EFFECT OF ORGANIC FERTILIZERS ON PIGMENT CONTENT AND COOKING TIME OF BHINDI

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ABSTRACT

Use of chemical fertilizers and pesticides is becoming more and more difficult due to its increasing cost and probable harmful effects on crops as well as human health. This is the reason many farmers nowadays are opting organic farming. As a result, organic fertilizers and pesticides are more in demand. The current research evaluates the efficacy of 3 easily available organic fertilizers including Beej Sanjeevani (as a seed treating agent), Humaur (foliar spray) and Myceemeal (soil fertilizer). The crop used was *Abelmoschus esculentus* L. Moench Var. Parbhani Kranti, commonly known as Okra or Bhindi. The effect of these fertilizers is determined by comparison of the Chlorophyll and β-Carotene content in treated and untreated plants, as well as cooking time taken by the pods of the treated and untreated plants. For determining the cooking time, four common methods of cooking were employed- deep fry, shallow fry, baking and steaming.

It was found that Humaur foliar spray gave the best results in terms of the pigment content as well as the cooking times, followed by Beej Sanjeevani seed treatment. Their results were also found out to be statistically significant, when compared to the control. Myceemeal and Myceemeal in combination with Humaur and Beej Sanjeevani, however performed poorly in the tests.

Keywords : Bhindi, Chlorophyll-a, Chlorophyll-b, β-Carotene, Retinol Equivalent

INTRODUCTION

Okra or Bhindi is also called lady's finger (*Abelmoschus esculentus* L. Moench) belongs to the family Malvaceae. It is cultivated as a vegetable and is a favourable dish in Indian meals. It is grown mostly for its tender green fruits which are cooked in various ways dehydrated or used as salad food (Abusaleha and Shanmugavenu, 1988).

Nowadays, the availability of farm yard manures is very poor and the cost of fertilizers is also increasing day by day. Since the chemical fertilizers are costly and also their shortage is experienced many times, it was thought necessary to study whether different seed treatment, hormones, biofertilizers, can enhance growth, yield and crop productivity of okra or bhindi by applying chemical fertilizers with reduced dose (Jamdhade & Joshi, 1998).

In a view of the significance of okra as a vegetable crop, the present research experiment was planned to find out the effect of crop productivity of various fertilizers available easily in the market. This research was set in the following objectives

1. To study physiological changes of bhindi by treating the seeds with Beej Sanjeevani (seed fortification).
2. To study physiological changes of bhindi by applying foliar application of Humaur.
3. To study physiological changes of bhindi by application of Myceemeal.
4. To study application of Humaur, treating seeds with Beej Sanjeevani and Myceemeal can increase the crop productivity.

MATERIALS AND METHODS

To study the crop productivity under the influence of various fertilizers of bhindi (*Abelmoschus esculentus* L. Moench) var. Parbhani Kranti. All experiments were conducted at Botanical Garden, Government Institute of Science, Aurangabad. The Field was laid out in randomised block design.

Type of field treatment (T)

T1: control (100 N : 50 P2O5 : 50 K2O kg/ha)

T2: control + Humaur 2ml/l

T3: control + Humaur 3ml/l

T4: control + Beej Sanjeevani (seed treatment)

T5: control + Myceemeal 500kg/acre

T6: Beej Sanjeevani (seed treatment) + Humaur 2ml/l + Myceemeal 500kg/acre

The spacing between adjacent rows was adjusted to 0.6 cm whereas the spacing between adjacent plants was around 0.3 cm. Urea was used as a Nitrogen source, whereas super phosphate and murate of potash were used as phosphorus and potassium source respectively. 2 seeds were planted per hill 0.3 cm apart. The seeds were hand dibbled, immediately after which, thiamate at 10kg/ha is applied and covered with soil as a plant protection measure.

Plot layout

Sr. no.	Replication			
	Row 1	Row 2	Row 3	Row 4
1	T1	T3	T5	T4
3	T3	T5	T4	T2
4	T5	T1	T3	T5
5	T6	T4	T1	T3

2.20m

4.20 m

Plot size: 4.20 × 2.20 m
Treatments: 6
Replications: 4
Design: Randomised Block Design (RBD)

Sr. no.	Type of study undertaken	Frequency	Harvesting time
1	**Chlorophyll content of leaves**	2	At 50 days and 70 days since sowing
2	**β-Carotene content of leaves**	1	At 50 days since sowing
3	**Cooking time of pods**	1	Harvested pods

1) CHLOROPHYLL CONTENT OF LEAVES

Chlorophyll content in freshly expressed juice at 50 and 70 days after sowing of seeds was estimated. It was extracted in prechilled 80% Acetone and observation at 663nm and 643 nm were read in a spectrophotometer. Using the observation coefficient, the amount of chlorophyll was calculated.

