IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

"EFFECT OF VARIOUS CONCENTRATIONS OF DIFFERENT FERTILIZERS ON GROWTH AND OTHER PARAMETERS OF *BRASSICA NIGRA* L."

Jha S. S[1]. Watakhere D. N.[2] and Jakhi P. S.[2]
Research Scholar[1, 2], Prof and Head
Department of Botany Institute of Science, Nagpur, India 440001

Abstract: India is an agriculture based country, farmers need adequate resources to replenish soil fertility and maintain the productivity of soil. Really, the green revolution has popularized the use of chemical fertilizers to achieve higher productivity. In the recent days Crop production through sustainable methods in agriculture become the need of the day as there is a growing concern to conserve the environment and make the earth last longer for future. But due to continuous and indiscriminate use of fertilizers, the natural fertility of soil has been lost and this activity has contaminated our soil, water and food. Farmers are always in need of searching alternative to replace the chemical fertilizers. By considering all the aspects of fertilizer applications and more productivity constant search of farmers for manures and fertilizers which are eco-friendly and biodegradable is going on. Sustainable agriculture has become important in the present days.

Fertilizers are any material of natural or synthetic origin that is applied to soil or to plants tissue (usually leaves) to supply one or more plant nutrients to the growth of plants. They play important role in increasing crop productivity and commonly used for all crops, application rate are depends on the soil fertility. Based on production process, the fertilizer can be categorized into three types: Chemical, Organic and Bio-fertilizers. The use of these fertilizers has its advantages and disadvantages in the context of nutrients supply, crop growth and environmental quality by considering importance of yield efforts has been taken to observe the effects of various grades of UREA, Potash and Vermiwash on the various growth parameters on *Brassica nigra* L.

Index Terms **- Fertilizers, *Brassica nigra* L., Nutrient management, Growth parameters and Bioferetilizers**

I. INTRODUCTION

The farmers use chemical fertilizers as a supplemental source of nutrients but they do not apply in balanced proportion. Moreover, neither chemical fertilizer nor bio fertilizer alone can help achieve sustainable crop production. However, fertilizer management practices of the agricultural area is very poor where most of the farmers use only urea as a fertilizer which is sometimes above recommended dose. They are not sufficiently aware of management practices and use of other fertilizers and bio fertilizer. Possibly these are the main causes of poor yield and soil health deterioration. Also, increase in N fertilizer led to increase in nitrate content of the crop tissues without significant increase in yield (**Custic** *et al*., **1994**). Increasing the use of chemical fertilizer led to high cost in vegetable production and creates pollution of their agricultural environment as well as affects the soil fertility. Fertilizers are any material of natural or synthetic origin that is applied to soil or to plants leaves to supply one or more plant nutrients to the growth of plants. They play important role in increasing crop productivity and commonly used for all crops, application rate are depends on the soil fertility. Based on production process, the fertilizer can be categorized into three types: Chemical, Organic and Bio-fertilizers. The use of these fertilizers has its advantages and disadvantages in the context of nutrients supply, crop growth and environmental quality. As per literature survey it becomes important need to use optimum utilization of each type of fertilizer and achieve balanced nutrient management for crop growth. According to literature survey increases in usage of chemical fertilizer alone create problem such as diminishing soil productivity and multiple nutrients deficiencies and disorders. The use of organic manures and fertilizers which are of biological origin is one of the important practices in this form of agriculture. Vermiwash is Biofertilizers that is known to bring about growth enhancement in a wide Variety of plants. The nutrients have to be present in the soil or provided through suitable sources on adequate amounts and forms usable by plants. There are two methods of application nutrients, first mainly through plant roots, i.e., soil dressing and the second through the foliar application. The soil dressing application is the suitable for give plant requirements at once time, then plants absorb there needed gradually and slowly during the growing season. However, foliar fertilization, it's necessary only for that plants which obtain additional nutrients such as N, P, K and or micro elements. The main advantage of foliar fertilization is the immediate uptake of the nutrients applied. The common fertilizers of different concentration (Biofertilizer, Potash and Urea) were used to study the plant growth regulators on vegetable plants. Broad leaf mustard (*Brassica* var.) is known as better yield of various field crops within short period. The chemical fertilizers and pesticides decreased soil fertility and caused health problems to the consumers. Due to adverse effects of chemical fertilizers,

interest has been stimulated for the use of organic manures (vermiwash) of these different concentration (10%, 20%, 30% &40%) and different concentration of chemical fertilizers (Urea and Potash) (2%, 4%, 6%& 8%). So in my project we are studying the effect of different concentration of Urea and Potash and compare the results with different concentration of Vermiwash treated plants. And finding the concentration of chemical fertilizer are significant and also which chemical fertilizer are best.

2. RESEARCH METHODOLOGY

Methodology for the present work includes following aspects.
An investigation entitled, the effect of different concentration of chemical fertilizers (Urea and Potash) and different concentration of organic fertilizer (Vermiwash) on growth (no. of leaves, length of leaves, leaves area ,height of plants, etc.), yield (gross weight)

Design and plan of layout:

First seeds are germinated in coco pit in seedbed and then seedlings are transplanted to field. The experiment was laid out in randomized block design with four treatments of same fertilizer and one block for control plants.
Experiment:
Field experiments
Design: Randomized blocks design
Plot size: 75*70cm
Distance between plants: 10cm
Total no. of plots: 13

Application of chemical Fertilizers-

The fertilizers are weigh the properly and make the stock solution. From these stock solution preparation of 2%, 4%, 6% and 8% of Urea and Potash in water. Spray of different grades of different chemicals on different blocks according to their concentration.

Application of Vermiwash-

First the vermiwash are prepared from waste green vegetables and slurry of cow dung and100 of earthworms for decomposing purposes. Water is added continuously and after 1-1.5 month's vermiwash is ready. Prepare different concentrations like10%, 20%, 30% and 40% and spray on different blocks of different mustard plants.
Experimental data for various vegetative and reproductive characters was taken and shown and enlisted in Tables, Plates and figures.

1. Average number of leaves-

Number of fully opened leaves was recorded in one block (each percentage categories) by counting total numbers of leaves and divided them by total number of plants present in this block. Number of leaves per plants was calculated.

2. Average Plant height-

The Plant height was measured from base of the plant to the tip of fully opened leaf on the main shoot and the mean plant height was calculated by length of total plant divided by total numbers of plants present in this block and expressed in cm.

3. Average length of leaf-

The length of leaf was measured from base of leaf to tip of leaf. Average leaf length was calculated by length of total leaves divided by numbers of leaves studied and the
Mean was expressed in cm.

4. Average leaf area-

Measured one large leaf of each plants in one block are put on graph paper and
Marked with the help of pencil and counted the surface area .And the mean of leaf area was calculated, dividing total area of leaves by total numbers of leaves studied, expressed in cm sq.

5. Percentage of flowering plants-

Counted total number of flowering plants in single block and divide them by total number of plants in this block and multiply by 100, calculating the percentage of flowering in each block.

6. Average no. of pods per plant-

Counted total no. pods in first 5 plants from each blocks and divide them by total no. of plants studied (5). Average no. of pods per plant was calculated.

7. Average no. of seeds per pod-

Counted total no. of seeds in every pods present in first 5 plant of each block and divide them by total no. of pods. Average no of seeds per pod was calculated.

8. Average weight of each pod-

Weigh the total no of pods from first 5 plants with their pedicel and divide them by total no. of pods weigh. Average weight of single pod was calculated.

9. **Gross productivity-**

Gross productivity of plant which means the total weight of plants. The weight of each plant was observed and the average gross productivity was obtained as total weight of plants divided by total numbers of plants study.

