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WEED BIOMASS AS AN ORGANIC MACRO AND MICRONUTRIENT SOURCE ON GROWTH, PRODUCTIVITY AND QUALITY OF HYBRID CHILLI (*CAPSICUM ANNUUM* L.)

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KEYWORDS

Biodigested liquid organic manure (BDLM)
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ABSTRACT

A pot experiment was conducted during the summer season of 2014 in red sandy clay loamy soil in farmer's field at Talaku Village of Chitradurga (Dist.) Karnataka to assess weed biomass as an organic macro and micronutrient source on growth, productivity and quality of hybrid chilli. The pot experiment comprised of 12 treatments laid out in a complete randomized design and replicated thrice. The results revealed that application of *Hyptis suaveolens* BDLM at 150 kg N equivalent ha^{-1} recorded significantly better growth and yield parameters *viz.*, plant height, number of branches $plant^{-1}$, total biomass (g), number of fruits $plant^{-1}$, 100- fruit weight (g), fruit length and fruit yield $plant^{-1}$ and it was on par with *Cassia tora/sida cordifolia/Cassia spectabilis/ Crotalaria juncea* BDLM at 150 kg N equivalent ha^{-1} and RDF at 150, 75 & 75 kg N, P_2O_5 & K_2O per ha. Similar trend was also observed in quality parameters *viz.*, ascorbic acid, capsaicin, oleoresin content and total extractable colour (ASTA Units) in all the treatments except RDF and control. These results are only indicated and based on one-year experimentation and required to arrive at more consistent and definite conclusion for recommendation to the farmers.

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INTRODUCTION

Certain plants in nature possess characteristics which put them in an advantageous position with regards to their competition with other plants in the neighbourhood and such characteristics, often referred to as weedy characteristics help these plants to establish themselves suitably in human disturbed (cultivated fields) or undisturbed (uncultivated) habitats. Weeds are an established source of plant nutrients and these are ploughed down in the soil for decomposition, release and availability of nutrients for uptake by crop plants. Weeds by virtue of their rapid vegetative growth can accumulate significant quantity of essential macro and micro nutrients. However, the capacity of nutrient absorption and accumulation by them depends upon their growth behaviour (Sushil Kumar and Jayanta Deka, 2015).

Weeds produce huge biomass on its own without any assistance from mankind within a short period of time, mine out sizeable quantities of unavailable nutrients and convert them into available form when the biomass is used as FYM, vermicompost etc in field and horticultural crops. This would also serve as alternative source of macro and micro nutrient sources in organic farming. Saravanane *et al.* (2008) reported that weeds like *Xanthimum strumarium* and *Psoralea corylifolia* contain about 3.0 -3.5% N. *Achyranthus aspera* and *Solanum xanthocarpum* have over 0.7% of P and *Chenpodium album* contain more than 8% of K on oven dry weight basis. Further, weeds also accumulate high amounts of other secondary and micronutrients e.g. 2.04-2.07% Ca in *Cirsium arvense* and *Polygonum hydropiperoides,* 585 ppm Zn in *Setaria lutescence,* 14 ppm Cu in *Bromus inermis,* 32 ppm B in and 39 ppm Mn in *Taraxacum sp.,* 0.71% Mg and 373 ppm Fe in *Polygonum hydropiperoides.*

Since, chilli being a major spice with great export potential, the emphasis needs to be given for improving the quality apart from productivity and both can be achieved by organic farming practices which optimize and balance the supply of all the plant required nutrients through efficient utilization of on farm available resources. Application of FYM improves quality of chilli by enhancing ascorbic acid content (Chavan *et al.*, 1997), oleoresin content (Malawadi, 2003) and colour value. In this context, it is felt that organic nutrition is a remedy to manage the ill effects of chemical farming so as to manage soil health for sustaining the soil productivity and quality of chilli. But the organic manures like FYM, vermicompost and other composts take more time for preparation, transportation, bulky nature and their usage and also acute shortage of availability for use in organic crop production (Chandrakala *et al.,* 2011). Therefore to overcome this problem the different weed biomass i.e on farm resources are subjected to decomposition by using cow dung slurry, cow urine and water in a certain proportion and the resulted product is called as biodigested liquid manure (BDLM). In this regard, an attempt was made to evaluate weed biomass as an organic macro and micronutrient source on growth, productivity and quality of hybrid chilli.

