Can Zero Budget Natural Farming deal with the calamitous effects of floods and Cyclones?

Evidence from Titli and Pethai Cyclones in Andhra Pradesh, India

The extent of damage

- In Andhra Pradesh, a southern state of India, two districts were severely affected namely Srikakulam, and Vizianagaram districts where there was significant damage to crops.
- The data reveals that more than 8800 hectares of vegetable crops, 1352 ha of paddy crop, 77.6 ha of banana plantation, 132 ha of cotton crops have been destroyed by the cyclone across three blocks of Srikakulam (Sangomla 2018).
- There was immense damage to the crops due to the Pethai cyclone in December, where 2179 ha of Paddy and 30 ha of horticultural crops were colossally damaged.
- The Pethai cyclone as a cyclonic storm crossed the coast at South of Kakinada with a wind speed of 70-90 kilometers per hour. It continued with pervasive rain and lashed in north coastal districts of Andhra Pradesh.

Aim of the Study

- This study aims to figure out the calamitous effects of two major cyclones in the year 2018 viz., cyclone Titli, and cyclone Pethai (Ganeshan 2018; J.B.S 2018; Mohammed 2018; P.Pavan 2018) on two types of farming systems namely the ZBNF and the Chemical farming. Amongst the two cyclones, the extent of damage was high in the Titli cyclone.

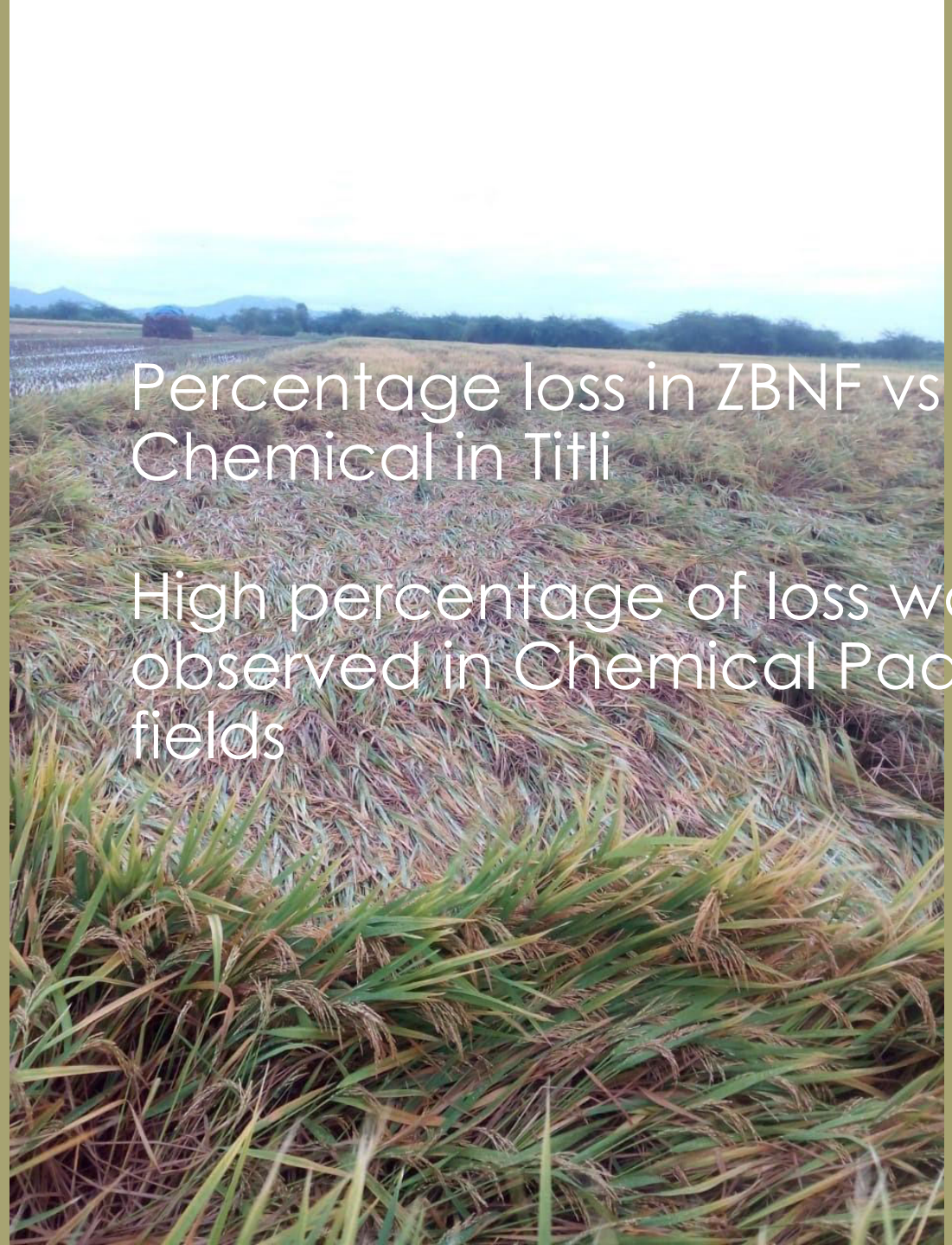
Objectives of the study

- *Compare the responsiveness and percentage of damage in chemical farming versus Zero Budget Natural Farming practices,*
- *Analyse the relative influencing factors in the two production systems for the damage,*
- *To provide evidence on the relative robustness of ZBNF to withstand cyclones when compared to the business as the usual production system.*