3. OBSERVATION

For the present Investigation, to study the Effect of various concentrations of different fertilizers on growth and other parameters of *Brassica nigra* L. experiments are arranged as per methodology and results obtained are tabulated in table no I to VIII and further explained with plates and figures which are mentioned like below.

Treatment details:

The details of treatment are giving below-
C- Control- without any treatment
U1- mustard are treated with 2% urea
U2- mustard are treated with 4% urea
U3- mustard are treated with 6% urea
U4- mustard are treated with 8% urea
P1- mustard are treated with 2% potash
P2- mustard are treated with 4% potash
P3 mustard are treated with 6% potash
P4- mustard are treated with 8% potash
V1- mustard are treated with 2% vermiwash
V2- mustard are treated with 4% vermiwash
V3- mustard are treated with 6% vermiwash
V4- mustard are treated with 8% vermiwash

PRE-HARVEST STUDY:

Morphological attributes:

Growth parameter:

Vegetative parameters:

Average no. of leaves-

- Average no. leaf of plant in the treatments C, U1, U2, U3 and U4 was found to be-6.24, 6.50, 6.60, 7.00 and 7.71 respectively. The average leaf area of plant was maximum in treatment- U4 (7.71) then followed by- U3, U2, C and U1.
- While in the treatments C, P1, P2, P3 and P4 was found to be-4.12, 4.30, 4.43, 4.02 and 4.47 respectively. The average no. leaf of plant was maximum in treatment- P4 (4.47) then followed by- P2, P1, C and P3.
- The treatment C, V1, V2, V3 and V4 was found to be-5.84, 7.24, 7.40, 7.99 and 8.23 respectively. The average no. leaf of plant was maximum in treatment V4 (8.23) then followed by V3, V2, V1 and C.

Average height of plant-

- Average height of plant in the treatments C, U1, U2, U3 and U4 was found to be-16.80, 18.29, 18.32, 19.85 and 23.23 respectively. The average height of plant was maximum in treatment U4 (23.23) then followed by U3, U2, U1 and C.
- While in the treatments C, P1, P2, P3 and P4 was found to be-14.67, 13.47, 16.05, 15.00 and 15.36 respectively. The average height of plant was maximum in treatment-P2 (16.05) then followed by P4, P3, C and P1.
- The treatment C, V1, V2, V3 and V4 was found to be 17.13, 19.11, 19.37, 21.47 and 24.98 respectively. The average height of plant was maximum in treatment V4 (24.98) then followed by V3, V2, V1 and C.

Average length of leaf-

- Average length of leaf in the treatments C, U1, U2, U3 and U4 was found to be-12.67, 12.96, 13.04, 13.96 and 16.70 respectively. The average length of leaf was maximum in treatment- U4 (16.70) then followed by U3, U2, U1 and C.
- While in the treatments C, P1, P2, P3 and P4 was found to be-12.32, 12.71, 13.15, 10.07 and 9.20 respectively. The average length of leaf was maximum in treatment- P2 then followed by P1, C, P2 and P4.
- The treatment C, V1, V2, V3 and V4 was found to be- 10.45, 11.05, 11.47, 12.23 and 12.96 respectively. The average length of leaf was maximum in treatment- V4 (12.96) then followed by V3, V2, V1 and C.

Average leaf area-

- Average leaf area of plant in the treatments C, U1, U2, U3 and U4 was found to be- 67, 50, 68, 86 and 114 cm sq. respectively. The average leaf area of plant was maximum in treatment- U4 (114cm sq.) then followed by- U3, U2, C and U1.
- While in the treatments C, P1, P2, P3 and P4 was found to be-67, 95, 89, 67 and 47 cm sq. respectively. The average leaf area of plant was maximum in treatment- P1 (95cm sq.) then followed by- P2, C&P3 and P4.
- The treatment C, V1, V2, V3 and V4 was found to be- 48, 53, 71, 86 and 117 cm sq. respectively. The average leaf area of plant was maximum in treatment V4 (117cm sq.) then followed by V3, V2, V1 and C.

Morphological attributes:

Reproductive parameters:

Percentage of flowering plants-

- Percentage of flowering plant in the treatments C, U1, U2, U3 and U4 was found to be- 93%, 86%, 71%, 92% and 85% respectively. The percentage of flowering plant was maximum in treatment- C (93%) then followed by- U3, U1, U4 and U2.
- In the treatments C, P1, P2, P3 and P4 was found to be-93%, 69%, 88%, 83% and 93% respectively. The percentage of flowering plant was maximum in treatment-C&P4 (93%) then followed by-P2, P3 and P1.
- The treatment C, V1, V2, V3 and V4 was found to be-93%, 74%, 82%, 73% and 89% respectively. The percentage of flowering plant was maximum in treatment- C (93%) then followed by V4, V2, V1 and V3.

Average no. of pods per plant-

- Average no. of pods per plant in treatment C, V1, V2, V3 and V4 was found to be14.20, 15.8, 23.60, 28.80 and 29 respectively. The average no of pods per plant was maximum in treatment V4 (29) then followed by V3, V2, V1 and C.

Average no. of seeds per pods-

- Average no. of seeds per pod in treatment C, V1, V2, V3 and V4 was found to be-9.80, 10.60, 11.40, 12.40 and 12.60 respectively. The average no. of seeds per pods of plant was maximum in treatment V4 (12.60) then followed by V3, V2, V1 and C.

Average weight of pods-

- Average weight of single pod in treatment C, V1, V2, V3 and V4 was found to be-0.270, 0.275, 0.280, 0.282 and 0.282 respectively. The average weight of plant was maximum in treatment- V4 (0.282) then followed by V3, V2, V1 and C.

Average gross weight of per plants-

- Average gross weight of plant in the treatments C, U1, U2, U3 and U4 was found to be-12.16, 12.58, 13.71, 16.15 and 22.3 gram respectively. The average gross weight of plant was maximum in treatment- U4 (22.3g.) then followed by- U3, U2, U1 and C.
- While in the treatments C, P1, P2, P3 and P4 was found to be-12.16, 16.80, 14.94, 9.53 and 6.92 gram respectively. The average gross weight of plant was maximum in treatment- P1 (16.80g.) then followed by- P2, C, P3 and P4.
- The treatment C, V1, V2, V3 and V4 was found to be-9.54, 7.23, 12.45, 5.92 and 6.92 gram respectively. The average gross weight of plant was maximum in treatment V2 (12.45g.) then followed by C, V1, V2 and V4.

TABLE –I

Chronological data of Experiment

Sr. No	Description	Date of Work
1.	Design of Experiment	18/12/2019
2.	Imbibitions of Seed	21/12/2019
3.	Preparation of Plastic Seed bed	21/12/2019
4.	Sowing of Seeds	21/12/2019
5.	Watering	Frequently after regular interval of three
6.	Observations for germination of Seeds	23-30/12/2019
7.	Observation of Shoot length	30/12/2019
8.	Preparation of Field plots	30/12/2019
9.	Transplantation	31/12/2019
10.	Treatment of Fertilizers	08 and 20/01/200
11.	Observations for number of leaf per plant	13,30 Jan,7,14 Feb 2020
12.	Observations for plant height	10//02/2020
13.	Observations for leaf length	10/02/2020
14.	Observations for leaf surface area	10/02/2020
15.	Observations for Flowering in plant	19/02/2020
16.	Observations for Gross Wt.	19/02/2020