MATERIALS AND METHODS

The pot experiment was conducted at Talaku village situated at 14º 26′ N latitude and 76° 40′ E longitude of Challakere Taluk, Chitradurga (Dist.) Karnataka during *Summer* season of 2014 in red sandy clay loamy texture having (coarse sand 33.58 %, fine sand 37.81 %, silt 6.8 % and clay 21.0 %), with a bulk density of 1.47 g cc^{-1}. The soil pH was slightly alkaline (7.7) and the electrical conductivity was normal (0.25 dSm^{-1}). The soil was low in organic carbon (0.47%) and medium in available nitrogen (289.7 kg ha^{-1}), phosphorus (48.5 kg ha^{-1}) and potassium (152 kg ha^{-1}). The study comprising 12 treatment *viz., Cassia tora* biodigested liquid manure (BDLM) @150 kg N equivalent ha^{-1}, *Acanthospermum hispidum* BDLM @150 kg N equivalent ha^{-1}, *Crotalaria juncea* BDLM @150 kg N equivalent ha^{-1}, *Hyptis suaveolens* BDLM @150 kg N equivalent ha^{-1}, *Cassia spectabilis* BDLM @150 kg N equivalent ha^{-1}, *Sida cordifolia* BDLM @150 kg N equivalent ha^{-1}, *Mirabilis jalapa* BDLM @150 kg N equivalent ha^{-1}, *Prosopis juliflora* BDLM @150 kg N equivalent ha^{-1}, *Celosia argentea* BDLM @150 kg N equivalent ha^{-1}, *Alternenthera sessilis* BDLM @150 kg N equivalent ha^{-1}, Recommended dose of fertilizer (150, 75 & 75 kg N, P_2O_5 and K_2O ha^{-1}), Control (without fertilizer) and replicated thrice under completely randomized design.

Protocol for preparation of biodigested liquid organic manures by using ubiquitous plants

The green biomass of *viz., Cassia tora* (Tankati gida), *Acanthospermum hispidum* (Kadle mullu/Mullu gida), *Achyranthes aspera* (Uttarani gida), *Wedelia chinensis* (Gargi gida), *Alternanthera philoxeroides* (Dodda honagone soppu), *Crotalaria juncea* (Sunhemp), *Bidens pilosa* (Batte mettu), *Hyptis suaveolens* (Gandha tulasi), *Cassia spectabilis* (Dodda tankati), *Sida cordifolia* (Barlu gida), *Stylosanthes scabra* (Vilaethi togiri gida), *Euphorbia geniculata* (Alpa bedi soppu), *Mirabilis jalapa* (Sanje mallige), *Prosopis juliflora* (Bellary jaali), *Celosia argentea* (Anne soppu), *Alternenthera sessilis* (Honagone soppu), *Chromolaena odorata* (Communist kale) and *Ageratum conyzoides* L. (Gobbu soppu) were collected separately and chopped. About 3.0 kg of each was placed in a cylindrical plastic drum. Fresh cattle dung (1.5 kg), cattle urine (2.0 lt.) and water (10 lit.) were added to each plastic drum. The content were incubated and stirred regularly for 45 days (Prdeep Gopakkali and Sharanappa, 2014). At the end of 45 days the nutrient composition *viz.,* macro (N, P and K), secondary (Ca, Mg and S) and selected micronutrients (Fe, Zn, Cu, Mn) were analysed by adopting standard procedure. After analyzing nutritional value of liquid manures, promising liquid manures were selected based macro and micronutrient content and availability of their biomass in that area.

