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# Influence of *Chromolaena odorata* compost on growth and yield of finger millet

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***Abstract:*** *Chromolaena odorata is an invasive weed posing problems in plantation crops and replacing existing fauna in high rain fall areas of Karnataka. Chromolaena produce 3 to 4 kg biomass/m$^2$ in non-cropped areas in high rain fall areas and contains nutrient equivalent to that of traditional green manure crops. It's utility for composting or green manure can serve as alternative strategy to contain the weed. Field study was planned under this content at Main Research Station, Hebbal, University of Agricultural Sciences, Bengaluru, during Kharif 2013 in irrigated finger millet. The treatments comprised of various combinations of Chromolaena's compost with recommended dose of fertilizer (RDF), RDF+ farm yard manure (FYM), RDF alone and unfertilized control. Finger millet receiving recommended fertilizer alone resulted in significantly lower total dry matter production per plant, yield and yield components than various combination of Chromolaena's compost with RDF and RDF+ FYM. Higher grain yield (5367 kg ha$^{-1}$) obtained in application of Chromolaena odorata (90%) + cow dung slurry (10%) + microbial slurry + rock phosphate @ 7.5 t.ha$^{-1}$+RDF (5367 kg ha$^{-1}$) and Chromolaena odorata (90%) + cow dung slurry (10%) + microbial culture @ 7.5 t.ha$^{-1}$+RDF over RDF alone (5142 kg/ha).*
***Keywords:*** *Chromolaena odorata, finger millet*

## I. Introduction

*Chromolaena odorata* (L.) R.M. King and H. Robinson (Asteraceae) commonly known as Communist weed /Siam weed is a native of South and Central America. It was previously included in the genus *Eupatorium*, now under the genus *Chromolaena* (King and Robinson, 1970a). The genus *Chromolaena* contains 129 species and all are found in the Neo-tropical world (South and Central America) (King and Robinson, 1970b). In India, it is variously known as *gandhi gulabi, communist pacha, sam- solokh, tongal-lati, sam-rhabi* while in other Asian countries it is called Siam weed, Christmas bush, baby tea and Santa Maria. In other countries it is known by the name of their former dictators (Muniappan, 1988). It is more aggressive, colonizes, suppresses native flora and is considered now as a noxious weed. It has occupied pastures, marginal lands, open areas, building sites, along roads, railways, streams, dry deciduous forests and interior shrub jungles, where it is highly competitive and suppress other flora grow. It is a menace in plantations, agriculture and other ecosystems. It suppresses young plantations, agricultural crops and smothers vegetation. The weed poses a grate threat to the fragile biodiversity of the Western Ghats, eco-tourism, forestry, watershed management and sustainable farm management, where it is competitively replacing the existing indigenous rich flora, thereby creating ecological imbalance. This weed has assumed much importance due to its alarmingly increasing intensity day by day (Ramachandra Prasad *et al*., 2003). The use of the compost of *Chromolaena odorata* in field crops has not been attempted adequately else where. Hence the possibility on the use of *Chromolaena* in combination with fertilizers in relation to other compost is explored in finger millet crop.

## II. Materials and Methods

A field experiment was conducted at Main Research Station, Hebbal, University of Agricultural Sciences, Bangalore, consisting of eleven treatments on fixed site during *Kharif* 2013 with finger millet. The experiment was laid out in randomized block design with three replications. The soil was sandy loam in texture and medium fertility with respect to N, P and K status and had OC 0.34%. The treatments comprised various combinations of *Chromolaena's* compost with recommended dose of fertilizer (RDF), RDF+ farm yard manure (FYM), RDF alone and unfertilized control. The green biomass of *Chromolaena* collected from near by locality was chopped into small pieces. As per the treatments, organics viz, cow dung slurry, microbial culture, forest soil, leaf litter etc, were prepared compost and obtained in 3 months, which was black, light in weight and friable.