Titli Cyclone

Titli Cyclone

- Data was collected from 40 ZBNF damaged plots and 40 chemical plots in Srikakulam district
- The percentage loss is high in Chemical plots when compared to ZBNF plots
- The Recovery was fast in ZBNF when compared to Chemical farms
- Time taken for recovery is fast in ZBNF Paddy when compared to chemical Paddy crop



Percentage loss in ZBNF vs Chemical in Titli

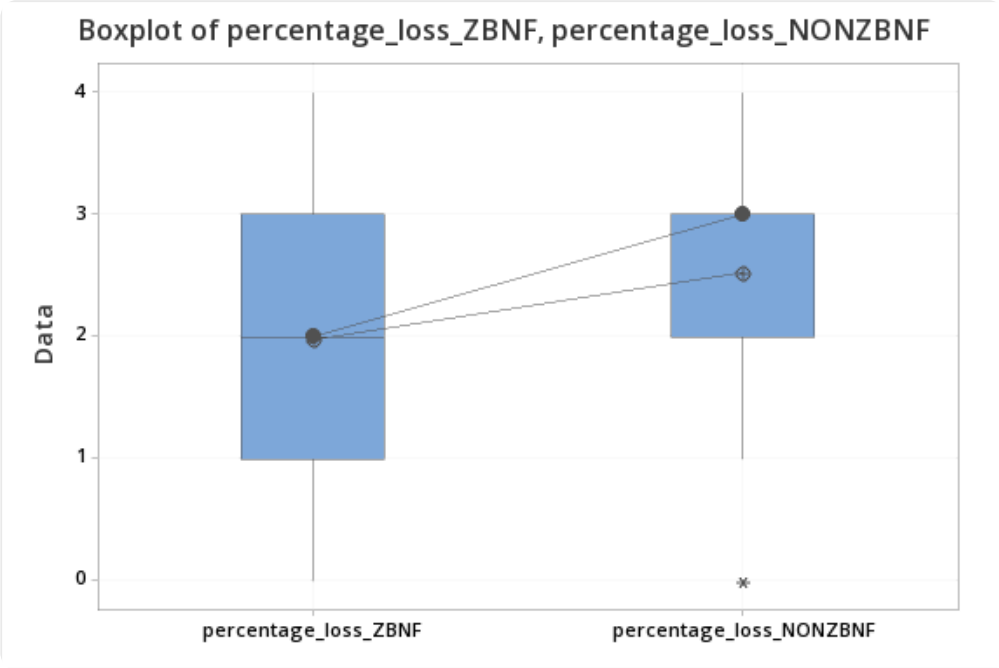
High percentage of loss was observed in Chemical Paddy fields

Test

Null hypothesis $H_0: \mu_1 - \mu_2 = 0$

Alternative hypothesis $H_1: \mu_1 - \mu_2 \neq 0$

T-Value	DF	P-Value
-2.21	77	0.030



Recovery percentage

Descriptive Statistics

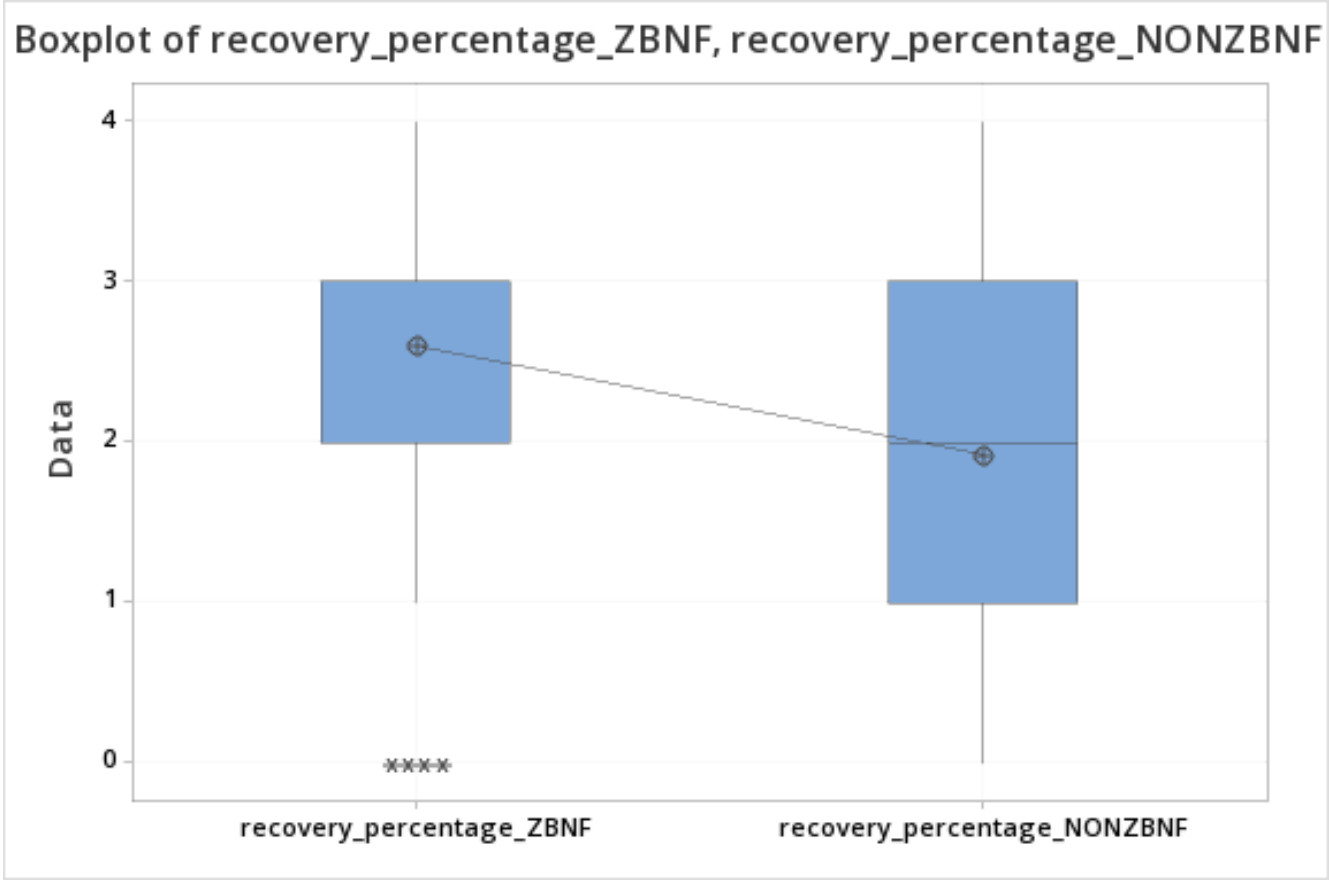
Sample	N	Mean	StDev	SE Mean
recovery_percentage_ZBNF	40	2.60	1.19	0.19
recovery_percentage_NONZBNF	40	1.93	1.12	0.18