Nutrient composition of different biodigested liquid manures

Data on N, P, K, Ca, Mg, S, Fe, Zn, Cu and Mn content of different biodigested liquid manures were analyzed. Among the different liquid manures *Crotalaria juncea* BDLM had higher nitrogen (0.64%), sulphur (0.41%) and copper (10.11 ppm), *Hyptis suaveolens* BDLM possed higher phosphorus (0.31%) and Zinc (9.21 ppm), *Prosopis juliflora* BDLM rich in potassium (0.45 %), *Acanthospermum hispidum* BDLM had maximum per cent of calcium (0.13), *Cassia tora* BDLM was rich in magnesium (0.10%) and iron (134.50 ppm), *Stylosanthes scabra* BDLM rich manganese (15.60 ppm) as compared other liquid manures. But on an average *Hyptis suaveolens* BDLM rich in all the analyzed nutrients.

The quantity of biodigested liquid manures required for each pot was computed on N equivalent basis at 150 kg recommended N per ha for chilli on soil weight basis, using weight of soil per pot and weight of one ha furrow slice soil (Pradeep Gopakkali and Sharanappa, 2014).

$$\text{Quantity of N required per pot} = \frac{150 \text{ kg}}{\text{Weight of 1 ha furrow slice}} \times \text{Weight of soil per pot}$$

$$\text{Quantity of BDLM required per pot} = \frac{\text{Qty of N req. per pot}}{\text{\% N content of BDLM}} \times 100$$

The growth parameters *viz.,* plant height (cm), no of branches $plant^{-1}$, dry weight (g) (Adhikary, 2014) and yield attributes i.e., number of fruits $plant^{-1}$, 100 fruit weight (g), fruit length (cm) and dry fruit yield (g $plant^{-1}$) (Ajeet Singh *et al.,* 2013) were recorded as per the standard procedure and the quality parameters, *viz.,* ascorbic acid content of green chilli (mg 100 g^{-1}), total capsaicin content (%) of powdered dry chilli, total extractable colour value measured in ASTA Units (American Spice Trade Association) and per cent oleoresin were estimated as outlined by Sadasivam and Manickam (2004)

The data obtained from the various growth parameters, yield attributes, dry fruit yield and quality parameters were subjected to statistical analysis (Gomez and Gomez, 1984). Based on the results the following interference were drawn.

RESULTS AND DISCUSSION

Growth parameters

The data pertaining to growth attributes of chilli as influenced by different biodigested liquid manures at harvest are presented in Table 1.

The results shows that application of *Hyptis suaveolens* BDLM at 150 kg N equivalent ha^{-1} recorded significantly higher plant height (84.1 cm), number of branches per plant (30.7) and total biomass (166.4 g $plant^{-1}$) followed by *Cassia tora/ sida cordifolia/Cassia spectabilis/Crotalaria juncea* BDLM at 150 kg N equivalent ha^{-1} and RDF at 150, 75 & 75 kg N, P_2O_5 & K_2O per ha (80.1 cm, 28.0 and 160.8 g $plant^{-1}$, respectively) which were at par with each other. Whereas, significantly lower plant height, number of branches per plant and total biomass per plant were recorded with control (61.5 cm, 18.7 and 93.2 g $plant^{-1}$). The bio-digested liquid manures improved the total biomass production of chilli as it provided readily available nutrients, growth hormones and microbes. The results are in agreement with the findings of Waghmode (2010), who reported the increased yield of sweet corn with biodigested liquid organic manures, Pradeep Gopakkali and Sharanappa (2014) also noticed in chilli with the application of glyricidia biodigested liquid manure. Higher dry matter production can be attributed to the ability of *Hyptis suaveolens* BDLM at 150 kg N equivalent ha^{-1} to satisfy the nutrient demand of crop more efficiently than others. Adequate and balanced nutrient supply could have made the plant to produce more dry matter and yield also noticed by Sheshadri Reddy *et al.* (2005) in ground-maize cropping system and Ananda *et al.* (2004) in

Table 1: Plant height, number of branches and total biomass at harvest chilli as influenced by different biodigested liquid manures