## III. Results and Discussion

**Effects of *Chromolaena* composts on crop growth:** Plot receiving unfertilized control resulted in significantly lower total dry matter production per plant than various combination of *Chromolaena's* compost with RDF and RDF alone at all stages of crop growth. Further, total dry matter per plant was significantly improved due to application of *Chromolaena odorata* (90%) + cow dung slurry (10%) + microbial slurry + rock phosphate @ 7.5 $t.ha^{-1}$+RDF (T3) and *Chromolaena odorata* (90%) + cow dung slurry (10%) + microbial culture @ 7.5 $t.ha^{-1}$+RDF (T2) over RDF alone, and *Chromolaena odorata* (90%) + cow dung slurry (10%) + microbial slurry + rock phosphate @ 7.5 $t.ha^{-1}$+RDF (T3) over RDF + FYM 7. 5 $t.ha^{-1}$ (T9), the pattern of variations in *Chromolaena's* compost with RDF was similar at all stages of crop growth (Table 1).

In these treatments due to better performance of finger millet in growth parameters under weed composts were due to supplying readily available macro and micro nutrients in the compost of *Chromolaena* (Acharya and Kapur; 2001; Quanshah *et al.,* 2001; Saravanane, 2005; Channappagoudar *et al.,* 2007). These nutrients present in *chromolaena's* composts might be easily taken up by finger millet plant similar to FYM and utilized in the synthesis of higher photosynthates as evident from higher dry matter accumulation in the plants. The superiority of 7.5 t. $ha^{-1}$ of *chromolaena's* compost with respect to higher total dry matter distribution into leaves and stem at vegetative stage and better translocation to ear during later stages (reproductive phase). Increased by dry matter production improved the plant height. These results are in accordance with the findings of Subramanian and Kumarswamy, 1989; Shankarappa, 1993; Shivakumar, 2001 and Channappagoudar *et al.,* 2007.

**Effect on yield components:** Unfertilized control resulted in significantly lower the number of fingers per ear, finger length, number of ear head per plant, ear weight per plant and 1000 grain weight, (3.66, 5.23cm, 1.36, 5.34 g and 0.6 g respectively) as compared to RDF alone (5.53, 6.26cm, 2.46, 11.9 g and 1.8 g respectively) or RDF with FYM (6.0, 7.63 cm, 2.65, 19.7 g and 2.9 g respectively) or various *Chromolaena's* compost. However, *Chromolaena's* compost with RDF in the form of treatments as *Chromolaena odorata* (90%) + cow dung slurry (10%) + microbial slurry + rock phosphate @ 7.5 $t.ha^{-1}$+RDF (T3), *Chromolaena odorata* (90%) + cow dung slurry (10%) + microbial culture @ 7.5 $t.ha^{-1}$+RDF (T2) and RDF + FYM 7. 5 $t.ha^{-1}$ (T9) resulted in higher number of finger per ear (6.66 to 6.0), finger length (7.83 to 7.63cm), number of ear head per plant (2.73 to 2.63), ear weight per plant (20.9 to 18.9 g) and 1000 grain weight (2.9 to 3.5 g ) (Table 2),

The increased yield components with the use of various combinations of *Chromolaena's* composts was due to these biomasses serving as organic biomass supplementing part of the major nutrients and other elements required by the crop. They supply plant nutrients and by- products such as useful hormones and others directly to the standing crop upon decomposition. Besides, these *Chromolaena* plant biomasses possess good microbial association in the rhizosphere and upon using this in composting and supplying to the main field would favor good growth by encouraging useful microbes in soil. Further, use of weed composts also enhances the soil organic carbon which helps in increasing plant growth promoting rhizobacter in the soil. These were known to produce phyto-hormones and vitamins apart from nitrogen fixing by free living micro organisms to the growing crop plants. All these biological features improved plant height, leaf number and LAI, which in turn favoured more light interception by the canopy of maize and consequently increased dry matter accumulation in plant. In addition, biological factors by using weed composts favored the soil chemical and biological properties which led to higher nutrient uptake by the crop. All these resulted in higher agronomic efficiency of applied N (Table 30). Similar results were reported by Mishra *et al*., 1996; Mani, 1991; Arunachalam *et al*, 1995, Rathore *et al*, 1993 and Shivakumar (2001); Anon, 2004 and Kumar, 2004.