TABLE –II AVERAGE NO. OF LEAF PER PLANT

Sr. No	Treatment	Average No. of Leaf per plant			
		13/01/2019	30/01/2019	07/02/2020	14/01/2020
		II A			
1.	Control	2.23	4.5	5.57	12.67
2.	2% Urea	2.17	4.5	6.36	12.96
3.	4% Urea	2.38	4.47	6.42	13.04
4.	6% Urea	2.3	4.85	6.77	13.96
5.	8% Urea	2.46	4.99	6.77	16.7
		II B			
1.	Control	2.28	4.33	5.53	4.33
2.	2% Potash	2.46	4.40	5.94	4.40
3.	4% Potash	2.61	4.47	6.18	4.47
4.	6% Potash	2.55	4.22	5.10	4.22
5.	8% Potash	2.77	4.40	6.30	4.40
		II C			
1.	Control	4.04	6.07	7.14	6.14
2.	2%	4.17	8.14	9.10	7.57
3.	4%	4.18	8.50	9.14	7.79
4.	6%	4.27	9.08	9.99	8.61
5.	8%	4.46	9.44	10.13	8.90

TABLE –III

Average height of plant in cm						
Sr.no.	Urea		Potash		Vermiwash	
1.	Control	16.8	Control	14.67	Control	17.13
2.	2%	18.29	2%	13.47	10 %	19.11
3.	4%	18.32	4%	16.06	20%	19.37
4.	6%	19.85	6%	15	30%	21.47
5.	8%	23.23	8%	15.36	40%	24.98

TABLE –IV

Observations for leaf length in Cm						
Sr.no.	Urea		Potash		Vermiwash	
1.	Control	12.67	Control	12.32	Control	10.45
2.	2%	12.96	2%	12.71	10 %	11.05
3.	4%	13.04	4%	13.51	20%	11.47
4.	6%	13.96	6%	10.07	30%	12.23
5.	8%	16.70	8%	9.2	40%	12.69

TABLE –V

Observations for leaf surface area in sq. cm						
Sr.no.	Urea		Potash		Vermiwash	
1.	Control	67	Control	67	Control	67
2.	2%	50	2%	95	10 %	53
3.	4%	68	4%	89	20%	71
4.	6%	86	6%	67	30%	86
5.	8%	114	8%	47	40%	117

TABLE –VI

Observations for Flowering % in plant as on date 19/02/2020						
Sr.no.	Urea		Potash		Vermiwash	
1.	Control	93	Control	93	Control	93
2.	2%	86	2%	69	10 %	74
3.	4%	71	4%	88	20%	82
4.	6%	92	6%	83	30%	73
5.	8%	85	8%	93	40%	89

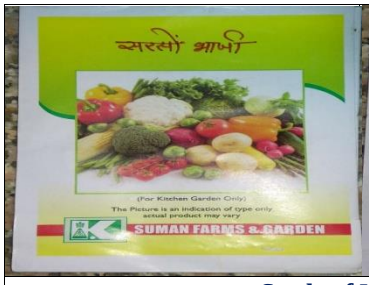
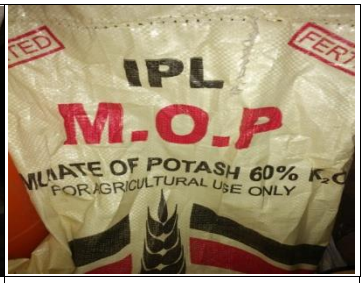
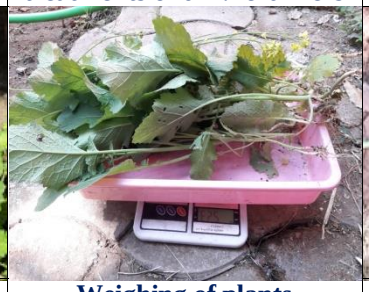
TABLE –VII

Observations for Average No. of pods per plant, No. of seeds per Pod, weight of single Pod in gram **for treatment of Vermiwash**				
Sr.no.	Treatment	Average No. of pods per plant	Average No. of seeds per Pod	Average weight of single Pod in gram
1.	Control	14.2	9.8	0.270
2.	10 %	15.8	10.6	0.275
3.	20%	23.6	11.4	0.280
4.	30%	28.8	12.4	0.282
5.	40%	29	12.6	0.282

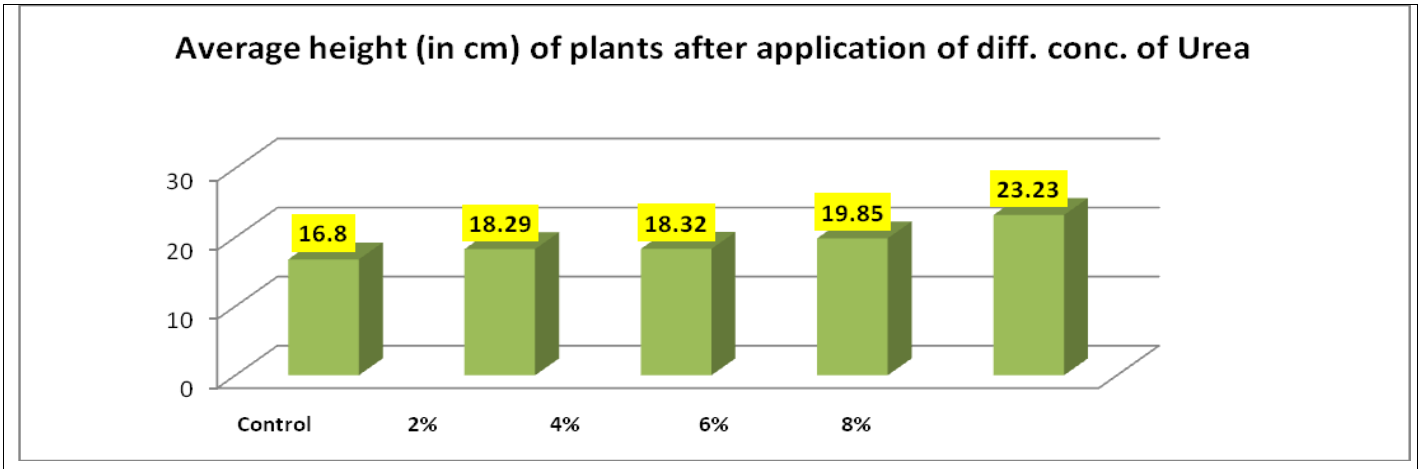
TABLE –VIII

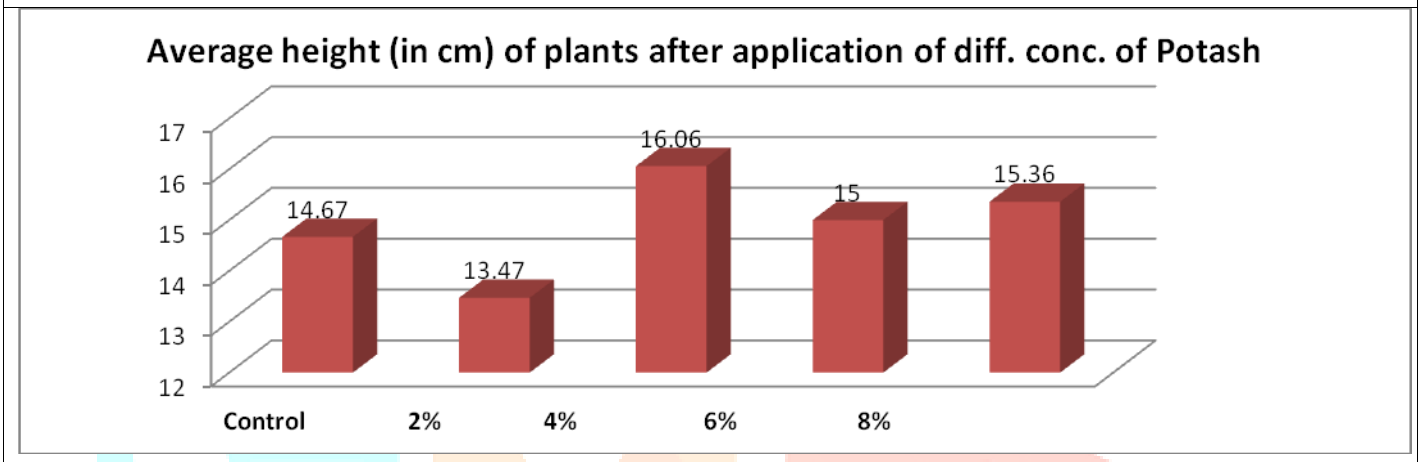
Observations for gross productivity in gm as on 19/02/2020						
Sr.no.	Urea		Potash		Vermiwash	
1.	Control	12.16	Control	12.16	Control	9.54
2.	2%	12.58	2%	16.8	10 %	7.23
3.	4%	13.71	4%	14.94	20%	12.45
4.	6%	16.15	6%	9.53	30%	5.92
5.	8%	22.30	8%	9.07	40%	6.92