Test

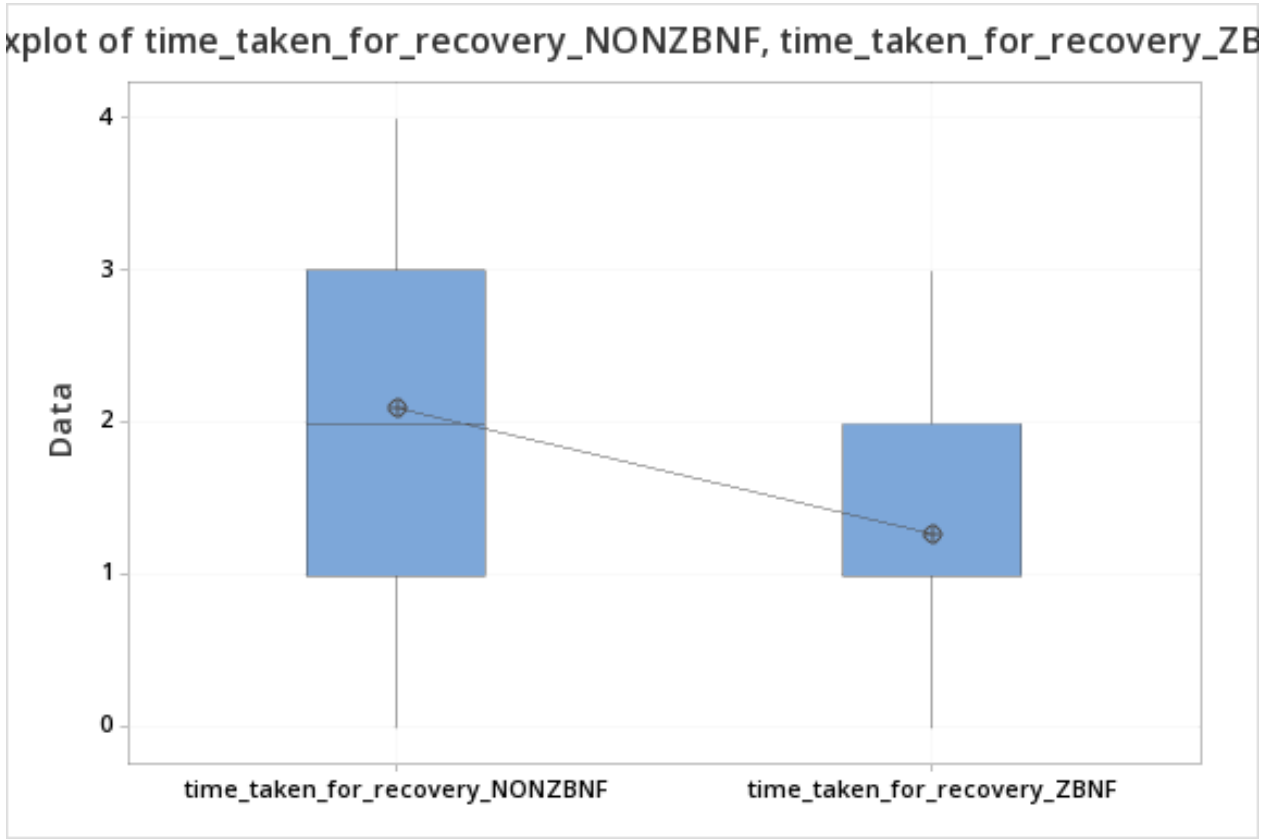
Null hypothesis $H_0: \mu_1 - \mu_2 = 0$

