

**EFFECT OF DIFFERENT ORGANIC FERTILIZERS  
WITH  
VERMIWASH ON GROWTH AND YIELD OF OKRA**

*(Abelmoschus esculentus)* Cv. P – 11.

**D.S.M.M.SHIROMI MANGALA SAMIRAJA**



**FACULTY OF AGRICULTURE**

**EASTERN UNIVERSITY**

**SRI LANKA**

**2019**

# ABSTRACT

The experiment was conducted at the Crop Farm of Eastern University, Sri Lanka during the period January to April 2019 to study the effects of organic manures with foliar application of vermiwash on growth and yield of okra (*Abelmoschus esculentus*) plants, with the variety of P-11.

This experiment was laid out in a Completely Randomized Design (CRD) with eight replicates. The treatments were; viz., T1 = Control (Recommended fertilizer), T2 = Poultry manure 10 t/ha with 25% vermiwash, T3 = Poultry manure 10 t/ha with 50% vermiwash, T4 = Poultry manure 10 t/ha with 75% vermiwash, T5 = Poultry manure 10 t/ha with 100% vermiwash, T6 = Cattle manure 10 t/ha with 25% vermiwash, T7 = Cattle manure 10 t/ha with 50% vermiwash, T8 = Cattle manure 10 t/ha with 75% vermiwash, T9 = Cattle manure 10 t/ha with 100% vermiwash with eight replicates. Agronomic practices were carried out as per the recommendation by the Department of Agriculture, Sri Lanka.

The results showed that foliar application of 100% vermiwash with 10 t/ha poultry manure had a significant ( $p < 0.05$ ) effect on tested parameters of okra over the control. Poultry manure 10 t/ha with 100% vermiwash increased plant height (29.71%), number of branches/plant (36%), number of leaves/plant (37.03%), length of tap root (32.41%), leaf area (44.52%), leaf area index (25.95%), number of flowers/plant (50%), total dry weight/plant (43.17%), number of pods/plant (42.1%), length of pod (25.06%), girth of pod (23.25%), number of seeds/pod (38.59%), fresh weight of pods/plant (14.20%), dry weight of pods/plant (31.60%), chlorophyll content (13.21%), total yield/plant (33.73%) than the recommended fertilizer.

This result suggests that poultry manure 10 t/ha + vermiwash @ 100% is the potential source of plant nutrients for sustainable crop production. Because poultry manure and vermiwash are inexpensive and environmentally friendly organic sources which are easily available at our surrounding. It can be successfully substitute for chemical fertilizers as an alternative for safe food production.

# TABLE OF CONTENTS

ABSTRACT.....	I
ACKNOWLEDGEMENT.....	III
TABLE OF CONTENTS .....	IV
LIST OF TABLES.....	X
LIST OF FIGURES.....	XII
ABBREVIATION.....	XIII
INTRODUCTION.....	1
2. REVIEW OF LITERATURE.....	6
2.1 Okra ( <i>Abelmoschus esculentus</i> L.).....	6
2.1.1 Origin, history and distribution .....	7
2.1.2 Taxonomy.....	7
2.1.3 Botanical description .....	8
2.1.3.1 Stem and root .....	8
2.1.3.2 Leaves and flowers .....	8
2.1.3.3 Fruit and seeds .....	9
2.1.4 Uses and nutritional composition .....	10
2.1.5 Recommended varieties in Sri Lanka.....	11
2.2 Foliar application.....	12
2.2.1 Foliar application of nutrients.....	13
2.3 Vermiwash .....	13
2.3.1 Properties of vermiwash .....	14
2.3.2 Microbial diversity of vermiwash.....	15
2.3.3 Earthworms and their structure.....	16
2.3.4 Uses and functions of earthworms.....	16
2.3.5 Effects of vermiwash .....	16

2.3.5.1 Plant height .....	16
2.3.5.2 Number of leaves .....	17
2.3.5.3 Root growth .....	17
2.3.5.4 Leaf area.....	18
2.3.5.5 Flowering .....	18
2.3.5.6 Yield.....	19
2.3.5.7 Grain quality .....	19
2.3.6 Role of vermiwash in sustainable of crop production .....	20
2.4 Poultry manure .....	20
2.4.1 Land application of Poultry manure .....	20
2.4.2 Composition of poultry manure.....	21
2.4.3 Plant nutrients in poultry manure .....	22
2.4.4 Microbial population of Poultry litter.....	22
2.4.5 Uses of poultry manure.....	23
2.4.5.1 As a nutrient source .....	23
2.4.5.2 As a soil amendment.....	23
2.4.5.3 As an animal feed.....	23
2.4.5.4 As a fuel source.....	24
2.4.6 Effects of poultry manure .....	24
2.4.6.1 Plant height .....	24
2.4.6.2 Number of leaves .....	25
2.4.6.3 Root growth .....	25
2.4.6.4 Leaf area and leaf area index .....	25
2.4.6.5 Flowering .....	26
2.4.6.6 Yield.....	26
2.4.7 Problems related to the Poultry manure .....	27
2.5 Cattle manure .....	27

