CHAPTER VI

EVALUATION OF VARIOUS WEED COMPOSTS ON YIELD AND QUALITY OF FODDER MAIZE

The soils of the world are either being worn out and left in ruins or are being slowly poisoned. The restoration and maintenance of soil fertility has become a universal problem.

-Sir Albert Howard

6.1 Introduction

The dairy cattle enterprise is important in the livelihood base of marginal farmers principally due to its cash income generation. However the current levels of production are lower than the expected potential of most breeds kept by farmers largely due to nutritional problems in terms of quantity and quality of feed. As a result of increasing population, cash and food crops occupy the bulk of the farms leaving little land for forage cultivation. Therefore it does not meet the dry matter requirements of the animals. The quantity and quality of manure is also affected. The inevitable result is that dropping of overall farm productivity.

Maize (Zea mays L.) is one of the important among cereal crops next to wheat and rice in the world. The productivity of maize mainly depends on its nutrient management. The development of appropriate interventions in areas that allows for more efficient use of the maize crop as a source of fodder is considered as one of the viable option for increasing feed supply at the small holding farms where maize forms the main staple cereal (Kiruiro et al., 2001). Now a days the use of chemical fertilizers is becoming a limiting factor because of their high cost. These are not available at affordable prices to the farmers. So there is a need to reduce the cost of cultivation mainly on the cost incurred on the purchase of chemical fertilizer. The best option is to blend the chemical fertilizer with the cheaply available organic source of nutrients like FYM, green manure, dry manure, composts, vermicomposts etc.

The organic materials are scattered resource for the production of organic manures. There are various kinds of organic manures i.e. farmyard manure, green manure, compost, vermicompost etc., prepared from different agricultural or biological wastes. Organic manures increase the organic matter and organic matter in
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...turn releases the plant nutrients in readily available forms for the crops. The nutrients of manures are highly variable from plant to plant, place to place and method of preparation (Ellerbrock et al., 1999). Some or all of their nitrogen is changed to ammonia to nitrate and phosphorus is changed to phosphate (Russell, 1999). The recycling and use of crop residues or organic manure has been given more consideration for ensuring sustainable land use and agricultural production. The impacts of crop residues are surface applied or incorporated into the soil. Soil incorporated residues tend to decompose faster than surface residues and has a higher potential for N immobilization because of greater fluctuations in surface temperature.

Various studies have shown the importance of organic nutrient sources in improving crop yields and land productivity. Their integrated use with inorganic fertilizers was shown to increase the potential of the organic fertilizer sources (Asfaw et al., 1998; Helu et al., 1999; Heluf, 2002).

Fresh weeds can act as a very good starting material for the preparation of organic manure as compost which reduces bulk density up to 45%, increases the utilization efficiency of the compost. Compost is an organic fertilizer that can be made on the farm at very low cost. Compost is a decomposed organic matter and can be prepared from crop residues and animal manure. Most of these ingredients can be easily found around the farm. Composting refers to the biooxidation process of transforming wastes into a stabilized form and compost refers to the resulting product i.e. stabilized organic matter. A complete definition of composting as stated by many authors (Gray et al., 1971; de Bertoldi et al., 1983; Diaz et al., 1993) is: “the controlled exothermic biooxidative decomposition of organic materials by indigenous micro-organisms in a moist warm aerobic environment, leading to the production of carbon dioxide, water and a stabilized organic matter can defined as compost”.

Composting is an aerobic process in which microorganisms convert a mixed organic substrate into carbon dioxide \((\text{CO}_2)\), water, minerals and stabilized organic matter. Control of environmental conditions during the process distinguishes composting from natural rotting or decomposition (Zucconi and de Bertoldi, 1987). Controlled conditions particularly of moisture and aeration are required to yield temperatures (120 to 140 °F) conducive to the microorganisms involved in the composting process (Chen and Inbar, 1993). Generally, proper conditions for active composting include an adequate supply of oxygen for microbial respiration...
(approximately 5% of the pore space in the starting material), a moisture content between 40 and 65%, and C/N ratio between 20:1 and 40:1 (Rynk et al., 1992). The C/N ratio generally decreases because C is lost from the pile as CO₂. Little or no trace of the original feedstock materials should be discernible in the final product. It should be dark brown to black in color, consistent in size, soil-like in texture (Rynk et al., 1992). The pH frequently rises above 7 as ammonia is liberated during protein degradation (Rynk et al., 1992).