Alternative hypothesis $H_1: \mu_1 - \mu_2 \neq 0$

T-Value	DF	P-Value
2.61	77	0.011



Recovery time



Descriptive Statistics

Sample	N	Mean	StDev	SE Mean
time_taken_for_recovery_NONZBNF	40	2.10	1.22	0.19
time_taken_for_recovery_ZBNF	40	1.275	0.933	0.15

Test

Null hypothesis $H_0: \mu_1 - \mu_2 = 0$

Alternative hypothesis $H_1: \mu_1 - \mu_2 \neq 0$

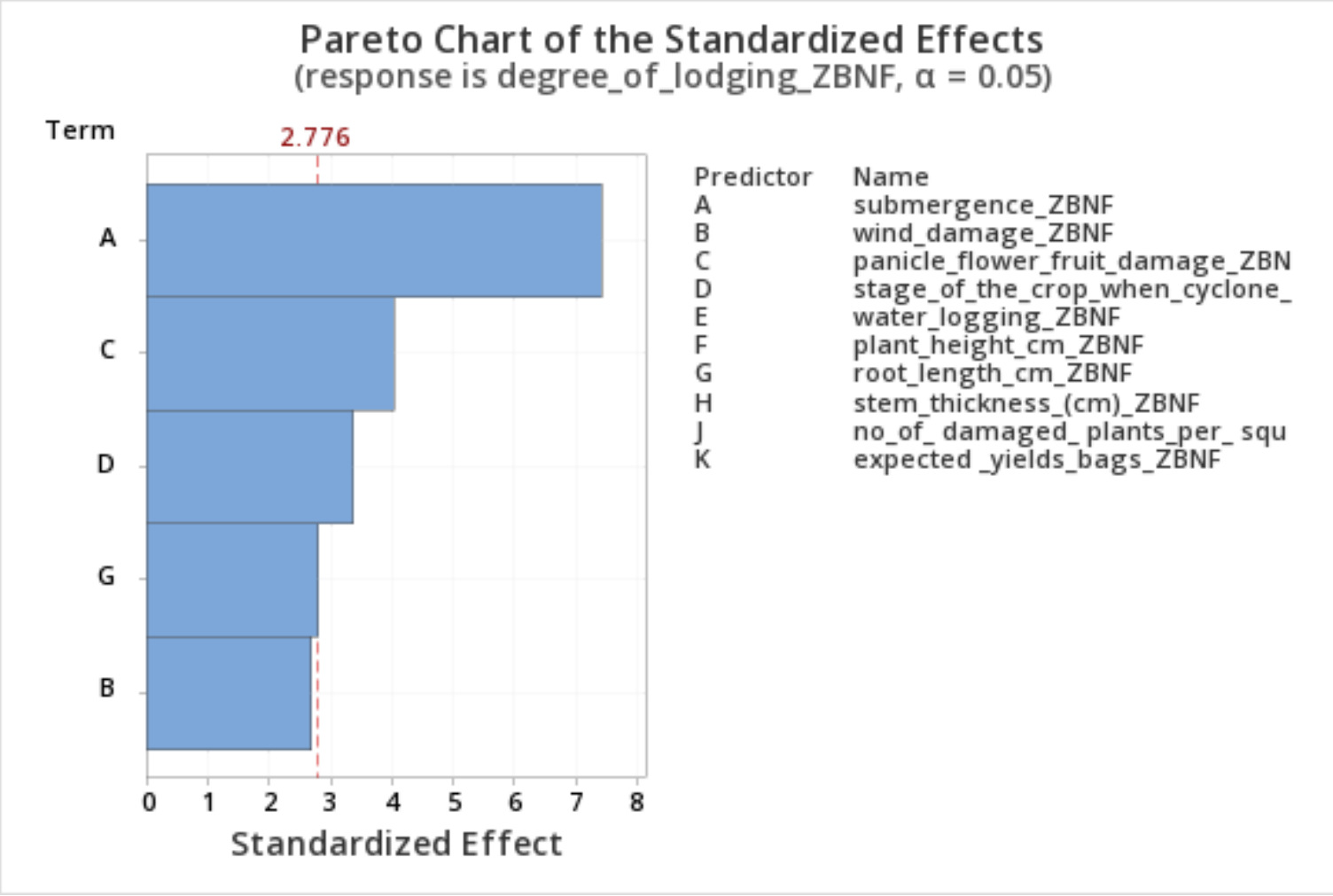
T-Value	DF	P-Value
3.41	73	0.001

The regression for most influencing factors for Lodging in ZBNF

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	34	91.4285	2.68907	40.78	0.001
submergence_ZBNF	4	10.5914	2.64785	40.16	0.002
wind_damage_ZBNF	4	1.6047	0.40117	6.08	0.054
panicle_flower_fruit_damage_ZBN	4	3.3189	0.82973	12.58	0.015
stage_of_the_crop_when_cyclone_	3	1.8586	0.61955	9.40	0.028
root_length_cm_ZBNF	19	7.4430	0.39174	5.94	0.048
Error	4	0.2638	0.06594		
Total	38	91.6923			