Treatments	Plant height (cm)	No. of branches	Biomass yield (g plant^{-1})
$T_{1:}$ *Cassia tora* BDLM @150 kg N equivalent ha^{-1}	83.1	30.0	165.6
$T_{2:}$ *Acanthospermum hispidum* BDLM @150 kg N equivalent ha^{-1}	73.5	23.3	107.6
T_3 : *Crotalaria juncea* BDLM @150 kg N equivalent ha^{-1}	80.7	28.3	162.1
T_4 : *Hyptis suaveolens* BDLM @150 kg N equivalent ha^{-1}	84.1	30.7	166.4
T_5 : *Cassia spectabilis* BDLM @150 kg N equivalent ha^{-1}	81.9	28.3	163.3
T_6 : *Sida cordifolia* BDLM @150 kg N equivalent ha^{-1}	82.7	29.0	164.3
T_7 : *Mirabilis jalapa* BDLM @150 kg N equivalent ha^{-1}	75.8	24.7	142.2
T_8 : *Prosopis juliflora* BDLM @150 kg N equivalent ha^{-1}	76.7	25.7	140.6
T_9 : *Celosia argentea* BDLM @150 kg N equivalent ha^{-1}	77.7	26.0	142.6
T_{10} : *Alternenthera sessilis* BDLM @150 kg N equivalent ha^{-1}	78.5	26.3	144.7
$T_{11:}$ RDF (150, 75 & 75 kg N, P_2O_5 & K_2O per ha)	80.1	28.0	160.8
$T_{12:}$ Control	61.5	18.7	93.2
S. Em ±	1.1	0.8	2.1
C. D. at 1 %	4.5	3.1	5.9
CV (%)	3.4	5.1	3.8

Note: BDLM: Biodigested liquid manure DAT: Days after transplanting; RDF: Recommended dose of fertilizer

Table 2: Yield attributes and dry fruit yield of chilli as influenced by different biodigested liquid manures

Treatments	No. of fruits plant^{-1}	100-fruit (g)	Fruit length (cm)	Dry fruit yield(g plant^{-1})
$T_{1:}$ *Cassia tora* BDLM @150 kg N equivalent ha^{-1}	73.3	79.9	8.3	54.6
$T_{2:}$ *Acanthospermum hispidum* BDLM @150 kg N equivalent ha^{-1}	46.7	79.3	7.9	34.7
T_3 : *Crotalaria juncea* BDLM @150 kg N equivalent ha^{-1}	69.3	79.7	8.2	52.5
T_4 : *Hyptis suaveolens* BDLM @150 kg N equivalent ha^{-1}	74.0	79.9	8.3	55.1
T_5 : *Cassia spectabilis* BDLM @150 kg N equivalent ha^{-1}	71.0	79.8	8.2	53.0
T_6 : *Mirabilis jalapa* BDLM @150 kg N equivalent ha^{-1}	60.7	79.4	7.9	46.6
T_7 : *Sida cordifolia* BDLM @150 kg N equivalent ha^{-1}	72.0	79.8	8.2	54.2
T_8 : *Prosopis juliflora* BDLM @150 kg N equivalent ha^{-1}	59.0	79.4	8.0	45.2
T_9 : *Celosia argentea* BDLM @150 kg N equivalent ha^{-1}	60.0	79.5	8.1	45.8
T_{10} : *Alternenthera sessilis* BDLM @150 kg N equivalent ha^{-1}	60.3	79.5	8.1	46.5
$T_{11:}$ RDF (150, 75 & 75 kg N, P_2O_5 & K_2O per ha)	68.7	79.7	8.2	52.2
$T_{12:}$ Control	39.0	79.2	7.8	28.5
S. Em ±	1.55	0.22	0.22	0.8
C. D. at 1 %	6.15	NS	NS	3.3
CV (%)	4.3	2.0	2.6	2.8

Note: BDLM: Biodigested liquid manure DAT: Days after transplanting RDF: Recommended dose of fertilizer NS: Non significant

groundnut. Whereas, significantly lower plant height and branches were noticed under control which was attributed to non availability of sufficient quantity nutrients in soil to meet the crop requirement throughout the crop growth period.

Yield attributes and dry fruit yield

The data pertaining to yield and yield parameters of chilli as influenced by different biodigested liquid manures at harvest are presented in Table 2.