In composting one of the main factors that can be most influenced by technology and around which system designs are developed is the provision of oxygen to the composting mass. The carbon dioxide content gradually increases and the oxygen level falls. The average CO₂ plus O₂ content inside the mass is about 20%. Oxygen concentration varies from 15 to 20% and carbon dioxide from 0.5 to 5% (Mac Gregor et al., 1981). Chrometzka (1968) reports oxygen requirements that range from 9 mm l/g/h for mature compost to 284 mm l/g/h with fresh compost. Lossin (1970) mentions demands that ranged from 900 mg/g/h on day-1 of composting to 325 mg/g/h on day-24. Regan and Jeris (1970) report 1.0 mg oxygen/g volatile solids/h at a temperature of 30° C and 13.6 mg/g at a temperature of 45° C. So after one month intervals turning the whole material upside down was employed for providing oxygen and achieving uniform homogenous decomposition of the organic wastes. The pits were again irrigated and closed by dung-mud mixture.

The weed plants present in grounds, roadsides, around and between the crop form a raw material for manures. The weeds are rich in cellulose and other readily decomposable carbohydrates. The direct application of such undecomposed matter brings a deficiency of N compounds. Hence before using them as manure it is necessary to compost or partially decompose them as to increase the C/N ratio. This nitrogen content can be used for preparation of compost which can give better returns as compared to the green manures (Biradar, 2002). In the present investigation attempts have been made to compare the effects of the composts prepared from the selected weeds viz. Cassia tora L., Ipomoea muricata L. and Hyptis suaveolens (L.) Poit. on the growth and quality of the fodder Maize (Zea mays L.).

6.2 Materials and methods

6.2.1 Raw material and composting process

The fresh vegetation of Cassia tora L., Ipomoea muricata L. and Hyptis suaveolens (L.) Poit. was collected from the Dr. Babasaheb Ambedkar Marathwada
University campus, brought to laboratory and chopped into small pieces (2 - 3 cm) by iron cutter. Equal amount (13333 kg/ ha) of weed vegetation was used for the preparation of NADEP compost. The fresh vegetation of weeds was spread on the hygienic floor and another lot was also sprayed with 5 % dung slurry to enhance the composting process. These pretreated materials were set alternately along with well-composted inoculum and soil on each layer in the aerobic tanks. Each pit used for composting was 105 x 75 x 90 cm (l x w x h).

A minimum moisture content of 12 to 15 % is essential for bacterial activity (Miller, 1989). However even at levels of 45 % or below the moisture level can be limiting (Jeris and Regan, 1973) causing composting facility operators to prematurely assume that their compost process has stabilized (Richard, 1992). So sufficient water must be sprinkled in order to maintain the optimal moisture (50 - 70 %) over the material.

Finally amorphous, dark brown, well-fermented composts were obtained. The uniformly mixed samples (100 gm) of each treatment were collected immediately from the pits for nutrient analyses.

**6.2.2 Experimental site, design and treatments**

Field trial was carried out in the Research farm situated at Botanical garden of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad during August 2007 to January 2008. Experiment was laid out in a randomized block design (RBD) with six treatments as *Cassia* compost (CC), *Ipomoea* compost (IC), *Hyptis* compost (HC), Mix compost (MC) in equal proportion of above three (1:1:1), fertilizer alone (NPK) and absolute control (CON) with four replicates each.

All the prepared composts were transferred to the experimental area and incorporated into the top of soil (15 - 20 cm) by disking. Samples (100 g) of each treatment were collected for nutrient analyses and the contents of these manures are reported (Table 2). These treatments were compared with recommended dose of fertilizers alone (NPK) and control (CON). The fodder maize (*Zea mays* L.) var. ‘African Tall’ (Mahalaxmi) produced by Mahendra Hybrid Seeds Co. Ltd., Jalna was cultivated at the seed rate of 100 kg/ha. to plot with the size 9 m².