Procedure:

1. 1g of finely cut and well mixed representative sample of leaves or fruit tissue was weighed and put in a clean mortar
2. The tissue was grinded to a fine pulp with addition of 20 ml of 80% acetone
3. It was centrifuged at 5ooo rpms for 5 minutes. The supernatant was transferred to a 100ml volumetric flask.
4. The residue was again grinded in 20 ml of 80% acetone and centrifuged, the supernatant was transferred to the same volumetric flask.
5. The process was repeated until the residue became colourless. The mortar and pestle were thoroughly washed with 80% acetone and the washings were collected in the same volumetric flask.

6. The final volume was adjusted up to 100 ml using 80% acetone.
7. The absorbance of the extract was recorded at 645, 663 and 652 nm against solvent blank using a spectrophotometer

Calculation:

The Chlorophyll content was estimated using the following equations-

a) mg of Chlorophyll-a per gram of tissue = {[12.7 (A663) – 2.69 (A645)] × V} 1000×W

b) mg of Chlorophyll-b per gram of tissue = {[22.9 (A645) – 4.68 (A663)] × V} / 1000×W

c) mg of total Chlorophyll per gram of tissue = {[20.2(A645) – 8.02(A663)] × V} / 1000×W

where, A is absorbance at particular wavelength, V is the final volume of the extract and W is the fresh weight of the tissue extracted.

2) β-CAROTENE CONTENT IN LEAVES

Columns were prepared with following dimensions, 2.5 cm diameter and 5 cm height. They were filled with fine powder prepared by grinding aluminium oxide and sodium sulphate in equal proportions for 5 cm height.

1 g fresh leaves were grinded using mortar and pestle with 5 ml acetone and 5 ml petroleum ether to make the pigment extract. 10 ml of this extract was loaded on the column. Pigments were allowed to pass through the column. Elute was collected having β-Carotene up to 20 ml with petroleum ether. Optical density was read on the spectrophotometer at 450nm.

β-Carotene in fresh leaves was calculated using following formula

O.D. = 80 µg/g of β-Carotene

3) TIME OF COOKING

a) **Shallow fry:** This is a dry method of cooking. Fresh pods were chopped in small cylindrical pieces. As a lubricating layer, 50ml of oil was taken on a preheated pan. Bhindi pieces were allowed to cook for some time. After completion of cooking, remaining oil was measured and time taken for cooking was noted down.

b) **Deep fry:** Fresh pods were chopped in small cylindrical pieces. 50 ml of oil was taken in the pan. The time taken for cooking was noted down and the remaining oil after frying was measured.

c) **Baking method:** Oven was used for baking. Finely chopped pods were placed in the baking oven tray with 50 ml oil sprayed on the surface of the bottom of the tray. Baking oven was adjusted at 90°C. Cooking time was recorded along with a change in colour of the pods.

d) **Steaming method:** 100 g of freshly available pods chopped to cylindrical size and were taken in a boiling pan in which 25 ml water was taken. Gas was used as a source of energy. Time taken for cooking and change in colour was noted down.

The statistical analysis for all the test results were carried out by the method given by Panse and Sukhatame (1978).

RESULTS AND DISCUSSION

1. EFFECT ON COOKING TIME OF PODS

The cooking times of fruits of 5 plants in all treatments was measured during the experiment and are presented and graphically represented.

2. EFFECT OF CHLOROPHYLL AND B-CAROTENE CONTENT IN LEAVES

The Chlorophyll and β-Carotene from selected plants, average of them were analysed and the results of the same are presented in the table.