**Effect on yield:** Unfertilized control gave significantly lower yield than RDF, RDF + FYM and combinations of *Chromolaena's* compost + RDF. Further, addition of RDF along with FYM and *Chromolaena's* compost significantly improved the yield more than RDF. Enriched compost of *Chromolaena* with RDF gave similar grain yield as that of FYM+ RDF. Among various combination *Chromolaena's* compost, *Chromolaena odorata* (90%) + cow dung slurry (10%) + microbial slurry + rock phosphate @ 7.5 $t.ha^{-1}$+RDF (T3) gave relatively higher grain yield (5362 kg $ha^{-1}$). This higher grain yield of finger millet (Table 3) with conjunctive use of organic and inorganic nutrient sources were attributed to the higher growth parameters viz., plant height, number of leaves per plant, LAI which favoured increased light interception by the canopy. This higher LAI and more light interception perhaps favoured the production of higher dry matter accumulation in leaf, stem and ear dry weight during the growing season. in these treatment under organic and inorganic nutrition paved way for higher productivity as opinioned by Ramachandra Prasad (2009). Application of *Chromolaena odorata* (90%) + cow dung slurry (10%) + microbial slurry + rock phosphate @ 7.5 $t.ha^{-1}$+RDF ($T_{3)}$ gave significantly higher grain yield (5367 $kgha^{-1}$) which was found to be 29.43 percent higher as compared to unfertilized control (1580 kg $ha^{-1}$). This might be due to release of both $NH_4$-N and $NH_3$ N steadily during active crop growth period and in turn might have favoured the crop for obtaining higher yield, as also revealed by Mani (1991) and Ramachandra Prasad (2009). All these yield parameters were better by conjunctive use of FYM or weeds' compost along with fertilizer and produced higher kernel yield, as reported by Nanjundappa *et al.* (2000). Similar results were also reported by Thakur and Singh (1987) from Himachal Pradesh, observed that application of *chromolaena's* compost 5 t. $ha^{-1}$ increased the grain yield of rice by 20 percent over control. Similar findings were also made by Maskey and Bhattaraj (1984) reported that application of *chromolaena's* compost 5 t. $ha^{-1}$ recorded higher grain yield in rice-mustard sequence over *Ipomea cornea*. Several other workers also noticed increased grain yield with addition of weeds as a green Rathore *et al*., 1993; Anon, 2002a; Ramachandra *et al*., 2007 and Ramachandra Prasad 2009. The lower grain yield under unfertilized control plots might be due to the fact that soil may not able to meet the nutrient demand of the crop. Similar results were also reported by Thakur and Singh (1987). *Chromolaena's* compost was found to be cheaper than FYM. Thus, *Chromolaena's* bio- mass can be used for recycling nutrients to the crops, besides aiding in the management of the weed.

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**Table. 1.** Effect of Integrated Nutrient Management by involving combinations of *Chromolaena's* compost on total dry matter/plant (g) in finger millet at different stages during 2013.