**6.2.3 Fertilizer applications and plant sampling**

Recommended dose of mineral fertilizers N, P₂O₅ and K₂O (120:80:40 kg/ha) were applied through urea, single super phosphate and muriate of potash. Whole quantity of phosphorus (P) and potassium (K) was applied as basal dose for all the
treatments except CON at the time of sowing and the two equal doses of nitrogen were applied at 30 and 56 DAS to NPK treatment alone. The crop was harvested during the early hours of the day at 10 - 20 % flowering stage. At the time of harvest, total yield of maize crop per plot was recorded. Samples (100 g) from each plot were randomly collected and kept in oven at 90°C till constant weight (48 hr). Dry matter was determined and the dried samples were grinded and passed through 0.5 mm sieve to get equal size and packed in air tight polythene bags for analyses of nutrient uptake.

6.3. Analysis

6.3.1 Growth analysis

The growth analyses of maize crop was noted at 51 and 75 DAS as plant height, circumference, number of leaves per plant, plant fresh weight, stem weight, root weight, total leaves weight, 4th upper leaf- length, width & weight and leaf area per plant was determined by gravimetric method (Shahane and Mungikar, 1984; Mungikar, 1986).

6.3.2 Chemical analysis

The chemical analyses were done by adopting standard analytical methods. The leaf chlorophyll contents (a, b and total) were estimated following Yoshida et al. (1976), using 80 % acetone as a solvent for extraction of pigments. Ash values were obtained by burning the moisture free samples in a muffle furnace at 600°C for 2 hours and calcium (Ca) Content was analyzed by titrating the acid soluble ash solution against 0.01 N KMnO₄ solution using methyl red as indicator (AOAC, 1995). Nitrogen (N) was estimated by micro-Kjeldahl method after digesting the sample with Conc. H₂SO₄ (Bailey, 1967) and crude protein (CP) was then calculated by multiplying N value with 6.25 as specified by AOAC, (1995). The dry samples were boiled in distilled water, filtered and amount of water soluble reducing sugars was determined in the filtrate by using Folin-wu tubes (Oser, 1979). The amount of phosphorus was measured following Fiske and Subba Rau (1972) as described by Oser (1979). Potassium (K) Content was determined on a flame photometer (Digital flame photometer) as suggested by Jackson (1973). Taking into consideration the yield of dry matter and N content in it, total N accumulated by above ground biomass was calculated for each treatment. The amount of extra N accumulated was worked out by subtracting the amount of N accumulated in control or untreated. With the help of extra N accumulated and that supply with either urea or various composts the efficiency of nitrogen used by the plants was calculated.
6.3.3 Statistical analysis

All the results were statistically analyzed using the standard statistical method of analysis of variance (ANOVA) test and treatments means were compared using the least significant difference (C.D., p = 0.05) which allowed determination of significance between different applications (Mungikar, 1997).

6.4 Results and discussion

6.4.1 Analysis of weeds used for compost preparation

Analysis of the weeds were done on the dry matter basis. Results from the Table 1 indicates that the dry matter (kg/ha) was found highest in the weed Hypsissuaveolens (3176 kg/ha) followed by the Cassia tora (3037 kg/ha), Mix (2373 kg/ha) and lowest in Ipomoea muricata (1857 kg/ha). The nitrogen content was found highest in Hypsissuaveolens (71 kg/ha) followed by Cassia tora (65 kg/ha), Mix (45 kg/ha) and lowest in Ipomoea muricata (42 kg/ha). The phosphorus percentage was found highest in the Cassia tora, followed by Ipomoea muricata and Hypsissuaveolens with same value and minimum in Mix. The percentage of potassium was found maximum in the Hypsissuaveolens, followed by the Ipomoea muricata, Cassia tora and minimum in Mix. The percentage of calcium was found maximum in the Hypsissuaveolens, followed by the Mix, Cassia tora and Ipomoea muricata respectively. Total ash percentage was found highest in the order as Hypsissuaveolens, Ipomoea muricata, Cassia tora and found less in Mix. The C/N ratio was highest in Hypsissuaveolens weed as 5.05, followed by Ipomoea muricata (4.98), Mix (4.56) and recorded less in Cassia tora (4.12).

