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# EVALUATION OF ORGANIC AND INORGANIC FERTILIZERS ON CHLOROPHYLL CONTENT, LEAF AREA AND YIELD OF MAIZE

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**ABSTRACT**

***The present study aimed to evaluate the effect of Crotalaria weed manures along with inorganic fertilizers on chlorophyll content, leaf area and yield of maize. A field experiment was conducted at Dr. Babasaheb Ambedkar Marathwada University, Aurangabad with six treatments and four replicates. The six treatments were green manure (GM), compost (CM), vermicompost (VM), dry leaf manure (DM), chemical fertilizers (FE) and control (CO). The observations were recorded at 101 days after sowing (DAS). Based on the results, it is cleared that the application of compost (CM) was more effective in increasing the chlorophyll content, leaf area and yield of maize.***

**KEYWORDS**: ***Crotalaria manures, fertilizers, chlorophyll, leaf area, yield, maize***

## INTRODUCTION

Maize (*Zea mays* L.) is one of the most important cereal crops of the world (Ghimire *et. al.*, 2015; Ashraf *et. al*., 2016). It requires a harmonic supply of macronutrients especially NPK (Vari and Pepo, 2014). Among these, nitrogen is one of the main elements of the chlorophyll. It means the nitrogen supply of plants is strongly connected with the leaf surface area (Pagola *et. al.,* 2009) and relative chlorophyll content. Chlorophyll content of the leaves provides information about the physiological condition of the plant (Carter, 1994) and the relationship between nitrogen and chlorophyll content of the leaves too (Hao *et. al.,* 2010). Chlorophyll plays direct roles in photosynthesis and hence closely relates to photosynthesis capacity, development and yield of crops (Ghimire *et al.,* 2015).

Commonly, nitrogen (N) supplies by farmers through the inorganic fertilizers to get more yield of the crops but due to the continuous and reckless use of fertilizers worsen soil physical properties, declines soil fertility (Verdonck, 1988) and ultimately the crop yield (Hepperly *et al.*, 2009). In opposite, the biomass of the weed is reported to have higher nutrient contents, which adds humus to soil on decomposition and degradation (Saravanane *et. al.,* 2008). It not only supplies NPK to the soil, but also sustains soil health enhances crop productivity and lead to sustainable agriculture. Therefore, the integrated use of inorganic fertilizers with organic manures is a sustainable approach for efficient nutrient usage which enhances the efficiency of the chemical fertilizers while reducing nutrient losses (Schoebitz and Vidal, 2016). Synergistic effects of organic manures with inorganic fertilizers accumulate more nitrogen in soils (Huang *et. al.*, 2007) which affect chlorophyll concentration and consequently influence crop yield and other vegetative and reproductive traits. In this investigation, the present study was undertaken to explore the effect of *Crotalaria* weed manures along with inorganic fertilizers on chlorophyll content, leaf area and yield of maize.

## MATERIALS AND METHODS

A field experiment was conducted on the Research farm of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad. The experimental design was a randomized block design (RBD) with six treatments and four replicates.

The fresh green foliage of *Crotalaria notonii* Wt. and Arn. was collected from the university campus and chopped into small pieces (2 - 3 cm). Then the weed pieces were incorporated into the plots at the rate of 13333 kg/ha about 15 - 20 cm deep in the soil as green manure (GM). The same amount of plant material was used for the preparation of compost (CM), vermicompost (VM) and kept for drying as dry leaf manure (DM). The known weights of plant material were evenly spread in the pits for compost and vermicompost to a

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thickness of about 5 cm. Afterward sprinkled with 5 % dung slurry and soil added alternately. Finally, the pits were closed with cow dung slurry and fine clay to prevent loss of heat or exchange of gases. After partial decomposition (18 days), first turning was given for homogeneous decomposition of organic wastes and sufficient water was sprinkled to maintain the optimal moisture (50 - 70 %). Then the main species of earthworm *Eudrilus eugeniae* Kinberg (90 individuals per pit) was released into the vermicomposting pit only. The identification of earthworm was done by Julka (1988). Finally, dark brown coloured granular materials were obtained for the use of field trials. These manures were applied to the appropriate plots along with fertilized and unfertilized plots. The fodder maize (*Zea mays* L.) variety 'African Tall' was planted at the rate of 100 kg/ha. Each plot with a size of 3 x 3 $m^2$ consisted of nine rows spaced 30 cm apart. The fertilizers were supplied as nitrogen (N), phosphorus (P) and potassium (K) at the rate of 120, 80 and 40 kg/ha. The entire amount of P and K were applied as basal dose to all the treatments except absolute CO at the time of sowing and N was supplied in two equal splits to FE treatment only at 57 and 89 days after sowing (DAS).