Factors influenced for lodging in ZBNF -Titli

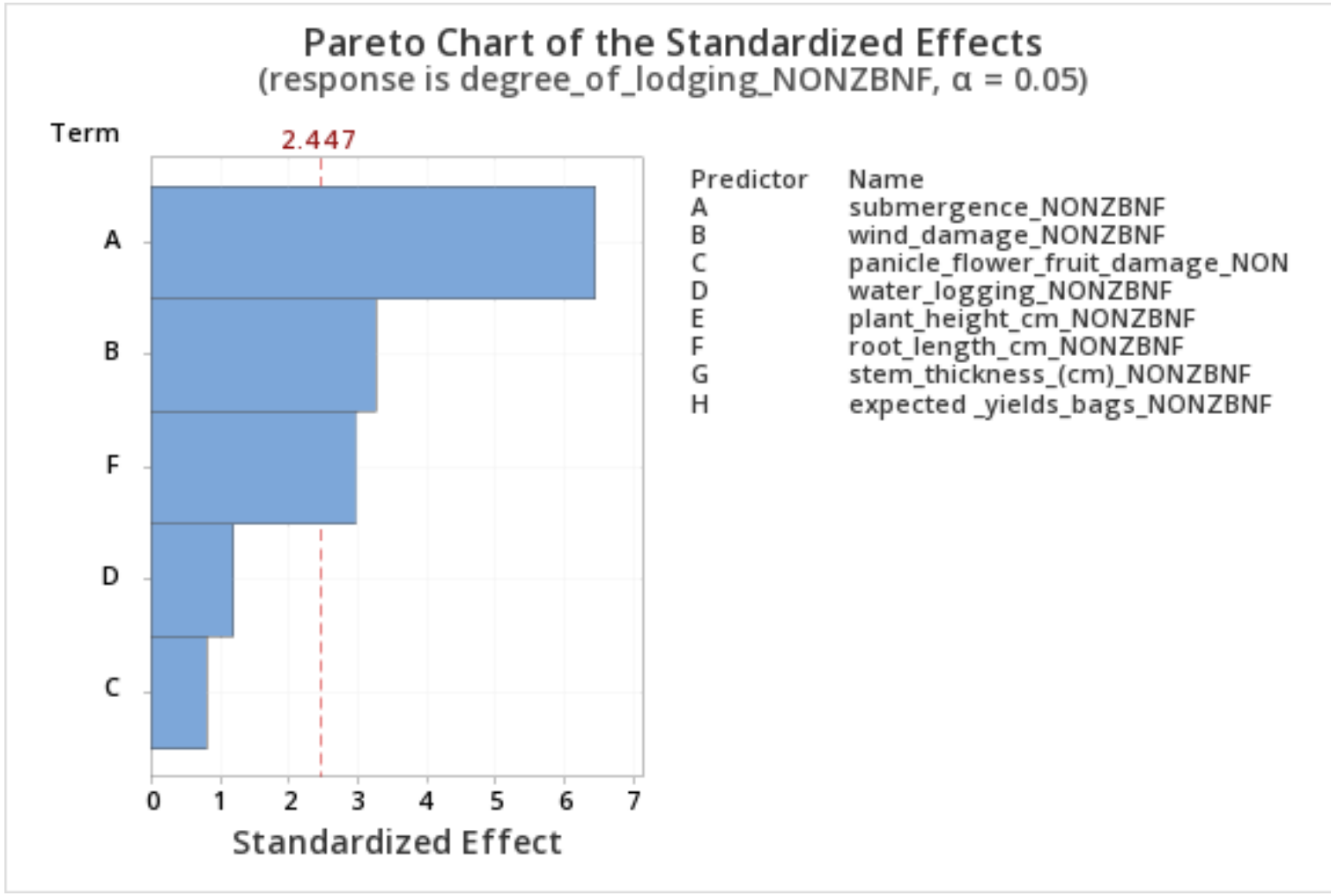


The graphs reveal that Submergence, wind damage, panicle/fruit damage, Stage of the crop and root length are the most influencing factors

Lodging in Chemical Plots

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	32	59.5054	1.8595	13.07	0.002
submergence_NONZBNF	3	11.7888	3.9296	27.62	0.001
wind_damage_NONZBNF	4	4.1678	1.0420	7.32	0.017
panicle_flower_fruit_damage_NON	4	0.6158	0.1539	1.08	0.443
water_logging_NONZBNF	4	0.9514	0.2378	1.67	0.273
root_length_cm_NONZBNF	17	12.7852	0.7521	5.29	0.024
Error	6	0.8536	0.1423		
Total	38	60.3590			



The data reveal that submergence of the crop for longer time, wind damage and and lesser root length are responsible for crop lodging