Yield is the manifestation of yield attributing characters. Higher dry fruit yield of chilli was linked to the yield attributes *viz.*, number of fruits per plant, hundred dry fruit weight and fruit length. In the present study, significantly more number of fruits and higher dry fruit yield were noticed with the application of *Hyptis suaveolens* BDLM at150 kg N equivalent ha^{-1} (74.0 and 55.1 g plant^{-1}, respectively) which was at par with *Cassia tora*/ *Sida cordifolia*/ *Cassia spectabilis*/ *Crotalaria juncea* BDLM at 150 kg N equivalent ha^{-1} and RDF (150, 75 and 75 kg N, P_2O_5 and K_2O ha^{-1}). The higher dry fruit yield of chilli might be due to the favourable effects of major and micronutrients and also microorganisms (Somasundaram, 2003) present in these biodigested liquid manures as a result better translocation of photosynthate from the source to sink which is evidenced by number of fruits per plant, 100 fruit weight (Table 2) and better growth parameters *viz.*, taller plants, more number of branches (Table 1) which is the cause for higher dry matter production. Significant difference in the dry fruit yield per plant of chilli due to different biodigested liquid manure treatments may be attributed to variation in the nutrient content in different biodigested liquid manures and conversion of unavailable nutrients into available form by microbes in soil (Table 2). Whereas, absolute control treatment recorded significantly lower number of fruits and dry fruit yield (39.0 and 28.5 g plant^{-1}). Similar results were also reported by Sheshadri Reddy *et al.* (2005), Ananda *et al.* (2004), Sharma *et al.* (2013) and Pradeep Gopakkali and Sharanappa (2014). However, 100 fruit weight and fruit length did not differ significantly but followed the trend of number fruits per plant and dry fruit yield.

Quality parameters

The data pertaining to quality parameters *viz.*, ascorbic acid, capsaicin content, per cent oleoresin and total extractable colour (ASTA units) as influenced by different biodigested

Table 3: Quality parameters of chilli fruits as influenced by different biodigested liquid manures

Treatments	Ascorbic acid (mg 100 g^{-1})	Capsaicin content (%)	Oleoresin (%)	Total extractable colour (ASTA units)
T_1: *Cassia tora* BDLM @150 kg N equivalent ha^{-1}	132.57	1.69	12.35	125.92
T_2: *Acanthospermum hispidum* BDLM @150 kg N equivalent ha^{-1}	123.07	1.59	12.05	116.80
T_3: *Crotalaria juncea* BDLM @150 kg N equivalent ha^{-1}	129.20	1.65	12.25	120.37
T_4: *Hyptis suaveolens* BDLM @150 kg N equivalent ha^{-1}	134.77	1.76	12.43	129.43
T_5: *Cassia spectabilis* BDLM @150 kg N equivalent ha^{-1}	129.73	1.66	12.28	122.12
T_6: *Mirabilis jalapa* BDLM @150 kg N equivalent ha^{-1}	124.67	1.59	12.02	114.70
T_7: *Sida cordifolia* BDLM @150 kg N equivalent ha^{-1}	131.57	1.67	12.30	124.29
T_8: *Prosopis juliflora* BDLM @150 kg N equivalent ha^{-1}	123.33	1.62	12.08	115.62
T_9: *Celosia argentea* BDLM @150 kg N equivalent ha^{-1}	124.50	1.60	12.12	117.83
T_{10}: *Alternenthera sessilis* BDLM @150 kg N equivalent ha^{-1}	125.50	1.61	12.18	118.49
T_{11}: RDF (150, 75 & 75 kg N, P_2O_5 & K_2O per ha)	122.80	1.54	11.88	112.50
T_{12}: Control	118.93	1.54	11.60	108.50
S. Em ±	1.71	0.03	0.20	2.33
C. D. at 1 %	6.77	0.13	0.80	9.22
CV (%)	2.3	3.5	2.9	3.4

Note: BDLM: Biodigested liquid manure; RDF: Recommended dose of fertilizer

liquid manures are presented in Table 3.