The results were recorded at 101 days after sowing (DAS) for leaf chlorophyll contents, leaf area per plant and total yield of maize. The leaf chlorophyll contents (a, b and total) were estimated by following Nanjareddy *et. al.,* (1990). Leaf area per plant was determined by the gravimetric method (Mungikar, 1986) and the total yield of maize obtained per plot was recorded on the field itself (Davys and Pirie, 1969). All the results were statistically analyzed by the following (Mungikar, 1997).

**Table 1. Leaf chlorophyll content, leaf area and yield of maize as influenced by weed manures (Age of crop: 101 DAS)**

| Treatments | Leaf chlorophyll content (mg g-1 fw) | | | Leaf area ($cm^2$ $plant^{-1}$) | Fresh weight | |
|---|---|---|---|---|---|---|
| | A | B | Total | | kg $plot^{-1}$ | kg $ha^{-1}$ |
| GM | 1.57 | 0.87 | 2.44 | 180.00 | 29.750 | 33055 |
| CM | 2.00 | 1.04 | 3.04 | 220.00 | 31.500 | 35000 |
| VM | 1.64 | 0.62 | 2.27 | 177.50 | 30.500 | 33888 |
| DM | 1.72 | 0.84 | 2.56 | 187.50 | 30.225 | 33583 |
| FE | 1.47 | 0.77 | 2.24 | 160.00 | 27.750 | 30832 |
| CO | 0.80 | 0.41 | 1.21 | 117.50 | 10.700 | 11888 |
| **S.E.** | 0.14 | 0.08 | 0.22 | 12.61 | 2.96 | 3293 |
| **C.D.** | 0.31 | 0.18 | 0.49 | 28.49 | 6.69 | 7442 |

GM-Green manure; CM-Compost; VM-Vermicompost; DM-Dry leaf manure; FE-Fertilizers; CO-Control.

## RESULT AND DISCUSSION

The results summarized in Table 1 show significant differences for chlorophyll contents, leaf area and yield of maize. Chlorophyll a, chlorophyll b and total chlorophyll contents varied from 0.80 - 2.00, 0.41 - 1.04 and 1.21 - 3.04 mg/gm leaf fresh weight (FW), respectively. The chlorophyll contents were more in all the organic as well as inorganic treatments except CO. This is because the organic and inorganic manures contain both macro and micronutrients which enhance soil biomass and helps in the growth and development of plants along with increasing the chlorophyll contents (Koshale, 2018). Among the treatments, chlorophyll a, b and total chlorophyll were more in the CM amended plots. This result is in close conformity with the earlier findings of Siavoshi and Laware (2013). The mean values of the leaf area ranged from 117.50 - 220.00 $cm^2$ / plant. It was maximum in the plots treated with CM followed by DM, GM and VM amendments than that of FE application and minimum in untreated plots. Rao and Shaktawat (2001) also reported that the leaf area increases with the application of organic manures. Also, the average yield of fresh vegetation was more in the plots amended with CM followed by VM, DM, GM and FE treatments over the CO. All the results are statistically significant over the control and show a positive correlation of chlorophyll contents and leaf area with the yield of maize (Mrityunjay *et. al.* 2003)

Based on the above results, it can be concluded that the combined applications of organic and inorganic fertilizers are one of the best sources of nutrients for maize crop (Zhao and Zhou, 2011; Verma *et. al.,* 2014; Mahmood *et al.,* 2017). Among all the treatments, the application of compost (CM) along with fertilizers has far more noticeable effects on the chlorophyll contents, leaf area and yield of maize. The results are in agreement with the earlier findings of Naderi and Ghadiri, (2010); Hokmalipour and Darbandi (2011) and Naeem *et. al.,* (2018).

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