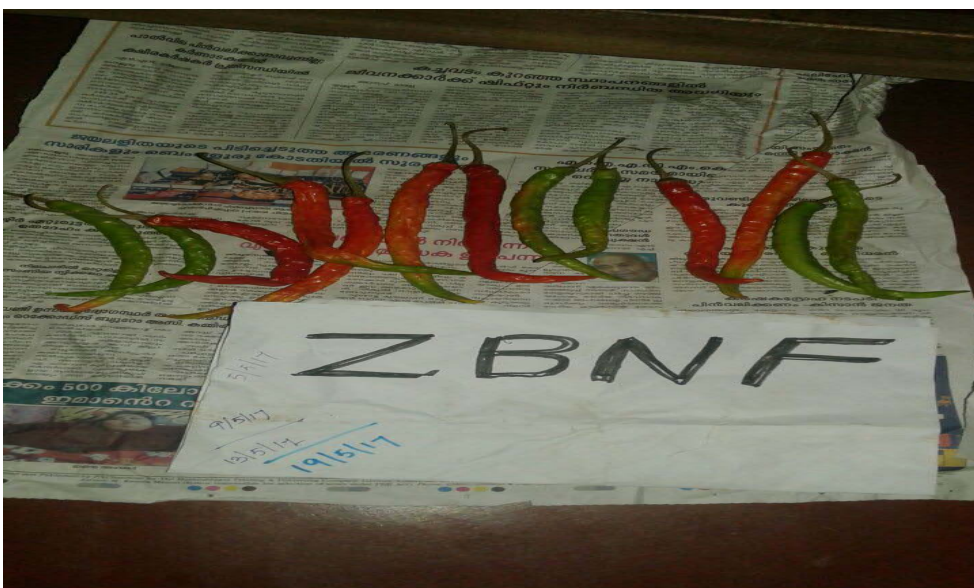
Chillies stored under different treatments 14th day – Chemical



Chillies stored under different treatments – Organic



Chillies stored under different treatments – ZBNF



Chillies stored under different treatments - ZBNF



Chillies stored under different treatments – Organic – T2



Chillies stored under different treatments – Chemical – T3



Dried Chillies under ZBNF had no fungal infection



Dried Chillies under organic had medium level of fungal infection



Dried Chillies under chemical had high level of fungal infection



Group discussion



Chilly – ZBNF – From different sample plots



Chilly – Organic – From different sample plots



The Research Project Team

List of Farmers

Sl No	Agro Ecological Zones	Name and Address of the farmers	Contact Number	First Season and Second season
1	AEZ 1	Sampreeth , Kottakunnu,Mennangadi Bathery	8157832308	First
		Sreeranjana TenavarmbathOrappuvayal Meenagadi Bathery	9645595449	Second
		Sunil Kallingara Nenmeni , Bathery	9447437285	Both
		Shaji Palapulickkal Mullankolly Panamaram	9562420282	Both
2	AEZ 2	Ayoob thottoli Vellamunda Manathavady	9387752145	First
		Shaji Kommayad Vellamunda Manathavady	9495031188	Second
3	AEZ 3	Divakaran Anoth Pozhuthana Kalpetta	9048723616	Both
		Sukumaranunny, Illathkalam,Tirunelly,Mananthavady	9447344175	Both