6.4.2 Analysis of the weed composts

All manures were prepared from equal amount of fresh vegetation of above mentioned weeds i.e. 13333 kg/ha. Results from the Table 2 indicates that the fresh weight (kg/ha) was recorded highest in the treatment IC (9000 kg/ha) followed by CC (8722 kg/ha), HC (8500 kg/ha) and lowest in mix compost (8389 kg/ha). Dry matter (kg/ha) was found highest in the treatment of IC (6625 kg/ha) followed by the treatment of HC (6397 kg/ha), CC (6218 kg/ha) and lowest in treatment MC (6017 kg/ha). The nitrogen content was found maximum in the treatment of IC (55.7 kg/ha) followed by CC (53.5 kg/ha), HC (50.2 kg/ha) and lowest in MC (45.6 kg/ha). The phosphorus percentage was found highest in the treatment of HC, followed by the treatment of CC and IC and minimum in MC. The percentage of potassium was found maximum in the treatment of HC treatment, followed by the treatment of IC, MC and minimum in CC. The percentage of calcium was found maximum in the treatment of CC, followed by the
treatment of MC, HC and IC respectively. Total ash percentage was found in the order as IC, CC, HC and found less in MC treatment. The C/N ratio was highest in MC treatment as 32.46, followed by IC (31.80), HC (31.56), and recorded less in CC (30.25).

6.4.3 First Growth Analysis (51 DAS)

First growth analysis of maize crop was done at 51 DAS (Table 3). The tallest plant (223.1 cm) was acquired in CC treated plots followed in order by HC (214.4 cm), IC (210.0 cm), NPK (206.3 cm) and MC (205.6 cm) and smallest CON (180.6) plots where soil available nutrients were not sufficient to meet the crop requirement. The circumference of plant was more in HC treatment followed in the order by CC, MC, IC, CON and lastly NPK. The number of leaves were 11 in the MC treatment and all other treatments shows 10 leaves. The fresh weight of root was highest in MC treatment, followed in order by NPK, HC, CC, IC and less in CON treatment. The fresh weight of stem was maximum in CC treatment, followed in order by IC, MC, HC, NPK and it was minimum in CON treatment. Leaves weight was observed highest in MC treatment, followed by IC, CC, NPK, HC and lowest in CON treatment. Plant fresh weight was greater in CC treated plant where as secondly MC treatment gives better results followed by IC, HC, NPK and lowest in CON treatment. Width of the 4th upper leaf was observed highest in CC, followed by IC, MC, HC, NPK and lowest in CON treatment. The highest length of 4th upper leaf was found in the treatment of CC, followed in order by IC, MC, HC, NPK and it was lowest in CON treatment. The weight of the 4th upper leaf was highest in IC and found lowest in CON treatment. The maximum leaf area was found in the treatment of CC followed in order by IC, MC, HC, NPK, while it was found minimum in CON treatment.

The treatments of weeds shows mix results on the basis of statistics. Some values are statistically significant, while some are nonsignificant over control. Height of the plant, total plant weight, leaf area gives statistically sizeable results for all the treatments over control.

A number of researchers have reported an increase in leaf area of plants with the application of organic manure (Rao and Shaktawat, 2001, Van Delden, 2001). Increased leaf area has implications for light interception and dry matter production to support plant growth and yield (Vargas et al., 2002).
6.4.4 Chemical analysis of maize plant (51 DAS)

a) Chemical analysis of root

Results from the Table 4 shows that, the fresh weight of root was highest with the MC, followed in order by NPK, HC, CC, IC and CON. The dry matter yield was observed highest in MC, followed by IC, NPK, HC, CC where as it was lowest in CON treatment. The yield of nitrogen was more in MC, followed by HC, NPK, CC, IC and least in CON. Crude protein yield showed same results as nitrogen. When statistics was applied, it gives combined results for various treatments. CC and IC treatments shows maximum significant results over control as compare to other treatments.

The phosphorus percentage was highest in CC, IC and HC treatments with same value followed by MC, NPK and least in CON. Potassium percentage in the root was maximum in the treatment of CC while it was minimum in the treatment of CON. The calcium percentage was highest in CC, followed by HC, IC, MC, NPK and least in CON treatment. Ash percentage was observed highest in MC, while it was lowest in CON treatment.

b) Chemical analysis of stem

Table 5 shows that, the fresh weight of stem was highest in CC, followed in order by IC, MC, HC and NPK, while it was least in the CON. The yield of dry matter was found maximum in the treatment of CC, followed in order by and IC, MC, HC, NPK, while it was found minimum in the CON. The yield of nitrogen and crude protein was found maximum in the treatment of IC, followed in order by CC, HC, MC and NPK, while it was found minimum in the CON. The yield of reducing sugar was highest in IC, followed y CC and lowest in CON treatment. Fresh weight of the plant shows statistically significant results over control for all treatments. Values of Dry Matter, N and CP were statistically significant over control in CC and IC treated plants only. Results of Reducing sugar were statistically imperative for CC, IC, HC and MC, while NPK showed non-significant results over control.