The quality parameters were superior under different biodigested liquid manurial treatments as compared to recommended dose of fertilizer application and control treatments. Among the different biodigested liquid manures, application of *Hyptis suaveolens* BDLM at 150 kg N equivalent ha^{-1} recorded significantly higher ascorbic acid (134.77 mg 100 g^{-1}), capsaicin (1.76 %), oleoresin (12.43 %) and total extractable colour (129.43 ASTA units) which was at par with *Cassia tora*/ *Sida cordifolia*/ *Cassia spectabilis* and *Crotalaria juncea* BDLM at 150 kg N equivalent ha^{-1}. However, significantly lower ascorbic acid (118.93 mg 100 g^{-1}), capsaicin (1.54 %), oleoresin (11.60 %) and total extractable colour value (108.50 ASTA units) were noticed with control treatment. The increase in ascorbic acid content might be ascribed to better availability and uptake of nutrients coupled with favourable conditions as a result of BDLM application which promoted synthesis of chlorophyll and increased the ascorbic acid content. This is quite evident from the positive and significant correlation between K content of capsicum fruits and ascorbic acid content (Kaminwar and Rajagopal, 1993). Increase in ascorbic acid content due to application of FYM or organic manures was also reported by Pradeep Gopakkali and Sharanappa (2014) and Chandrakala *et al.* (2011) in chilli, Chavan *et al.* (1997), Shashidhara and Shivamurthy (2008) in capsicum fruits and Patil *et al.* (2003) and Sable *et al.* (2007) in tomato.

Application of secondary and micronutrients is very much essential for yield (Table 2) and quality (Table 3) improvement of chilli (Bidari, 2000). However, Gollagi (1999) noticed improvement in the quality parameters of chilli with the combined application of micronutrients and growth regulator. Similarly, the ascorbic acid content and per cent whitened fruits were significantly lower with the application of copper ore tailings (COT) at higher dosage along with DAP (Diammonium phosphate) + CAN (calcium ammonium nitrate) form of nitrogen (Basavaraja *et al.*, 1998). The plant micronutrient requirement was satisfactorily met with the application of FYM or organic manures. These results are in agreement with the findings of Pither and Hall (1990) in tomatoes and Malawadi *et al.* (2003) in chilli who have reported higher content of ascorbic acid and oleoresin with the application of FYM and micronutrients. Santhosh Kumar Kattimani and Shashidhara (2006) also obtained higher oleoresin content in chilli with the application of FYM. Thimma Naik (2006) also observed increased oleoresin content from 2.30 to 14.0 per cent and colour value from 2.90 to 6.00 per cent with the application of organics *viz.*, poultry manure, vermicompost and FYM as sources of nutrients to chilli.

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REFERENCES

Adhikary, S. P. 2014. Studies on the influence of sugarcane trash vermicompost on the growth and biochemical parameters of brinjal plant (*Solanum melongena l.*). *The Ecoscan.* **8(3&4):** 207-210.

Ajeet singh, Gulati, I. J. and Rahul Chopra. 2013. Effect of various fertigation schedules and organic manures on tomato (*Lycopersicon esculentum* mill.) yield under arid condition. *The Bioscan.* **8(4):** 1261-1264.

Ananda, M. G., Reddy, V. C. and Kalyan Murthy, K. N. 2004. Effect of different nutrient sources on growth and yield of groundnut. *Environ. Eco.* **22(4):** 631-635.

Basavaraja, P. K., Nagaraja, A., Jagadesha, R. C., Yogeesha, H. S. and Manjunatha, H. M. 1998. Effect of copper ore tailings on fruit yield and seed quality of chilli. *Karnataka J. Agri. Sci.* **11**: 815-817.

Bidari, B. I. 2000. Studies on yield and quality of Byadgi chilli (*Capsicum annuum* L.) in relation to soil properties in transitional zone and part of dry zone of north Karnataka. *Ph.D. Thesis, Univ. Agric. Sci., Dharwad.*

Chandrakala, M., Hebsur, N. S. and Mahendra Kumar, M. B. 2011. Effect of FYM and fermented liquid manures on quality of chilli (*Capsicum annuum* L.). *Res. J. Agril. Sci.* **2(3):** 761-763.

Chavan, J., Syed Ismmail, Rudraksha, G. B., Malewar, G. U. and BAIG. 1997. Effect of various nitrogen levels through FYM and urea on yield, uptake of nutrients and ascorbic acid content in chilli

(*Capsicum annum* L.). *J. Indian Soc. Soil Sci.* **45(4):** 833- 835.