| Treatments | | Stages | | | |
|---|---|---|---|---|---|
| | | 30 DAS | 60 DAS | 90 DAS | At harvest |
| T1 | *Chromolaena odorata* (90%) + Cow dung slurry (10%) @7.5 t $ha^{-1}$+RDF. | 9.16 | 11.32 | 35.6 | 35.6 |
| T2 | *Chromolaena odorata* (90%) + Cow dung slurry (10%) + Microbial culture @ 7.5 t $ha^{-1}$+RDF. | 9.36 | 13.76 | 39.7 | 42.2 |
| T3 | *Chromolaena odorata* (90%) + Cow dung slurry (10%) + Microbial culture + Rock phosphate @ 7. 5 t $ha^{-1}$+RDF. | 9.37 | 13.7 | 40.0 | 44.9 |
| T4 | *Chromolaena odorata* (50%) + Leaf litter (50%) +Microbial culture @ 7. 5 t $ha^{-1}$+RDF. | 9.27 | 13.35 | 36.8 | 39.9 |
| T5 | *Chromolaena odorata* (2/3) +FYM (1/3) @ 7. 5 t $ha^{-1}$+RDF. | 7.86 | 10.76 | 31.8 | 33.9 |
| T6 | *Chromolaena odorata* + Forest soil (1-2 layers) + Microbial culture @ 7. 5 t $ha^{-1}$+RDF. | 8.67 | 10.57 | 33.6 | 34.9 |
| T7 | *Chromolaena odorata* (50%) + Leaf litter (50%) + Vermi culture @ 7. 5 t $ha^{-1}$+RDF. | 7.85 | 9.90 | 31.2 | 32.5 |
| T8 | *Lantana camera* + Green manure + Cow dung + Leaf litter @ 7. 5 t $ha^{-1}$+RDF. | 8.52 | 11.88 | 30.7 | 34.3 |
| T9 | RDF + FYM 7. 5 t $ha^{-1}$ | 9.51 | 10.82 | 33.4 | 34.2 |
| T10 | RDF alone | 7.41 | 9.55 | 29.7 | 31.5 |
| T11 | Unfertilized control (absolute control) | 6.47 | 8.83 | 17.2 | 19.5 |
| | " F" test | * | * | * | * |
| | S .Em ± | 0.35 | 1.04 | 3.21 | 3.61 |
| | CD (P=0.05) | 1.17 | 3.09 | 9.49 | 10.67 |

RDF = Recommended dose of fertilizer, 100 N: 50 $P_2O_5$: 50 $K_2O$ kg $ha^{-1}$
DAS = Days after sowing

**Table. 2.** Effect of Integrated Nutrient Management by involving combinations of *Chromolaena's* compost on number of fingers/ear head, finger length (cm), number of ear head/plant, ear weight/plant(g) and 1000 grain weight(g) in finger millet during 2013.

| Treatments | | No. of ear head per hill | No. of fingers / ear | Finger Length (Cm) | Ear Weight g/ Plant | 1000 grain weight(g) |
|---|---|---|---|---|---|---|
| T1 | *Chromolaena odorata* (90%) + Cow dung slurry (10%) @7.5 t $ha^{-1}$+RDF. | 2.57 | 6.56 | 7.30 | 17 | 2.7 |
| T2 | *Chromolaena odorata* (90%) + Cow dung slurry (10%) + Microbial culture @ 7.5 t $ha^{-1}$+RDF. | 2.63 | 6.66 | 7.60 | 18.91 | 3.2 |
| T3 | *Chromolaena odorata* (90%) + Cow dung slurry (10%) + Microbial culture + Rock phosphate @ 7. 5 t $ha^{-1}$+RDF. | 2.73 | 6.66 | 7.83 | 20.9 | 3.5 |
| T4 | *Chromolaena odorata* (50%) + Leaf litter (50%) +Microbial culture @ 7. 5 t $ha^{-1}$+RDF. | 2.58 | 6.56 | 7.36 | 17.63 | 3.2 |
| T5 | *Chromolaena odorata* (2/3) +FYM (1/3) @ 7. 5 t $ha^{-1}$+RDF. | 2.50 | 6.46 | 7.16 | 14.63 | 3.4 |
| T6 | *Chromolaena odorata* + Forest soil (1-2 layers) + Microbial culture @ 7. 5 t $ha^{-1}$+RDF. | 2.53 | 6.53 | 7.33 | 16.65 | 2.5 |
| T7 | *Chromolaena odorata* (50%) + Leaf litter (50%) + Vermi culture @ 7. 5 t $ha^{-1}$+RDF. | 2.49 | 6.63 | 6.40 | 14.20 | 2.2 |
| T8 | *Lantana camera* + Green manure + Cow dung + Leaf litter @ 7. 5 t $ha^{-1}$+RDF. | 2.51 | 6.50 | 7.16 | 16.10 | 2.4 |
| T9 | RDF + FYM 7. 5 t $ha^{-1}$ | 2.65 | 6.00 | 7.63 | 19.70 | 2.9 |
| T10 | RDF alone | 2.46 | 5.53 | 6.26 | 11.90 | 1.8 |
| T11 | Unfertilized control (absolute control) | 1.36 | 3.66 | 5.23 | 5.34 | 0.6 |
| | " F" test | * | * | * | * | * |
| | S .Em ± | 0.34 | 0.43 | 0.42 | 1.8 | 0.11 |
| | CD (P=0.05) | 1.01 | 1.27 | 1.26 | 5.32 | 0.33 |