The phosphorus content was found maximum in the treatments CC and IC with same value and lowest in CON. The potassium percentage was found maximum in the treatment of CC, followed by HC and minimum in CON. The calcium content in stem was found maximum in the treatment of CC, followed in order by IC, HC & NPK with same value, MC and minimum in CON treatment.
c) Chemical analysis of leaves

The fresh weight of leaves was found higher in MC treatment, followed by the order IC, CC, NPK, HC and minimum in the CON treatment (Table 6). The yield of dry matter was found maximum in the treatment of MC, followed in order by IC, CC, NPK, HC and lowest in CON. The yield of nitrogen and crude protein was found highest in IC, followed by CC, MC while it was lowest in CON. The yield of reducing sugar was found highest in the treatment of IC, followed in order by CC, MC, HC, NPK, while it was found lowest in CON. CC and IC treated plants shows statistically noteworthy results over control for all the parameters. Other treatments showed mingle results when statistics applied.

The phosphorus content was maximum in the treatment of CC, IC gives similar results with HC and minimum in CON. The potassium percentage was found maximum in the treatment of HC, followed in order by CC, IC, MC, NPK and minimum in CON. The calcium percentage was maximum in the treatment of CC, followed by IC, HC, MC, NPK and lowest in absolute CON. IC treatment shows highest percentage of ash, while it was lowest in CON treated plants.

Accumulation of dry matter and its distribution into different plant components is an important consideration in achieving desirable economic yield from crop plants (Singh and Yadav, 1989).

6.4.5 Second Growth Analysis (75 DAS)

During growth analysis of fodder maize at 75 DAS the maximum height (276.7 cm) of plant was found in the treatment of HC, followed in order by CC (275.8 cm), MC (268.1 cm), NPK (250.8 cm) and IC (248.8 cm) amendments over the CON (230.6 cm) plots (Table 7). The circumference of plant was more in CC treatment, followed by MC, IC and HC with similar values then NPK, while it was least in CON applied plots. Number of leaves were maximum in the treatments of CC, IC & HC treatments with similar values and least in CON treatment. The fresh weight of root was highest in MC, while lowest in CON. Fresh weights of total plant, stem, leaves, 4th upper leaf weight, width, length were maximum in CC treated plants while it was lowest in CON treatment. The maximum leaf area was found in the treatment of NPK, followed in order by CC, MC, IC and HC, while it was found minimum in CON.

Use of organic manure also reflected in the yield of maize confirmed with the earlier assertion of leaf area to be essential for simulation of light interception and photosynthate production (Stewart and Dwyer, 1999; Subedi and Ma, 2005).
Total plant weight and leaf area were statistically significant over control for all treatments, while plant height results were statistically significant for all treatments except IC treated plants.

6.4.6 Chemical analysis of maize plant (75 DAS)

a) Chemical analysis of root

The fresh weight of root was higher with the MC, followed in order by CC, HC, IC, NPK treatments than CON (Table 8). The dry matter yield was highest in MC followed by CC, NPK, IC, HC and it was lowest in CON treated plants. The content of nitrogen and crude protein was found maximum in the treatment of MC and minimum in the CON. All the results are statistically important over control except IC treated plants for N and CP.

The phosphorus and potassium contents in the root were maximum in the treatment of CC and minimum in CON. The calcium content in root found maximum in the treatment of IC, followed by CC, HC and minimum in CON. The ash Content in root found maximum in the treatment of MC, followed by HC, CC, NPK and CON, while it was lowest in IC treatment.

b) Chemical analysis of stem

Table 9 shows that, the fresh weight of stem was highest in CC, followed in order by HC, MC IC and NPK while it was least in the CON. The yield of dry matter was found maximum in the treatment of HC, followed in order by CC, MC, NPK, IC, while it was found minimum in the CON. The content of nitrogen and crude protein was found maximum in the treatment of CC, followed in order by HC, MC, IC, NPK, while it was found minimum in the CON. The yield of reducing sugar was highest in CC, followed by HC and lowest in CON treatment. Fresh weight values were statistically significant for all the treatments. Dry matter results were statistically considerable over control except IC treated plants. N, CP and RS results are statistically unhelpful only in the NPK treatment over control.

