EFFECT OF MANURES ON BIOMASS PRODUCTION AND PHARMACO-
BIOCHEMICAL PROPERTIES OF SOME GREENS

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ABSTRACT: The present paper deals with the study of biomass production of manures in the
greens such as Amaranthus polygamus and Amaranthus viridis of the family Amaranthaceae and
Spinacea oleracea of the family Chenopodiaceae. The medicinal uses and pharmaco –
phytochemical analysis were also carried out for the plant species which are widely used as greens.

INTRODUCTION

The agricultural lands are depleted of soil fertility due to continuous cultivation. In
order to increase the soil fertility modern man uses inorganic fertilizers. Though they
promote the growth of crops, susceptibility is the negative impact by over utilization of
fertilizers. Application of chemicals is widely practiced to control plant disease in modern
agriculture. It also provides mutants of pathogens. To over come all these factors
application of organic manures is suggested (Gupta et al., 1995; Dixit, 1998;
Maheswarappa et al., 1999 ; Shankar et al., 2000 and Gomathynayagam, 2000).

Since greens play a vital role in maintaining health, to control and to cure certain diseases,
an attempt was made to study the effect of organic and synthetic manures for increasing
biomass productivity, with quality and pharmaco-bio chemical activities of the
greens belonging the families Amaranthaceae and Chenopodiaceae.

MATERIALS AND METHODS:
The seeds of Amaranthus polygamus L., Amaranthus viridis L., and Spinacea
oleracea were collected from Tamilnadu Agricultural University, Coimbatore. The
plants were cultivated during late winter and early summer when the temperature is below
30°C i.e during the months of January and February. The pH of the cultivated land is
acidic with the value of 8.1. The soil has high nutrient rate of nitrogen – 129.9 kg/ac,
phosphrous – 3.0 kg/ac and potassium – 500 kg/ac.

The seeds were shown in three different fields of varied soil composition in nursery beds as
follows:

T1 = pure soil
T2 = Soil : FYM: Goat manure: Composed leaf litter at 2:1:1:1
T3 = Urea : Super Phosphate : Uriate of potash at 2:1:1:1

The size of the field was 14 x 14 m and in each bed, 100 seeds of each plant were sown
and watered regularly with frequent weeding. The germination count was done 20 days after
sowing. The following parameters were
observed on the 20th, 40th and 60th days after sowing.

a) Root and shoot length of seedling
b) Fresh and dry weights of the seedling
c) Leaf count

The number of seedlings germinated was counted and the germination percentage was calculated. From each treatment, 5 seedlings were carefully removed from the soil without any damage and washed in running water to remove the adhering soil particles. The length of the root, shoot and entire plant were measured. The uprooted seedling is washed and the fresh weight was taken. Then the seedlings were kept in an oven for 48 hours at 40°C for taking dry weight. The number of leaves present in the seedling was counted before taking fresh and dry weights.

Biochemical Analysis:

The protein and carbohydrate content in the plant samples were estimated according to the methods of Lowry et al, (1951) and Anthrone reagent method respectively. The amino acid content was also estimated by ninhydrin reagent method. The entire procedure was repeated for plants grown in control, organic and inorganic fertilizers.

**TAXONOMY AND MEDICAL USES**

**Taxonomy:**

*Amaranthus polygamus* L.

Annual prostrate herb, leaves obovate, apex obtuse, usually mucronate, flowers in axillary clusters, urticle ovoid, slightly rugose or wabed, usually circumscissile.

*Amaranthus viridis* L

Annual herb, leaves alternate, ovate to deltoid and often emarginated, inflorescence terminal paniced slender spikes. Stamens and perianth lobes three each.

*Spinacia oleracea* L

Annual herb, stem ribbed, leaves simple, alternate, spathulate, long petiolated, inflorescence terminal and axillary, paniculate spike. Flowers green, small bracteate.

**Medical Uses:**

*Amaranthus polygamus* L

It has excellent properties to cure nervous disorders, paralytic disorder piles, blood vomiting etc., The seeds and roots have immense medicinal properties.

*Amaranthus viridis* L

It has great impact in reducing the body heat, blood pressure and appetite. It also cures various diseases like piles, constipation, common cold, urinary and abdominal disorders. It is an excellent medicine to cure throat pain also.