It is evident from the data in the table that is presented in percent increase or decrease over control. The result obtained during the investigation showed in control plots at the age of 50 days, leaves had 347 mg/kg of Chlorophyll-a, 391 mg/kg Chlorophyll-b and 730 mg/kg of total Chlorophyll.at the age of 50 days, total chlorophyll content enhanced by 7.90% due to Humaur over control. Seed treatment with Beej Sanjeevani showed enhancement to the extent of 6.05 to 7.78% for chlorophyll-a, 3.83 to 9.62% for chlorophyll-b and 3.97 to 5.80% for total chlorophyll for 50^{th} and 70^{th} day stages. However, Myceemeal and Myceemeal with Humaur foliar spray could not increase chlorophyll-a, chlorophyll-b and total chlorophyll as compared to control at both stages.

The β-Carotene content in leaves at the stage of 50 days of crop age. It is evident from the table that vitamin A Retinol Equivalent (RE) ranged from 841.66 to 958.33 per 100 g in leaves of plants treated with Humaur and Beej Sanjeevani. However,Myceemeal could not produce required RE over control.

In bhindi leaves, Chlorophyll-a, b and total chlorophyll in mg/kg showed increase or decrease over control. Close look in these characters under present investigation clearly indicated that

at 50 and 70 days age of the plant, Humaur foliar spray i.e. T2 treatment showed Chlorophyll-a content 2.3 to 11.52 mg/kg, chlorophyll-b 10.48 to 11.49 mg/kg and total chlorophyll 7.7 to 7.94 mg/kg. T4 produced chlorophyll-a 6.05 to 7.78 mg/kg, chlorophyll-b 3.83 to 9.62 and total chlorophyll 3.97 to 5.81 mg/kg. T3 produced chlorophyll-a 2.02 to 5.18 mg/kg, chlorophyll-b 2.13 to 2.32 and total chlorophyll 0.13 to 4.79 mg/kg. Myceemeal in T5 and Myceemeal along with Humaur showed no increase in Chlorophyll-a, b and total chlorophyll content at any stage. This was because of the non-availability of nutrients.

Vitamin A Retinol Equivalent (RE) observations clearly indicated that the application of Humaur and Beej Sanjeevani produced enhanced results compared to the control. Myceemeal as well as Myceemeal in conjugation to Humaur spray and Beej Sanjeevani could not produce more vitamin A possibly because of non-availability of nutrients. Similar types of results were recorded by Ries and Houtz, (1980), Dixit (1983), Menon and Srivastava (1984), Joshi (1995) and Jamdhade and Joshi (1998).

Table 1: Effect of fertilizers on cooking time (mins)

Treatment	Deep fry	Shallow fry	Baking	Steaming
T1	**6.8**	**6.9**	**13.4**	**5.4**
T2	**6.3**	**6.0**	**11.9**	**5.0**
T3	**6.7**	**6.6**	**12.2**	**5.1**
T4	**6.5**	**6.2**	**12.4**	**5.0**
T5	**7.0**	**7.7**	**13.6**	**7.1**
T6	**6.8**	**7.0**	**13.8**	**6.1**
S.E.	**0.049**	**0.047**	**0.078**	**0.054**
C.D. at 5%	**0.109**	**0.104**	**0.170**	**0.120**
F. (t) level	**5.52**	**38.20**	**25.43**	**50.81**

Table 2: Effect of fertilizers on Chlorophyll content mg/g in leaf extract of bhindi (%increase or decrease over control)

Treatment	Chlorophyll-a		Chlorophyll-b		Total Chlorophyll	
	50 days	**70 days**	**50 days**	**70 days**	**50 days**	**70 days**
T2	2.30	11.52	10.48	11.49	7.94	7.70

T3	2.02	5.18	2.32	2.13	4.79	0.13
T4	6.05	7.78	3.83	9.62	3.97	5.81
T5	-16.71	-7.49	-29.41	-29.41	-22.60	-21.48
T6	-1.44	5.76	-12.27	-5.61	-16.30	-3.24

Table 3: Effect of fertilizers on β-Carotene and Vitamin A content

Treatment	β-Carotene content (µg)	Vitamin A content (RE/100 g)
T1	5100	875.00
T2	**5750**	**958.33**
T3	4700	783.33
T4	5050	841.66
T5	3350	558.33
T6	4350	725.00

CONCLUSION

From the results obtained under present investigation carried out, it may be concluded that application of Humaur at the rate of 2 ml/l, 3 ml/l in 5 applications was found to be superior for quality of crop with respect to pigment content and average cooking time. However seed treatment was found to be second most superior for the quality. Myceemeal as recommended and in combination of Humaur could not affect growth and also poor results.

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