The phosphorus content was found maximum in the treatment of CC & IC, followed by HC while it was less in CON. The potassium percentage was found maximum in the treatment of IC and HC, while it was minimum in CON. The calcium content in stem was found maximum in the treatment of CC, followed in order by IC & HC with same value, MC, NPK and it was minimum in CON. The ash content in the CC treated plant showed highest results, while it was lowest in control treatment.
c) Chemical analysis of leaves

Results from Table no. 10 shows that the fresh weight of leaves was found higher in CC treatment followed in order by MC, IC, HC, NPK and lower in CON treated plant. The yield of dry matter was found maximum in the treatment of NPK, followed by MC, HC, CC, IC and lowest in CON treatment. The nitrogen and crude protein yield was highest in CC, followed in order by IC, MC, HC, NPK while it was lowest in CON treated plant. The yield of reducing sugar was found highest in the treatment of CC and lowest in CON. The results of the fresh weight, Dry matter, N, CP and RS were statistically significant over control for CC, IC, HC and MC treated plants over control while results were significantly unenthusiastic for NPK treatments.

The phosphorus content was highest in IC, followed by CC & IC with same value and minimum in CON. The potassium percentage was highest in the treatment of CC & HC with same value, followed by MC & IC with same value while it was lowest in absolute CON. Ca percentage was highest in CC, followed by IC, HC, MC, NPK and least in CON. Surprisingly ash percentage was more in CON and was lowest in IC.

Patra et al. (2000) proved that organic manure contains high content of nitrogen and phosphorus and a slow and sustainable availability of the nutrients can occur in various crops. Same results were obtained in mint by Chand et al. (2001).

6.4.7 Chlorophyll Analysis

Chlorophyll a, chlorophyll b and total chlorophyll contents varied from 0.43-0.64, 0.09-0.33 and 0.52-0.88 mg/g leaf fresh weight respectively at first growth analysis (51 DAS) (Fig. 1) and 0.51-0.77, 0.17-0.31 and 0.69-1.03 mg/g fresh weight respectively for second growth analysis observed after 75 days (Fig. 2). The chlorophyll contents were more in IC amended plots, followed by HC, CC, NPK, MC while it was found minimum in CON plots for the first growth analysis (Fig. 1). The chlorophyll contents were highest in IC amended plots, followed by MC, NPK, CC, HC while it was found minimum in CON plots for the second growth analysis (Fig. 2).

Chlorophyll content and photosynthesis are biochemical processes which increases the yield of maize (Mohamed et al., 2008).

6.4.8 Analysis of aerial biomass of maize plant

Table 11 gives details of analysis of total aerial biomass of fodder maize plant at final harvesting (77 DAS). The average yield of fresh aerial biomass (kg/ha) of fodder maize was highest (49028 kg/ha) in the plots received with IC treatment, followed in order by CC (47528 kg/ha), HC (46694 kg/ha), MC (45681 kg/ha), NPK (42778 kg/ha).
and lowest in CON (36335 kg/ha). The dry matter (kg/ha) of maize was found maximum in the treatment of MC (8495 kg/ha) followed in order by CC (7918 kg/ha), IC (7534 kg/ha), HC (7282 kg/ha) and NPK (5917 kg/ha), while it was lowest in CON (5498 kg/ha). IC is the best treatment for the fodder maize production among all.

The nitrogen content (kg/ha) was found maximum in the amendment of IC (109.9 kg/ha), followed in order by CC (106.7 kg/ha), MC (101.5 kg/ha), NPK (75.5 kg/ha) and HC (73.0 kg/ha), while it was minimum in CON (46.6 kg/ha). The crude protein (kg/ha) content behaved same in this regard. The reducing sugar content (kg/ha) was observed maximum in the treatment of CC (363.5 kg/ha), followed by HC (351.2 kg/ha), IC (348.2 kg/ha), MC (312.7 kg/ha) and NPK (280.9 kg/ha), while it was found least in CON (184.5 kg/ha) (Fig. 4).

On the basis of statistical analysis it has been observed that all the values of fresh weight, dry matter, nitrogen, crude protein (kg/ha) and reducing sugar (kg/ha) were statistically significant in all the treatments over control. Ipomoea found best for the composting.