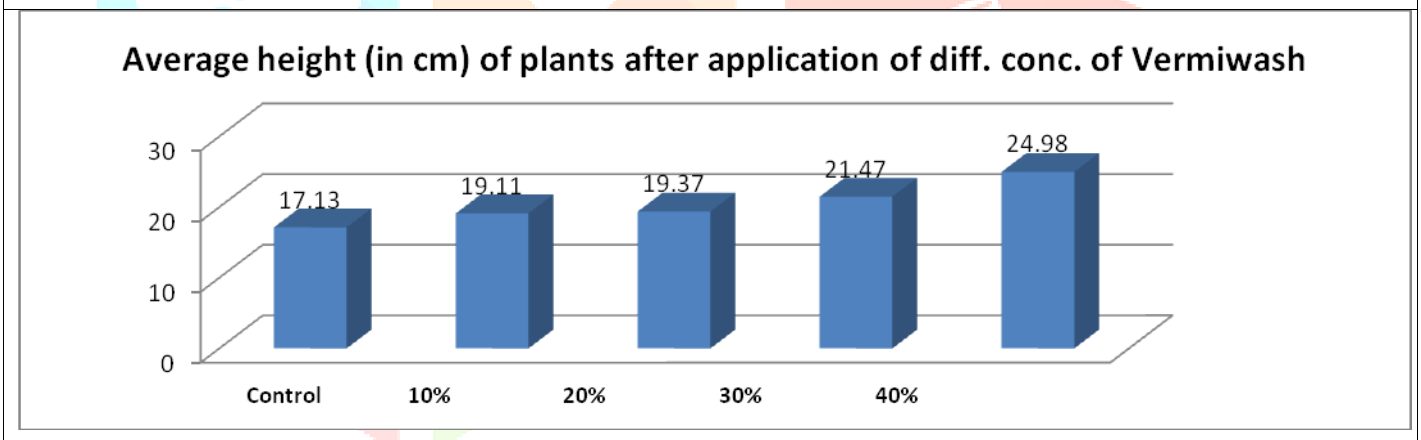
PLATE

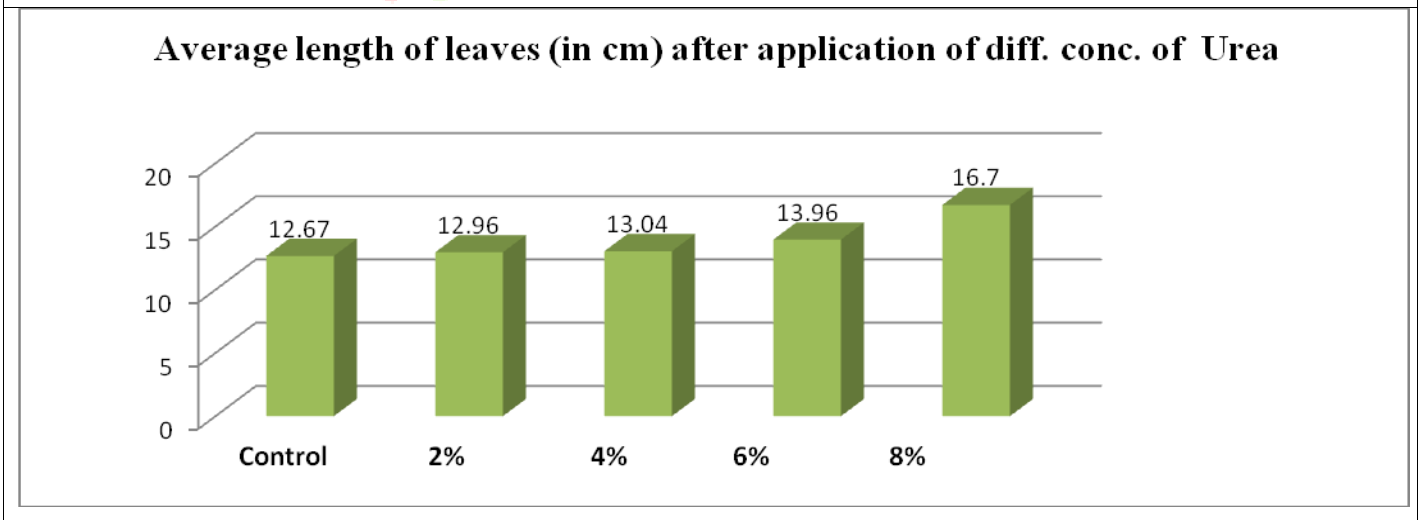
 			
Seeds of Mustard	Package of Urea	Package of Potash	
			
Weighing Of Fertilizers	Different grade fertilizers	Earthworms	Cow Dung Mixture
			
Cow Dung Slury	Washing Of Vermiwash	Re Washing Of Vermiwash	Diff. Grade Of Vermiwash
			
Seeds are showing in a coco pit	Watering of germinated seeds	Germinated seeds	Land preparation for plantation
			
Plots are ready for plantation	Planted seedlings	Plants are ready for treatments of diff. fertilizers	Spraying fertilizers
			
Chemical fertilizer (Urea and Potash) treated plants	Weighing of plants	Ready for measurements	