2.5.1 Importance of Land application of cattle manure.....	27
2.5.2 Composition of Cattle manure.....	28
2.5.3 Nutrients of cattle manure .....	28
2.5.4 Microbial population of cattle manure .....	29
2.5.5 Uses of cattle manure .....	29
2.5.5.1 Enhance soil fertility .....	29
2.5.5.2 Improve environmental conditions .....	30
2.5.5.3 Reduce diseases .....	30
2.5.5.4 Cattle manure as an energy source.....	30
2.5.6 Effects of cattle manure .....	31
2.5.6.1 Plant height .....	31
2.5.6.2 Number of leaves .....	31
2.5.6.3 Root growth .....	32
2.5.6.4 Flowering .....	32
2.5.6.5 Leaf area.....	32
2.5.6.6 Yield.....	33
2.6 Inorganic Fertilizers .....	33
2.6.1 Effects of inorganic fertilizers on environment.....	34
2.6.1.1 Nitrous oxide emissions.....	34
2.6.1.2 Methane emissions.....	34
2.6.1.3 Nitrate Pollution in groundwater due to fertilizer usage.....	34
2.6.1.4 Role of phosphatic fertilizers on environmental.....	34
2.6.1.5 Impact of heavy metal build-up in agricultural land.....	35
<b>3. MATERIALS AND METHODS .....</b>	<b>36</b>
3.1 Location and site .....	36
3.2 Climate .....	36
3.3 Variety .....	36

3.4 Experiment .....	36
3.4.1. Experimental design .....	37
3.4.2 Preparation of poly bags .....	37
3.4.3 Collection of cow dung and poultry droppings .....	38
3.4.4 Collection of vermiwash.....	38
3.4.4.1 Preparation of different concentrations of vermiwash.....	38
3.5 Agronomic practices .....	39
3.5.1 Preparation of potting media .....	39
3.5.2 Planting.....	39
3.6 Cultural practices.....	39
3.6.1 Gap filling and thinning out.....	39
3.6.2 Fertilizer application.....	40
3.6.3 Watering .....	40
3.6.4 Weeding.....	40
3.6.5 Pest and disease management.....	40
3.6.6 Foliar application of vermiwash .....	40
3.7 Growth assessments .....	41
3.7.1 Growth parameters .....	41
3.7.1.1 Plant height (cm).....	41
3.7.1.2 Number of branches .....	41
3.7.1.3 Number of leaves .....	41
3.7.1.4 Length of tap root (cm) .....	41
3.7.1.5 Leaf area (cm <sup>2</sup> ).....	41
3.7.1.6 Leaf area index.....	42
3.7.1.7 Number of flowers .....	42
3.7.1.8 Length of pod (cm) .....	42
3.7.1.9 Girth of pod (cm) .....	42

3.7.1.10 Total dry weight of plant (g).....	42
3.7.1.11 Days for 50% and 100% flowering.....	43
3.7.2 Yield and Yield components .....	43
3.7.2.1 Number of pods.....	43
3.7.2.2 100 seeds weight (g) .....	43
3.7.2.3 Total yield/plant.....	43
3.7.3 Quality parameters.....	43
3.7.3.1 Chlorophyll content .....	43
3.8 Statistical analysis .....	44
<b>4. RESULTS AND DISCUSSION .....</b>	<b>45</b>
4.1 Effect of organic manures with foliar application of vermiwash on growth parameters of okra.....	45
4.1.1 Plant height.....	45
4.1.2 Number of branches/plant .....	46
4.1.3 Number of leaves/plant.....	49
4.1.4 Length of tap root .....	50
4.1.5 Leaf area .....	51
4.1.6 Leaf area index .....	54
4.1.7 Days for 50% flowering and 100% flowering.....	55
4.1.8 Number of flowers/plant.....	57
4.1.9 Dry weight of leaves.....	58
4.1.10 Dry weight of stems/plant.....	60
4.1.11 Dry weight of roots/plant.....	62
4.1.12 Total Dry weight (leaves, stems, roots and pods).....	64
4.1.13 Length of pods.....	65
4.1.14 Girth of pods.....	67
4.2 Effect of different levels of organic manures with foliar application of vermiwash on yield and yield components of okra.....	70



4.2.1 Number of pods/plant.....	70
4.2.2 Number of seeds/pod.....	71
4.2.3 Fresh weight of pods.....	72
4.2.4 Dry weight of pods/plant.....	74
4.2.6 100 seed weight .....	78
4.3 Effect of different organic fertilizers with foliar application of vermiwash on quality parameters of okra.....	80
4.3.1 Chlorophyll content .....	80
<b>5. CONCLUSION .....</b>	<b>82</b>
<b>SUGGESTIONS FOR FUTURE STUDIES.....</b>	<b>83</b>
<b>REFERENCES.....</b>	<b>84</b>