The phosphorus content was found maximum in the treatment of CC and IC with same values, while it was lowest in CON. The potassium content in the maize was found highest in the treatment of HC then CC, MC, IC, NPK and was found lowest in CON. The calcium percentage was found maximum in the IC applied plots followed in order by CC, HC, NPK, MC and lowest in CON treated plots. Ash percentage was more with CC, followed by IC and lowest in MC.

**6.4.9 Percent increase over control and N efficiency ratio**

Table 12 expose percent increase over control of all treatments. The percent increase over control for fresh weight was found maximum with the application of IC (35), followed in order by CC (31), HC (29), MC (26) treatments and minimum in NPK (18) applied plots. The percent increase over CON for dry matter was found maximum with the application of MC (55), followed in order by CC (44), IC (37), HC (32) and minimum in NPK (8) (Fig. 5). The percent increase over control for nitrogen and crude protein was highest in IC treatment (136), followed by CC (129), MC (118), NPK (62) and lowest in HC (57). Percent increase over control for reducing sugar was more in CC (97), followed by HC, IC, MC while it was less in NPK treatment (52).

Table 13 indicates that the nitrogen efficiency ratio for fresh vegetation was highest in the plots treated with IC (228), followed by CC (209), HC (207), MC (205) and lowest in NPK (54), while the nitrogen efficiency ratio for dry matter was highest in
MC (66), followed in order by CC (45), IC (37), HC (36) and lowest in NPK as 3 (Fig. 6).

All the results are calculated on the dry matter basis and the values are the means of four replicates. Based on the results it is clear that the combined application of organic manure and chemical fertilizers are proved to be one of the best sources of nutrients for fodder maize as returned by increased crop growth, yield relative to the simply application of inorganic fertilizers and absolute control.

### 6.5 Conclusion

When we see the analysis of fresh weeds used as a source of nutrients, *Hyptis* stands first for dry matter & nitrogen content followed by *Cassia*, Mix and *Ipomoea*. But when this fresh vegetation get transformed into compost, sequence get drastically changed as *Ipomoea* showed highest result followed by *Cassia* then *Hyptis* and lastly Mix for fresh vegetation of the compost. This sequence get changed for dry matter as *Ipomoea* stood first followed by *Hyptis*, *Cassia* and then Mix. Where as input of Nitrogen in the compost was highest in *Ipomoea*, followed by *Cassia*, *Hyptis* and lastly Mix. This input of Nitrogen from weed composts decides the Nitrogen efficiency ratio for fresh weight, dry matter, & Nitrogen. The N efficiency ratio for fresh weight is highest in *Ipomoea*, followed by *Cassia*, then *Hyptis* and lastly Mixed treatment. For dry matter this sequence get reshuffled and Mix treatment recorded highest N efficiency , followed by *Cassia* compost, *Ipomoea* compost, then *Hyptis* and lastly NPK treated plots. In NPK treatment input N was 120 kg/ha.

*Ipomoea* compost had given better results for percent increase over control for fresh weight and Nitrogen while Mix compost given better results for dry matter. *Cassia* compost recorded best results for reducing sugars followed by *Hyptis* then *Ipomoea*, Mix and lastly chemical fertilizer.

Though the *Cassia* is legume it could not compete with *Ipomoea*. *Ipomoea* is the most productive weed climber in habitat & gives huge vegetation & biomass per square meter and per unit time. *Ipomoea* and *Hyptis* are the non traditional weeds had given statistically significant results and given tough competition with the traditional legume weed as *Cassia* & served as the better source of plant nutrients for the crop plants. For I\(^{\text{st}}\) and II\(^{\text{nd}}\) growth analysis results for fresh weight of the maize plant *Cassia* compost proved to be the best one but lastly for aerial biomass it could not compete with *Ipomoea* and Mixed compost.
The application of different composts prepared from the selected weeds significantly increased the growth, nutrient uptake and yield of maize. Combination of Weed composts with inorganic fertilizers gives efficient results as compare to alone inorganic fertilizer. Noxious weed *Hyptis* is proved to be better source of nutrients for improving the nutrient uptake and yield of the fodder maize. **Nitrogen efficiency of weed composts were three times more than those inorganic fertilizers.** *Ipomoea* composts are the best alternative for the inorganic fertilizers in view with [nutritional value and yield of the fodder maize followed by *Cassia*.](#)

From the above results it is concluded that weeds are not crop enemies but their better management results into production of high quality composts for low cost farming.