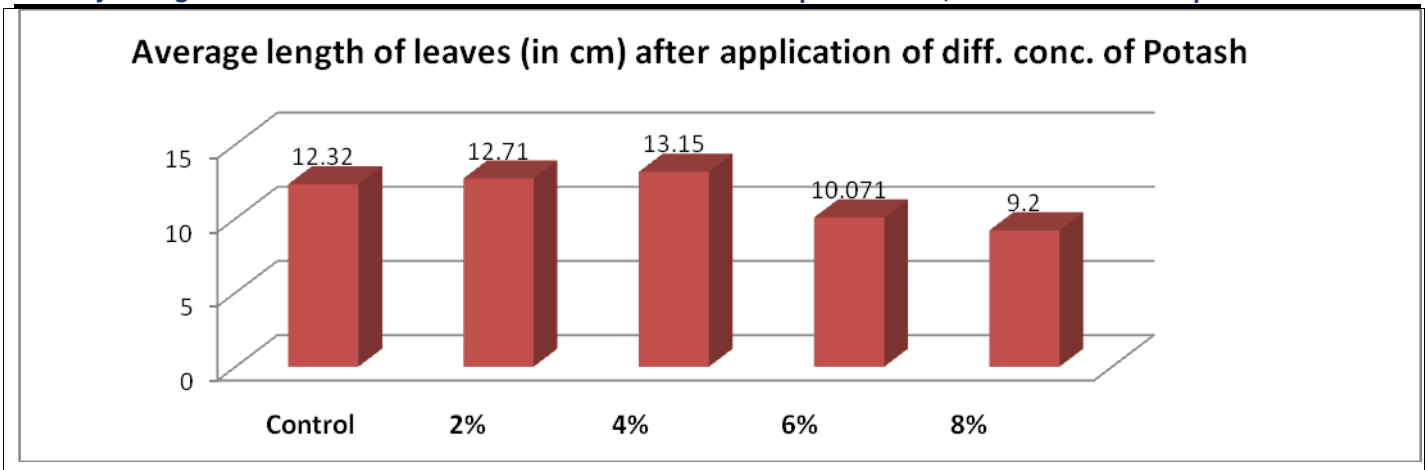
FIGURES

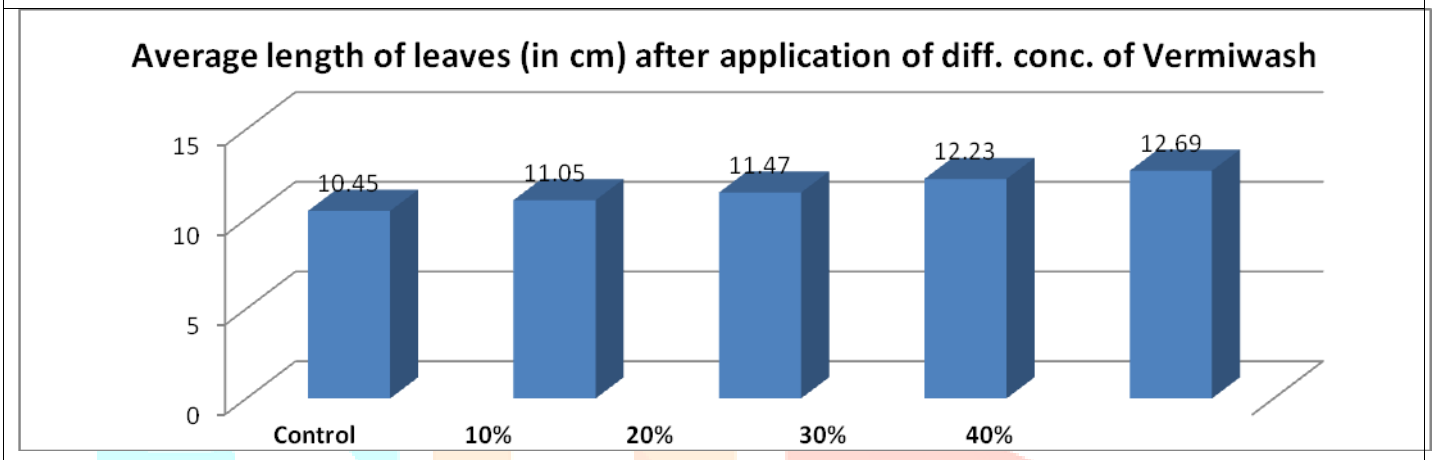

Average height (in cm) of plants after application of diff. conc. of Urea
30
20
10
0
16.8
18.29
18.32
19.85
23.23
Control
2%
4%
6%
8%

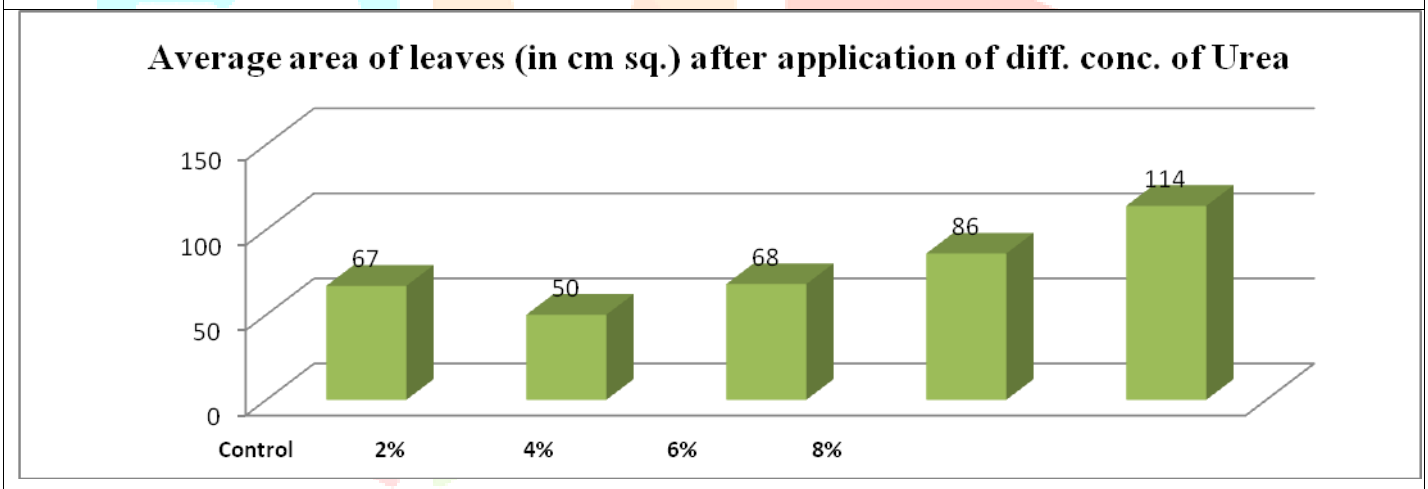

Average height (in cm) of plants after application of diff. conc. of Potash
17
16
15
14
13
12
14.67
13.47
16.06
15
15.36
Control
2%
4%
6%
8%

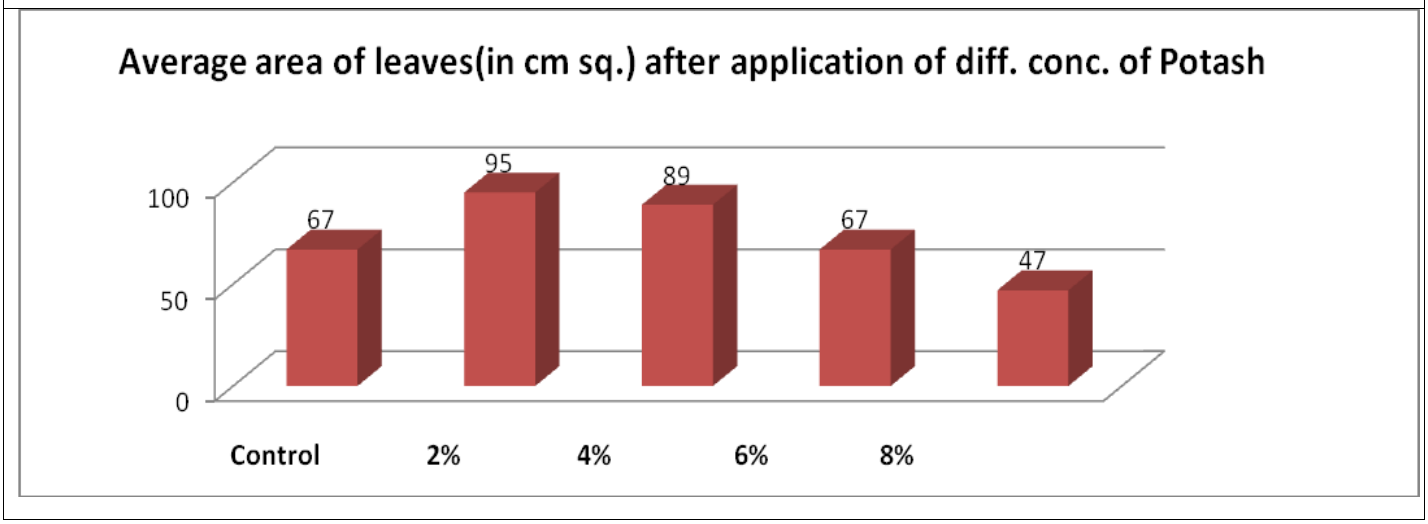

Average height (in cm) of plants after application of diff. conc. of Vermiwash
30
20
10
0
17.13
19.11
19.37
21.47
24.98
Control
10%
20%
30%
40%