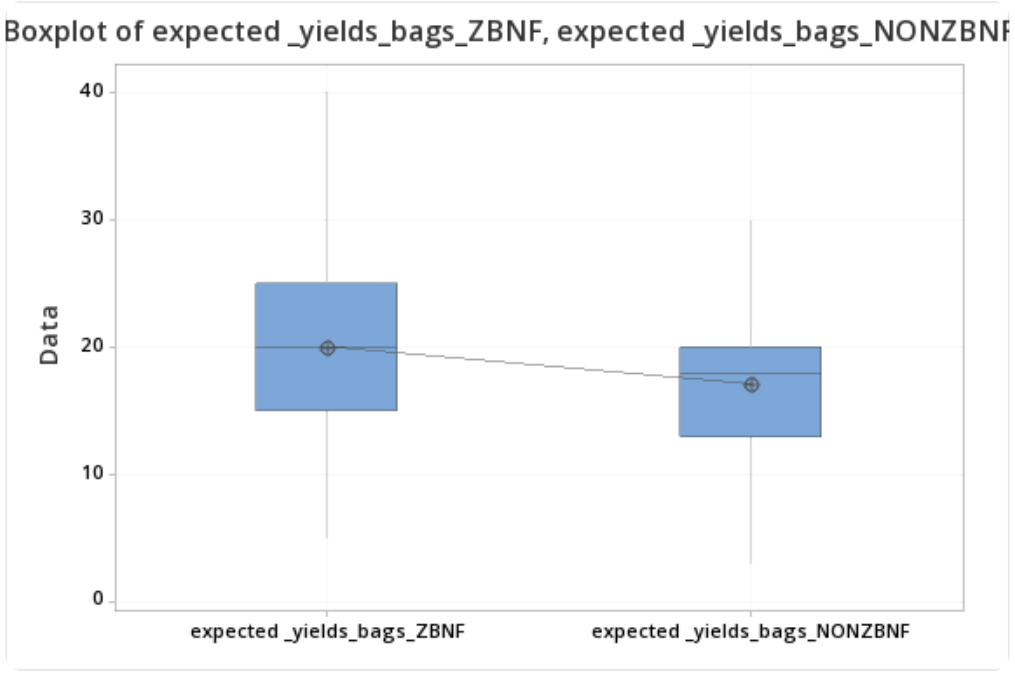
Expected yield in bags after cyclone

Test

Null hypothesis $H_0: \mu_1 - \mu_2 = 0$

Alternative hypothesis $H_1: \mu_1 - \mu_2 \neq 0$

T-Value	DF	P-Value
2.08	78	0.041



Evidence from Pethai Cyclone

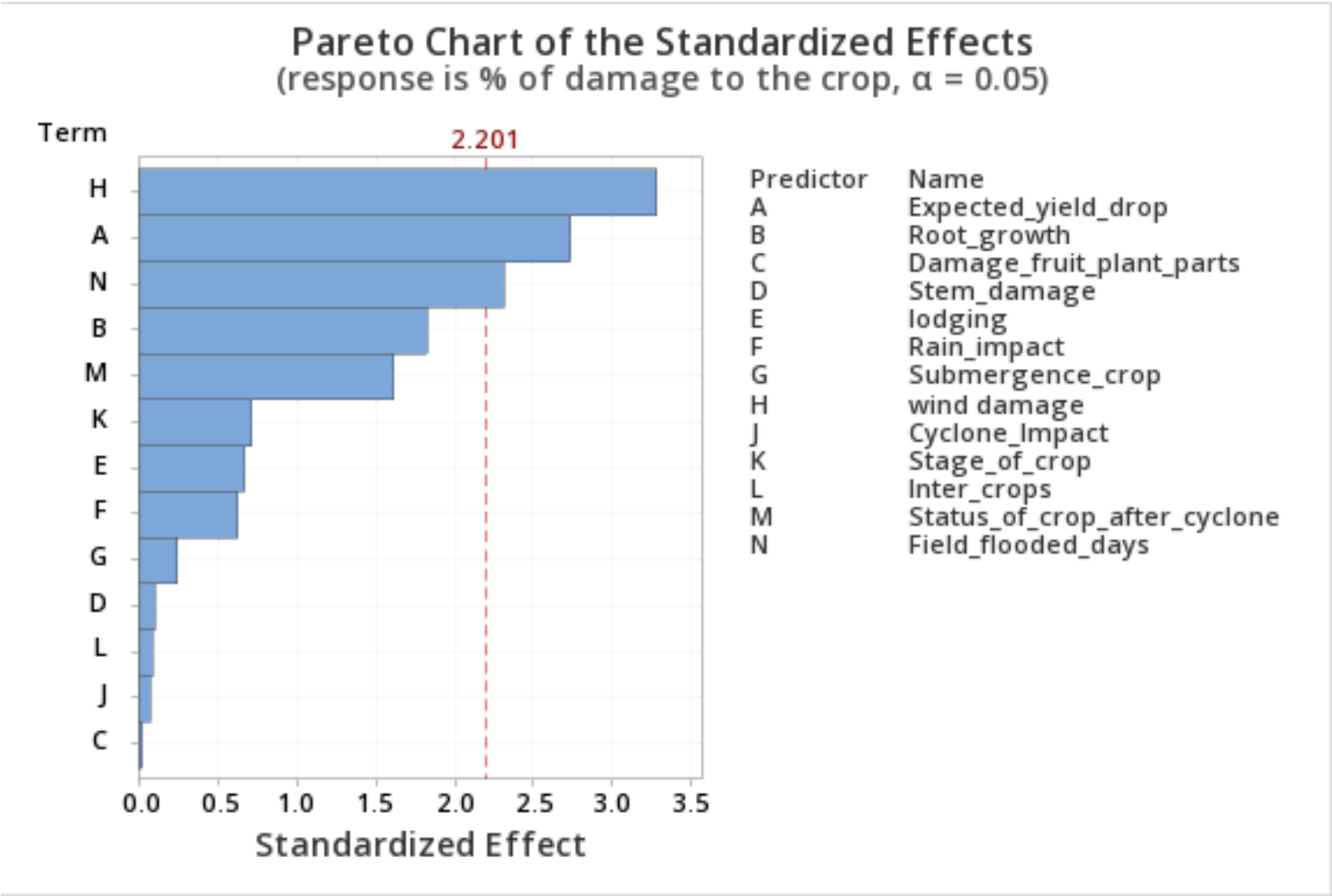
Crops

Crop	Freq.	Percent	Cum.
Banana	6	15.00	15.00
Chilli	6	15.00	27.50
Cotton	1	2.50	30.00
Maize	1	2.50	32.50
Paddy	25	62.50	95.00
Tobacco	1	2.50	100.00
Total	40	100.00	

Most influenced factors in Chemical fields

- Wind damage
- Yield drop in Chemical
- Field flooded days

Damage in Chemical farms



Analysis of Variance

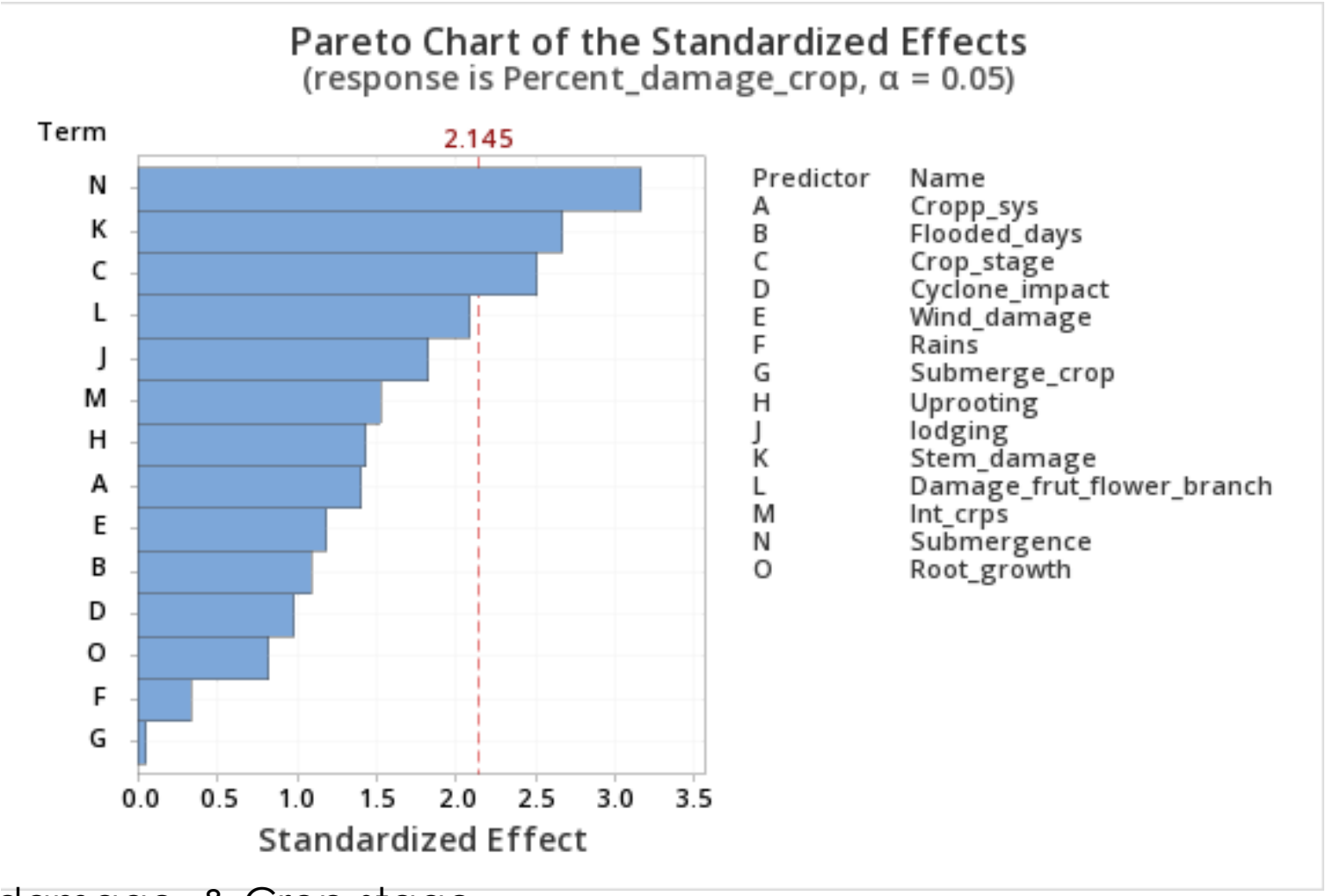
Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	28	64.2643	2.29515	3.76	0.012
Expected_yield_drop	4	11.3287	2.83217	4.64	0.019
Root_growth	1	2.0423	2.04226	3.35	0.095
Damage_fruit_plant_parts	1	0.0004	0.00037	0.00	0.981
Stem_damage	2	0.1041	0.05206	0.09	0.919
lodging	2	0.8596	0.42981	0.70	0.515
Rain_impact	2	0.7943	0.39716	0.65	0.540
Submergence_crop	1	0.0368	0.03680	0.06	0.811
wind damage	2	9.7076	4.85378	7.96	0.007
Cyclone_Impact	4	0.4496	0.11241	0.18	0.942
Stage_of_crop	4	2.2384	0.55960	0.92	0.488
Inter_crops	1	0.0054	0.00535	0.01	0.927
Status_of_crop_after_cyclone	1	1.5965	1.59650	2.62	0.134
Field_flooded_days	3	7.1064	2.36879	3.88	0.041
Error	11	6.7107	0.61007		
Total	39	70.9750			