*Spinacia oleracea* L

It enhances digestion rapidly and reduces abdominal pain, prevents stone formation in the urinary tract. It cures constipation in a remarkable manner. This plant is used as a urinary disorders etc. Since it is rich in Vitamin A, it is good for eyes. It is also given to cure jaundice and when gargled with, it cures throat pain.

**RESULTS AND DISCUSSION**

The germination percentage of the studied greens is given in Table1. *Spinacea oleracea* shows 100% germination percentage in the
nursery bed of organic than that of inorganic fertilizers and control. The other two species *Amaranthus polygamus* and *Amarantus viridis* show moderate germination percentage of 87 and 88%. The root and shoot lengths and the length of entire plant were bigger for *Spinacea oleracea* (Table 2). It also shows better growth in nursery bed containing organic manures when compared to control and inorganic fertilizers. The growth performance of the species, *Amaranthus polygamus* was lower in comparison to other species.

The fresh and dry weights of the seedlings grown in organic and inorganic manures are given in Table 3. Fresh weight of *Spinacea oleracea* records higher value in the field with organic manure of 3000, 4000 and 3000 gms in 20, 40 and 60 days plant respectively in 14 x 14 m plot. Lower value was observed in synthetic manures with 450, 550 and 500 gms in the 20, 40, 60 days old plants in *Amaranthus polygamus*. In dry weight also *Spinacea oleracea* shows similar pattern as that of fresh weight. It had 1500, 2000 and 1500 gms in 20, 40 and 60 days old plants where as *Amaranthus polygamus* showed lower values when compared to other species.

The maximum number of leaf count was seen in the seedling of organic manure in *Amaranthus viridis* leaves of 54, 63 and 70 number in 20, 40 and 60 days old plants. Less number of leaf counts was observed in the seedling of control for *Amaranthus polygamus* with 35, 47 and 50 numbers. *Spinacea oleracea* also contributed considerable values in leaf count (Table 4).

**Biochemical analysis:**

The contents of protein, carbohydrate and amino acid are given in Table 5. The species *Amaranthus viridis* possessed higher protein of 7.937 mg/g in the seedling grown in organic manure and 2.562 mg/g in inorganic manure. The species, *spinacea oleracea* also possessed high protein content in organic manure (6.625 mg/g).

Higher carbohydrate content of 3.562 mg/g was noted in *Amaranthus viridis* which was grown in the soil containing organic manure. Next to *Amaranthus viridis*, the species, *Amaranthus polygamus* constitutes higher values of carbohydrate content (3.437 mg/g and 3.062 mg/g in organic and inorganic manures amended soil respectively). The greens *Spinacea oleracea* show less carbohydrate content that the other two species analyzed.

The content of amino acid, in the plants grown in organic manure soil was higher for all the three greens (7.250 mg/g, *Spinacea oleracea*; 7.125 mg/g - *Amaranthus polygamus* and 6.187 mg/g - *Amaranthus viridis*).

The present study reveals that the seed germination, biomass and pharmaco phytochemical properties of the green such as *Amaranthus polygamus*, *Amaranthus viridis* and *Spinacea oleracea* were increased significantly by the application of organic manures. Since natural manures stimulate the growth of root, shoot and length of entire plant, it is concluded that usage of natural manures will be helpful in increasing biomass production and it also increases protein, carbohydrates and amino acid content considerably.
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Table 1. Germination percentage of greens as influenced by organic and inorganic manures

| S.No. | Name of the plant         | Germination % |        |        |        |
|-------|---------------------------|---------------|--------|--------|--------|
|       |                           | Control       | Organic| Inorganic |
| 1     | *Amaranthus polygamus*    | 55            | 87     | 75     |
| 2     | *Amaranthus viridis*      | 70            | 88     | 80     |
| 3     | *Spinacea oleracea*       | 69            | 100    | 83     |

Table 2. Changes in root length, shoot length and entire plant length of greens as influenced by manures

| Treatment | *Amaranthus polygamus* | *Amaranthus viridis* | *Spinacea oleracea* |
|-----------|------------------------|----------------------|---------------------|
|           | 20 days (cm)          | 40 days (cm)         | 60 days (cm)        |
| Root length | Control               | 5.5                  | 7.1                 | 9.1  |
|           | Organic                | 7.7                  | 8.7                 | 9.3  |
|           | Inorganic              | 4.5                  | 6.7                 | 8.4  |
| Shoot length | Control               | 15.1                 | 17.1                | 19.3 |
|           | Organic                | 16.5                 | 18.2                | 21.3 |