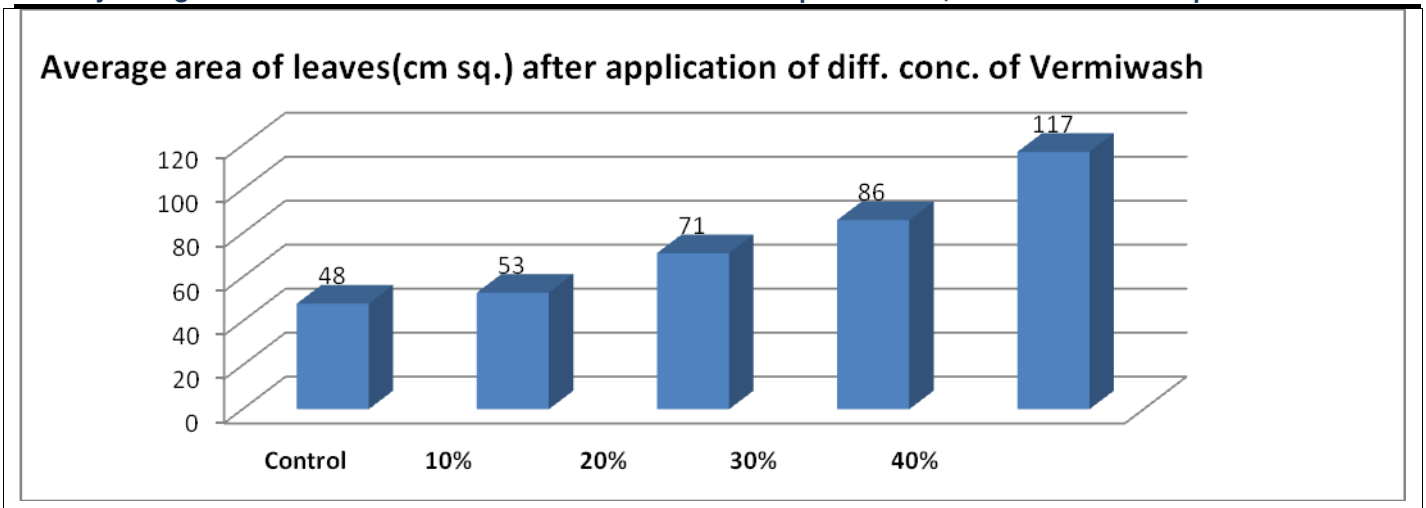

Average length of leaves (in cm) after application of diff. conc. of Urea
20
15
10
5
0
12.67
12.96
13.04
13.96
16.7
Control
2%
4%
6%
8%

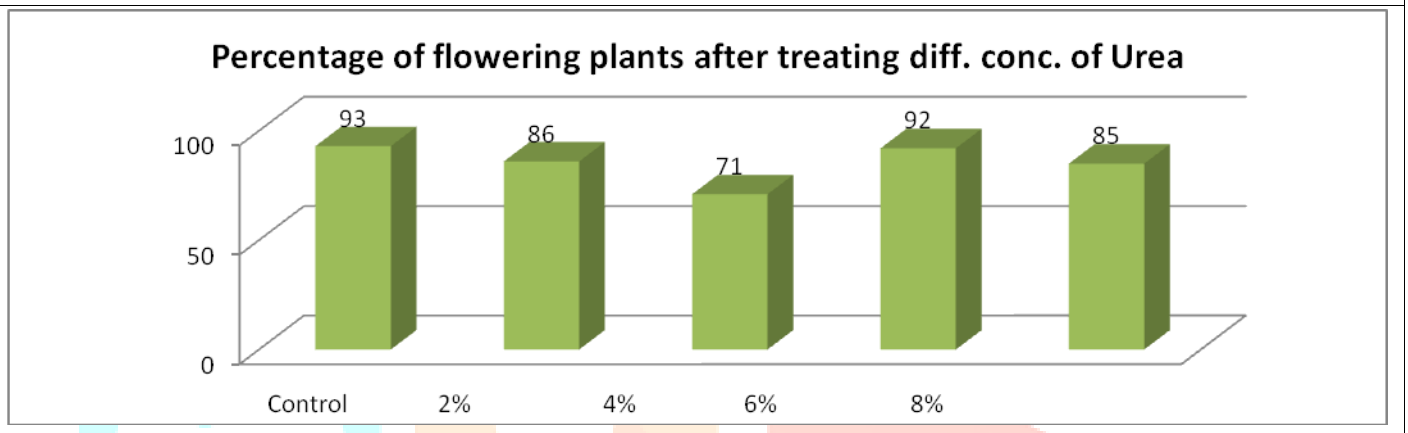

Average length of leaves (in cm) after application of diff. conc. of Potash
15
10
5
0
12.32
12.71
13.15
10.071
9.2
Control
2%
4%
6%
8%

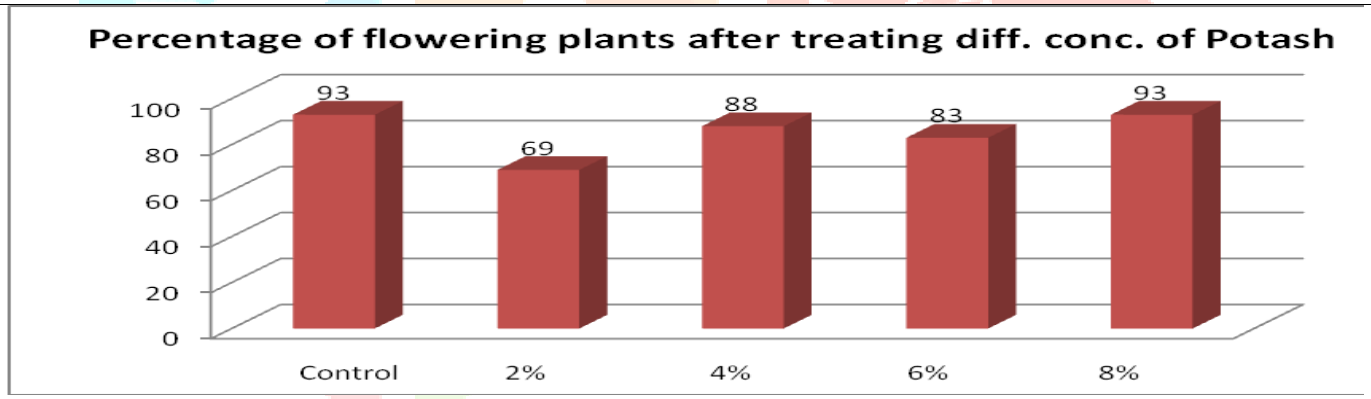

Average length of leaves (in cm) after application of diff. conc. of Vermiwash
15
10
5
0
10.45
11.05
11.47
12.23
12.69
Control
10%
20%
30%
40%