Regression on damage percentage in ZBNF

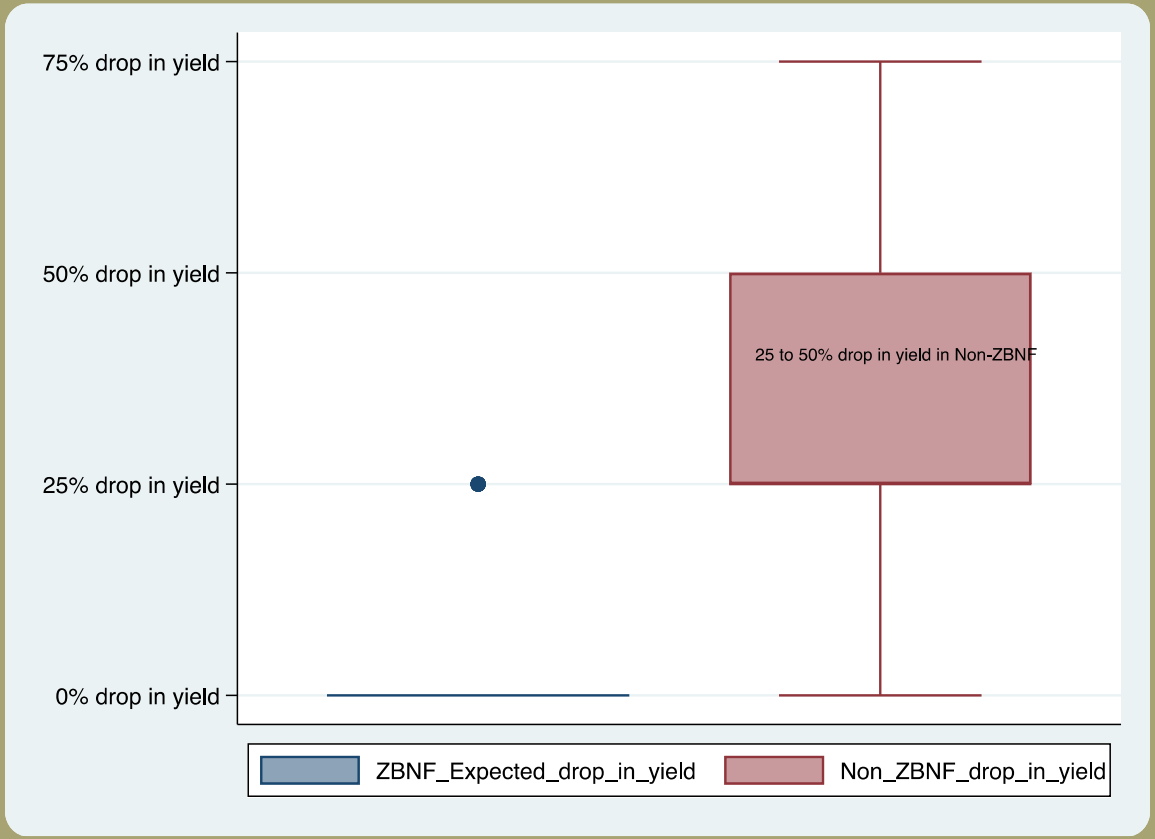
Analysis of Variance for Transformed Response

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	24	4.21433	0.17560	1.49	0.223
Cropp_sys	1	0.23406	0.23406	1.98	0.181
Flooded_days	4	0.64882	0.16221	1.37	0.293
Crop_stage	3	1.50915	0.50305	4.26	0.025
Cyclone_impact	1	0.11431	0.11431	0.97	0.342
Wind_damage	3	0.53618	0.17873	1.51	0.255
Rains	1	0.01368	0.01368	0.12	0.739
Submerge_crop	1	0.00032	0.00032	0.00	0.960
Uprooting	1	0.24477	0.24477	2.07	0.172
lodging	1	0.39671	0.39671	3.36	0.088
Stem_damage	1	0.84437	0.84437	7.15	0.018
Damage_frut_flower_branch	1	0.51674	0.51674	4.37	0.055
Int_crps	1	0.27635	0.27635	2.34	0.148
Submergence	1	1.18785	1.18785	10.05	0.007
Root_growth	4	0.48959	0.12240	1.04	0.423
Error	14	1.65428	0.11816		
Total	38	5.86861			

Percentage of damage in ZBNF-Pethai cyclone



Submergence, stem damage, & Crop stage



Pethai Cyclone There was 25 to 50% drop in yields in Non-ZBNF when compared to ZBNF fields