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| Treatment | Inorganic | Control | Organic | Inorganic | Control | Organic | Inorganic | Control | Organic | Inorganic | Control | Organic | Inorganic | Control | Organic | Inorganic | Control | Organic | Inorganic |
|-----------|-----------|---------|---------|-----------|---------|---------|-----------|---------|---------|-----------|---------|---------|-----------|---------|---------|-----------|---------|---------|-----------|
| Entire Plant Length | 14.2 | 20.5 | 24.2 | 16.3 | 24.2 | 26.9 | 18.7 | 23.2 | 18.7 | 27.1 | 27.3 | 19.3 | 27.3 | 31.0 | 21.5 | 34.2 | 71.9 | 51.6 |
| | | | | | | | | | | | | | | | | | 45.2 | 48.8 |

Table 3. Changes in the fresh and dry weight of greens as influenced by manures (in grams in 14 x 14 m plot)

| Treatment | \textit{Amaranthus polygamus} | \textit{Amaranthus viridis} | \textit{Spinacea oleracea} |
|-----------|-----------------|-----------------|-----------------|
| Fresh weight | 20 days (cm) | 40 days (cm) | 60 days (cm) | 20 days (cm) | 40 days (cm) | 60 days (cm) | 20 days (cm) | 40 days (cm) | 60 days (cm) |
| Control | 300 | 400 | 300 | 800 | 900 | 800 | 2600 | 2800 | 2600 |
| Organic | 650 | 750 | 600 | 1150 | 1250 | 1300 | 4000 | 4000 | 3000 |
| Inorganic | 450 | 550 | 500 | 950 | 1100 | 950 | 3000 | 3000 | 3000 |

| Dry weight | 20 days (cm) | 40 days (cm) | 60 days (cm) | 20 days (cm) | 40 days (cm) | 60 days (cm) | 20 days (cm) | 40 days (cm) | 60 days (cm) |
| Control | 150 | 200 | 150 | 400 | 450 | 400 | 1300 | 1400 | 1300 |
| Organic | 325 | 375 | 300 | 575 | 650 | 625 | 1500 | 2000 | 1500 |
| Inorganic | 250 | 225 | 225 | 475 | 550 | 475 | 1500 | 1500 | 1500 |

Table 4. Changes in leaf count / plant of greens as influenced by organic and inorganic manures

| Treatment | \textit{Amaranthus polygamus} | \textit{Amaranthus viridis} | \textit{Spinacea oleracea} |
|-----------|-----------------|-----------------|-----------------|
| 20 days | 40 days | 60 days | 20 days | 40 days | 60 days | 20 days | 40 days | 60 days |
| Control | 35 | 47 | 50 | 51 | 54 | 66 | 49 | 50 | 55 |
| Organic | 43 | 50 | 63 | 54 | 63 | 70 | 47 | 59 | 60 |
| Inorganic | 40 | 49 | 56 | 52 | 57 | 68 | 45 | 55 | 59 |

Table 5. Changes in protein, carbohydrate and amino acid of greens as influenced by organic and inorganic manures

| S. No. | Name of the plant | Estimation of protein (mg/g) | Estimation of carbohydrate (mg/g) | Estimation of amino acid (mg/g) |
|--------|-----------------|-----------------|-----------------|-----------------|
|        | Control | Organic | In organic | Control | Organic | In organic | Control | Organic | In organic |
| 1 | \textit{Amaranthus Polygamus} | 3.750 | 3.875 | 4.187 | 2.812 | 3.437 | 3.062 | 6.687 | 7.125 | 6.687 |
| 2 | \textit{Amaranthus viridis} | 3.937 | 7.937 | 2.562 | 3.312 | 3.562 | 3.437 | 6.437 | 6.687 | 6.187 |
| 3 | \textit{Spinacea oleracea} | 2.875 | 6.625 | 3.750 | 2.875 | 3.062 | 2.875 | 6.437 | 7.250 | 6.375 |