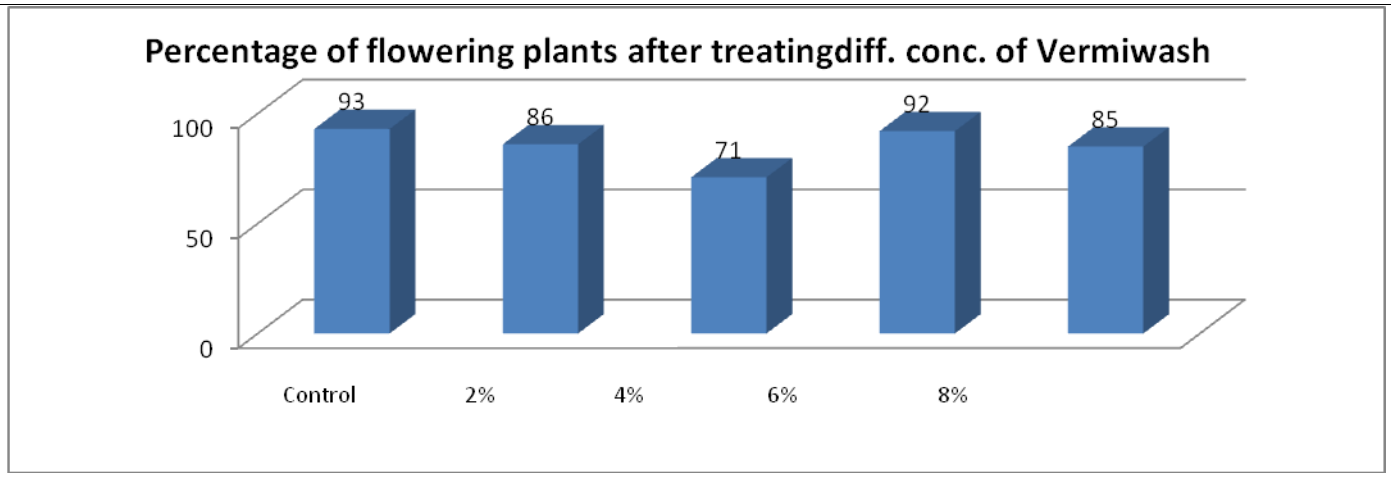

Average area of leaves (in cm sq.) after application of diff. conc. of Urea
150
100
50
0
67
50
68
86
114
Control
2%
4%
6%
8%

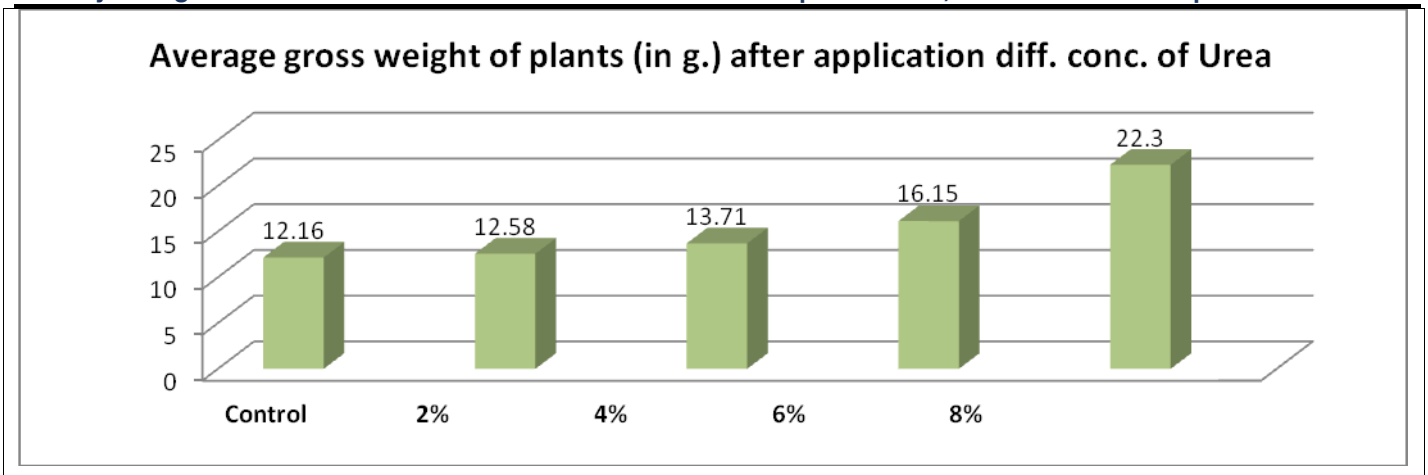

Average area of leaves(in cm sq.) after application of diff. conc. of Potash
100
50
0
67
95
89
67
47
Control
2%
4%
6%
8%

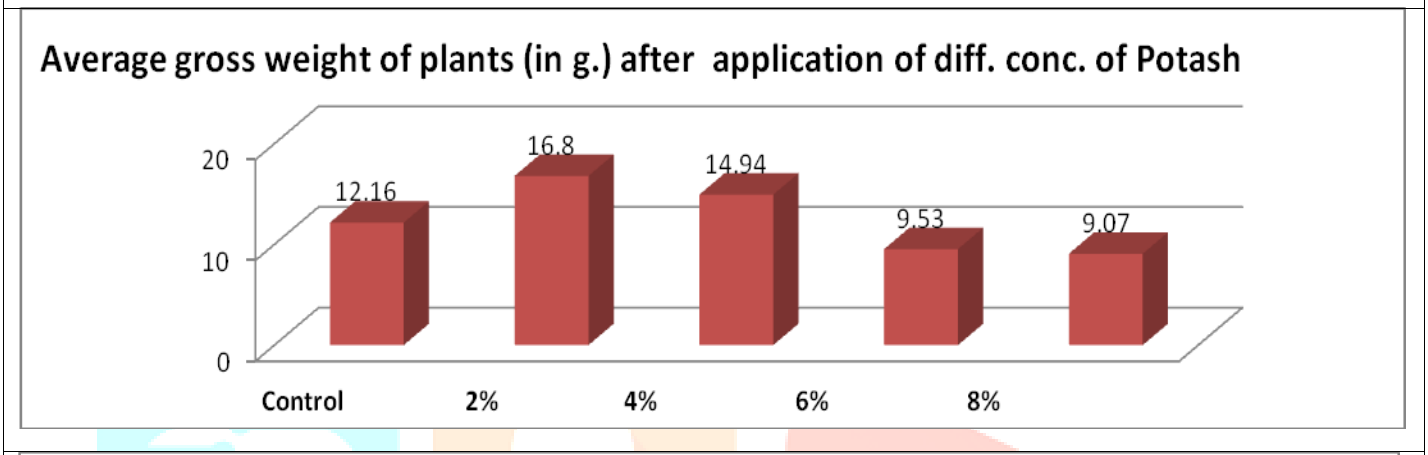

Average area of leaves(cm sq.) after application of diff. conc. of Vermiwash
120
100
80
60
40
20
0
48
53
71
86
117
Control
10%
20%
30%
40%

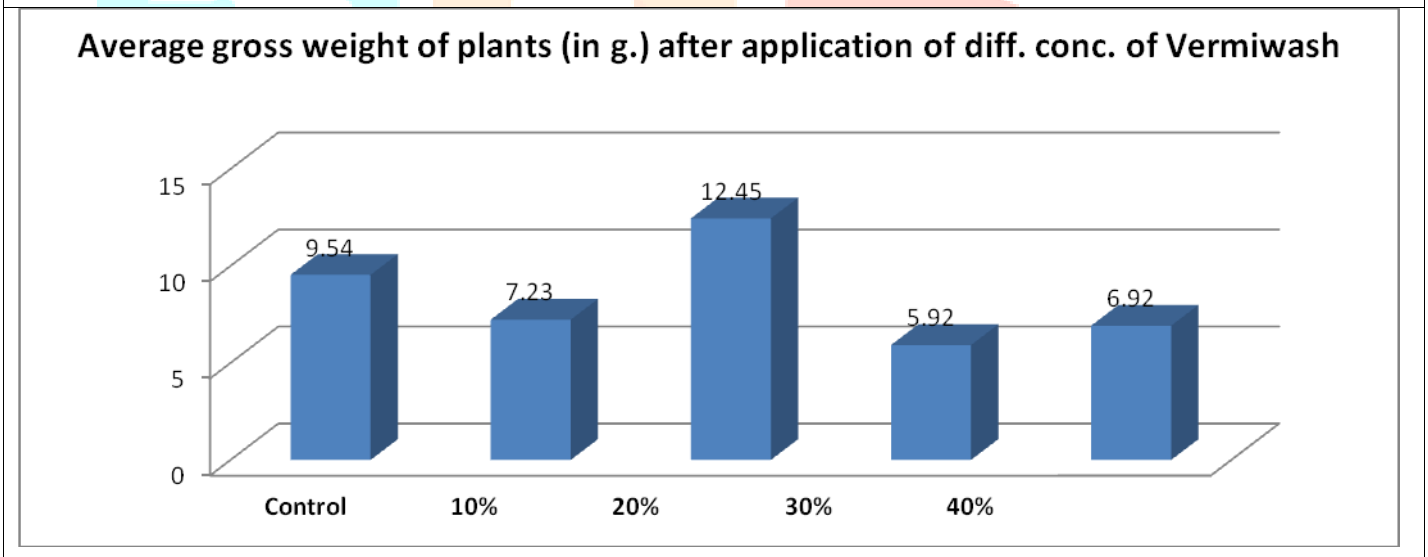

Percentage of flowering plants after treating diff. conc. of Urea
100
50
0
93
86
71
92
85
Control
2%
4%
6%
8%