Gollagi, S. G. 1999. Influence of growth regulators and nutrients on productivity potential and quality in chilli. *M.Sc.(Agri.) Thesis*, Univ. Agric. Sci., Dharwad (India).

Gomez, K. A. and Gomez, A. A. 1984. *Statistical Procedures for Agriculture Research* 2nd Editio n. *J. Wiley & Sons*, New York.

Kaminwar, S. P. and Rajagopal, V. 1993. Fertilizer response and nutrient requirement of rainfed chillies in Andhra Pradesh. *Fert. News,* **36(7):** 21-26.

Malawadi, M. N., Shashidhara, G. B. and Palled, Y. B. 2004. Effect of secondary and micronutrients on yield, nutrient uptake and quality of chilli. *Karnataka J. Agric. Sci.* **17(3):** 553-556.

Patil, P. N., Chalwade, P. B, Solanka, A. S. and Kulkarni, V. K. 2003. Effect of fly ash and FYM on physico-chemical properties of Vertisols. *J. Soils and Crops* **13(1):** 59-64.

Pither, R. and Hall, M. N. 1990. Analytical survey of the nutritional composition of organically grown fruits and vegetables. *Technical Memorandum*, 597, MAFF project-4350, Campdon Food and Drink Research Association.

Pradeep Gopakkali and Sharanappa 2014. Effect of organic production techniques on the growth, yield, quality and economics of chilli (*Capsicum annuum*) and soil quality in dry zone of Karnataka. *Indian. J. Agron.* **59(1):** 151-156.

Sable, C. R., Ghuge, T. D., Jadhav, S. B. and Gore, A. K. 2007. Impact of organic sources on uptake, quality and availability of nutrients after harvest of tomato. *J. Soils and Crops.* **17(2):** 284-287.

Sadasivam, S. and Manickam., A. 2004. *Biochemical methods for agricultural sciences*, Wiley Eastern Limited, New Delhi, pp.178-192.

Santhosh Kumar Kattimani and Shashidhara, G. B. 2006. Integrated nutrient management in chilli genotypes. *Karnataka J. Agric. Sci.* **19(3):** 506-512.

Saravanane, P., Nnjappa, H. V. and Ramachandrappa, B. K. 2008. Effect of weed utilization on growth parameters, yield and nutrient uptake of potato. *Potato J.* **35(4):**122-125.

Sharma, G. D., Risikesh Thakur, Som Raj, D. L., Kauraw and Kulhare P. S. 2013. Impact of integrated nutrient management on yield, Nutrient uptake, protein content of wheat (*Triticum astivam*) and soil fertility in a *Typic haplustert*. *The Bioscan*. **8(4):** 1159-1164.

Shashidhara, G. B. and Shivamurthy, D. 2008. Studies on the effect of integrated nutrient management on growth, yield and yield parameters of chilli genotypes under vertisol of north transition zone of Karnataka. *Karnataka J. Agric. Sci.* **21(3):** 433-435.

Sheshadri Reddy, S., Shivaraj, B., Reddy, V. C. and Ananda, M. G. 2005. Direct effect of fertilizers and residual effect of organic manures on yield and nutrient uptake of maize (*Zea mays* L.) in groundnut - maize cropping system. *Crop Res.* **29(3):** 390-395.

Somasundaram, E. 2003. Evaluation of organic sources of nutrients and *Panchagavya* spray on the growth and productivity of maize sunflower-greengram system. *Ph. D. Thesis,* Tamil Nadu Agric. Univ., Coimbatore, India.

Sushil Kumar and Jayanta Deka, 2015. Weed utilization-wealth from waste. *Indian farm.* **65(7):** 73-75.

Thimma Naik, M. 2006. Studies on the effect of organic manures on growth, yield and quality of chilli (*Capsicum annuum* L.) under Northern Transitional Zone of Karnataka. *M.Sc. (Agri.) Thesis, Univ. Agric. Sci., Dharwad.*

Waghmode, B. R. 2010. Response of sweet corn (*Zea mays* L. *saccharata*) to different sources of organics. *M.Sc. (Agri.) Thesis,* Univ. Agril. Sci., Dharwad.