DF = Recommended dose of fertilizer, 100 N : 50 $P_2O_5$ : 50 $K_2O$ kg $ha^{-1}$
DAS = Days after sowing

**Table. 3.** Effect of Integrated Nutrient Management by involving combinations of *Chromolaena's* compost on grain yield (kg $ha^{-1}$), straw yield (kg$ha^{-1}$) and harvest index in finger millet during 2013.

| Treatments | | Grain yield (kg $ha^{-1}$) | Straw yield (kg $ha^{-1}$) | Harvest index |
|---|---|---|---|---|
| T1 | *Chromolaena odorata* (90%) + Cow dung slurry (10%) @7.5 t $ha^{-1}$+RDF. | 5067 | 8345 | 0.37 |
| T2 | *Chromolaena odorata* (90%) + Cow dung slurry (10%) + Microbial culture @ 7.5 t $ha^{-1}$+RDF. | 5142 | 9265 | 0.35 |
| T3 | *Chromolaena odorata* (90%) + Cow dung slurry (10%) + Microbial culture + Rock phosphate @ 7. 5 t $ha^{-1}$+RDF. | 5367 | 9384 | 0.36 |
| T4 | *Chromolaena odorata* (50%) + Leaf litter (50%) +Microbial culture @ 7. 5 t $ha^{-1}$+RDF. | 5081 | 8582 | 0.28 |
| T5 | *Chromolaena odorata* (2/3) +FYM (1/3) @ 7. 5 t $ha^{-1}$+RDF. | 5011 | 9033 | 0.35 |
| T6 | *Chromolaena odorata* + Forest soil (1-2 layers) + Microbial culture @ 7. 5 t $ha^{-1}$+RDF. | 5011 | 8945 | 0.35 |
| T7 | *Chromolaena odorata* (50%) + Leaf litter (50%) + Vermi culture @ 7. 5 t $ha^{-1}$+RDF. | 4880 | 8720 | 0.35 |
| T8 | *Lantana camera* + Green manure + Cow dung + Leaf litter @ 7. 5 t $ha^{-1}$+RDF. | 5011 | 9018 | 0.35 |
| T9 | RDF + FYM 7. 5 t $ha^{-1}$ | 5289 | 9213 | 0.35 |
| T10 | RDF alone | 3637 | 7920 | 0.31 |
| T11 | Unfertilized control (absolute control) | 1580 | 2889 | 0.10 |
| | " F" test | ** | * | * |
| | S .Em ± | 385.6 | 390 | 0.05 |
| | CD (P=0.05) | 1137.7 | 1620 | 0.21 |

RDF = Recommended dose of fertilizer, 100 N: 50 $P_2O_5$ : 50 $K_2O$ kg $ha^{-1}$
DAS = Days after sowing