Percentage of flowering plants after treating diff. conc. of Potash
100
80
60
40
20
0
93
69
88
83
93
Control
2%
4%
6%
8%


Percentage of flowering plants after treatingdiff. conc. of Vermiwash
100
50
0
93
86
71
92
85
Control
2%
4%
6%
8%







4. RESULT AND DISCUSSION

In the present investigation

- Average no. of leaf per plant observed maximum in 8% treatment of Urea Potash and Vermiwash.
- Treatment of urea shows positive effect on average height of plant as compared to Potash and Vermiwash.
- Effect of Vermiwash and Urea are more positive for leaf surface area as compared to Potash.
- Effect of Potash is more positive for different concentrations of both urea and Vermiwash..
- Varioush Concentrations of potash shows more positive result on Flowering %
- Maximum gross productivity is observed in various concentrations of urea.
- Treatment of 40% Vermiwash was more productive for Average No. of seeds per Pod for Average weight of single Pod and Average No. of seeds per Pod.
- 8% Urea and 40% Vermiwash are more effective for almost all parameters associated for vegetative and reproductive features of Mustard.

From present investigation results of vermiwash treatment were promising and similar observations observed by El-Assiouty and Abo-Sedera (2006) has studied effect of various biological and other fertilizers on growth of spinach plant with similar kind of results from Egypt. Effect of fertilizer observed in present study is similar to result obtained by Effects of organic fertilizer and spacing on growth and yield of lagos spinach (*Celosia Argentea* L.) Akinfasoye *et al.* (2008), Abd El-al, Faten S, (2009). Hardy Schulz and Bruno Glaser, (2012), Ramteke and Shirgave (2012), has Studied the Effect of Common fertilizers on Plant Growth Parameters of Some Vegetable Plants and observed similar effects. Ali *et. al (2013)* has studied Effect of Bio and chemical

fertilizers on growth, yield and chemical properties of spinach plant (Spinacia oleracea L.) and observed similar result for growth parameters. Similar results to vermiwash treatment observed by Varghese and Malaya, (2014) who has studied Vermiwash and its Effect on Growth of *Capsicum frutescens.* Jagtap et. al. (2015) has also studied effect of vermiwash on seed germination performance and obtained some different results. Verma *et. al*. (2018) Vermiwash is a rich source of vitamins, hormones, enzymes, macronutrients and micronutrients when applied to plants help in efficient growth. Yeshiwas *et al.*, (2018), also observed similar results for Manure on Growth and Yield of Lettuce (*Lactuca sativa* L.), has studied Effect of urea and some organic acids on plant growth, fruit yield and its quality of sweet pepper (*Capsicum annum*) with few different results from present investigation. Bosekeng 2019, has studied Response of Ethiopian Mustard (*Brassica carinata* A. Braun) to Different Levels of Vermicompost and very similar results obtained for different verities of mustard.

5. CONCLUSION

In the present study it has been observed that

Out of 3 different fertilizers Vermiwash shows significant results for growth and development for *Brassica nigra*. L. and out of four different grade of vermiwash, 40% grade was very significant. So it is concluded that vermiwash is better for growth and development of *Brassica nigra*. L. Before applications of different doses of fertilizers field trial may be advised in different soil conditions and type. The vermiwash proves to be an effective fertilizer which contributes the growth and yield of *Brassica* sp. when sprayed directly.

6. ACKNOWLEDGMENT

Authors are thankful to Dr. R. G. Atram Director Institute of Science, Nagpur for providing necessary lab and field facilities. We are also thankful to Mr. Tushar Buche, Shri Vijay Ambadare and friends for support during this work.

7. REFERENCES

A. A. Ramteke and P. D. Shirgave (2012), Study the Effect of Common fertilizers on Plant Growth Parameters of Some Vegetable Plants, *J. Nat. Prod. Plant Resour., 2 (2):*328-333

Abd El-al, Faten S, (2009), Effect of Urea and Some Organic Acids on Plant Growth, Fruit Yield and its Quality of Sweet Pepper (*Capsicum annum*), *Research Journal of Agriculture and Biological Sciences, 5(4):* 372-379.

Aisha, H. Ali; Magda M. Hafez; Asmaa, R. Mahmoud and M.R. Shafeek, (2013), Effect of Bio and chemical fertilizers on growth, yield and chemical properties of spinach plant (Spinacia oleracea L.). *Middle East Journal of Agriculture Research, 2(1)*: 16-20.

Akinfasoye, j. A., d. J. Ogunniyan, w. B. Akanbi and a. O. Olufolaji, (2008), effects of organic fertilizer and spacing on growth and yield of Lagos spinach (*Celosia argentea* l.), *Journal of agriculture and social research (JASR) vol*. 8, no.*1*, 70-77

Custic, M., M. Poliak, T. Cosic, 1994. Nitrate content in leaf vegetables as related to nitrogen fertilization in Croatia. *Acta Hori., 371*: 407-412.

F.M.M. EL-ASSIOUTY and S.A. ABO-SEDERA, (2005), Effect of Bio and Chemical Fertilizers on Seed Production and Quality of Spinach (*Spinacia oleracea* L.), *International Journal Of Agriculture & Biology, 07–6–*947–952.

Gagopale Bosekeng 2019, Response of Ethiopian Mustard (Brassica carinata A. Braun) to Different Levels of Vermicompost in North East, Botswana, World Journal of Agricultural Research, Vol. 7, No. 3, 112-118

Hardy Schulz and Bruno Glaser, (2012), Effects of biochar compared to organic and inorganic fertilizers on soil quality and plant growth in a greenhouse, *J. Plant Nutr. Soil Sci.* 175, 410–422 experiment Soil Biogeochemistry, Martin-Luther-University Halle-Wittenberg, von-Seckendorff-Platz 3, 06120 Halle/Saale, Germany

Jagtap D. K., Kashid L. M. and Jakhi P. S., (2015) Seed germination performance inTrigonella foenum-graecum L. under the influence of GA Op and Vermiwash, International Journal of Life Sciencwe, 3 (3), 225-231

Subha Mary Varghese and M Lakshmi Prabha, 2014, Biochemical Characterization of Vermiwash and its Effect on Growth of *Capsicum frutescens*, *Malaya Journal of Biosciences, 1(2):*86-91.

Subha Mary Varghese, M Lakshmi Prabha Malaya (2014), Journal of Biosciences 1(2):86-91 ISSN 2348 6236 print / 2348 3075 online Biochemical Characterization of Vermiwash and its Effect on Growth of Capsicum frutescens

Yebirzaf Yeshiwas, Bezawit Yikeber Belayneh Zewdie, Ayehu Chekol and Alachew Walle, (2018), Effect of Nitrogen Fertilizer and Farmyard Manure on Growth and Yield of Lettuce (Lactuca sativa L.) International Journal of Agricultural Research, 13 (2): 74-79.