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COMPARATIVE STUDY OF EFFECT OF TEMPLE WASTE VERMICOMPOST AND CATTLE DUNG VERMICOMPOST ON THE GROWTH AND DEVELOPMENT OF BHINDI PLANT (*Hibiscus esculentus*)

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Abstract: Disposal of flowers offered daily to the deity in the temples by devotees creates pollution and unhygienic environment which leads to produce diseases. Hence, it is a matter of great concern to the temple management authorities as well as municipality of that area. These are either released in the water body (nearby ponds or river) or dumped at road side garbage bins. Flower vendors, marriage mandaps also generate a considerable quantity of flowers wastes. Being organic materials, these can be easily converted to good quality manure. Different varieties of seasonal coloured flowers are grown and utilized throughout India. An attempt has been made to prepare vermicompost from different types of flowers such as Marigold (*Tagetes*), Rose (Rosa), Chandni (*Tabernaemontana divaricata*), Yellow Kaner/White (*Cascabela thevetia*), oak (*Quercus*), mogra (*Jasminium sambac*) and lotus (*Nelumbo nucifera*) flowers. Flower waste vermicompost may be employed in vegetable as well as medicinal plants for the assessment of its quality. For this purpose twelve flower pots were selected and experiment were conducted in four combination of treatment, in Treatment-1 (TR-1) soil 4kg (8:0) alone as a control, Treatment-2 (TR-2) Soil + Temple waste vermicompost (8:1), Treatment -3 (TR-3) Soil + Cattle dung vermicompost (8:1) and Treatment-4 (TR-2) Soil + dung (8:1) were employed. In each pot two seed of bhindi plant were sown, called them Plant-1 (P1) and Plant-2 (P2). Each treatment was carried out in triplicate to reduce the variation. Experiments were conducted for 77 days (11 weeks). The main objective of this study is to find the quality of prepared vermicompost of floral waste on the growth and development of bhindi plant (*Hibiscus esculentus*) in comparisons to others.
Key words: Bhindi Plant, Cattle-dung vermicompost, Temple-waste vermicompost.
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INTRODUCTION

Solid waste is basically unwanted or discarded material that is not a liquid or a gas; it includes organic waste, paper, metals, glass, cloth, bricks, rocks and yard waste etc. Now a day due to increased population, numbers of temples are also increased and tons of temple waste in the form of flowers, leaves, fruits, sugar, milk and milk products, grains generated on daily basis. This waste is disposed in open dumps or river which generates foul odour and unhygienic environment which may lead to a numbers of diseases to human being. Looking into the hazardous impact of the improper disposal of wastes on the environment, emphasis should be given on aerobic composting which converts waste materials into organic manure rich in plant nutrients. Common treatment provided for these waste are composting and vermicomposting. Several workers reported the potential utilization of epigeic earthworm for successful degradation of organic waste, generated from different factories such as dairy industry (Gratelly *et al.,* 1996), Winery and distillery industry (Nogales *et al*., 2005), Paper and pulp industry (Elvira *et al*., 1997) and (Kumar and Jagadeesan, 2010), Wood and chips industry (Maboeta and Van Rensburg, 2003), Textile mill (Kaushik and Garg, 2004) and flower waste (Kumar and Anbuganapathy, 2010). Vermicomposting is known as a sustainable source of macro and micronutrients, plant growth hormones and enzymes (Kale and Karmegam, 2010) which not only enhance microbial population but also hold nutrients for longer periods (Ndegwa and Thompson, 2001). Kohli and Hussain (2016) proposed to use temple waste for eco-friendly treatment methods like vermicomposting. Kaushik and Garg (2004) considered vermicompost as a supplement to fertilizers and it releases the major and minor nutrients slowly with significant reduction in C/N ratio, synchronizing with the requirement of plants. Edwards (1995; 1998) explained that vermicompost may contain hormones, soil, enzymes and high microbial population which increase plant growth. Scott (1988) reported that the growth of hardy ornamentals, *Chaemocyparis lawsonian, Elaeagnus pungens, Cuppressocypari leylandii, Pyracantha* spp. *Cotoneaster conspicus* and *Viburnum bodnantense* increases significantly after addition of low levels of earthworm-worked organic wastes to the growth media even when the nutrients in the two media were balanced. Edwards and Burrows (1988) reported that the vermicompost has considerable potential for improving plant growth significantly, when used as a component of horticultural soil or container media. Babu (1995) concluded that a part from the available nutrients in the plants growth, there are so many promoter substances found in the earthworm's cast, which are responsible for the luxuriant growth of the plants. Nainawat (1997) observed that the addition of vermicast in different ratio to the soil increased the crop production. Gutierrez-Miceli *et al*., (2007) observed that a significant increase in mean stem diameter and mean plant height of tomato plant was observed by the addition of different concentrations of sheep manure vermicompost in soil. Singh *et al*., (2013) reported vermicomposting of three types of waste *i.e.* kitchen waste, farmyard waste and temple waste for period of 120 days for suggesting good compost for seed germination and plant growth, after analysis of C/N, C/P, TK and electrical conductivity, resulted that temple waste using *Eisenia fetida* is good as compared to other two waste. Subler *et al*., (1998) reported that the incorporation of small amount (10%) of pig manure vermicompost into a commercial bedding plant potting media was sufficient to produce a significant increase in the total biomass of tomato seedlings after 3 weeks of growth in the greenhouse. Edwards and Burrows (1989) reported that vermicompost produced by *Eisenia fetida* and prepared from various decaying organic matter have been claimed to be useful as plant growth media for a wide range of plants. Bryan and Lance (1991) found that tomatoes grown in compost-amended soils yielded more. Muscolo *et al*., (1999) reported that the vermicomposts are comprised of large amounts of humic substances, some of the effects of which on plant growth are similar to those of soil-applied plant growth regulators. Ghosh *et al*., (1999) observed that integration of vermicompost with inorganic fertilizers tended to increase the yield of crops *viz*- potato, rape seed, mulberry and marigold over other traditional composts. Mosaddeghi *et al*., (2000) reported that the cattle dung can also improve soil structure, soil moisture holding capacity, possibility of seed bed preparation for root growth, vegetative growth and improving the quality of crop yield. Canellas *et al*., (2000; 2002) concluded that plant growth regulator and plant growth hormones amend in vermicompost by the action of microorganisms or by the effects of humates, increases the growth and yields of plants. Atiyeh *et al*., (2000) reported that the vermicompost has substances such as humic acids (HA) and hormones that together regulate the growth and production of plants. Sanwal *et al*., (2006) reported increased crop yield and dietary antioxidants of broccoli with the use of compost and non-aerated compost tea.

Several other scientist reported the beneficial effects of vermicompost on crops like maize (Gutierrez-Miceli *et al*., 2008), wheat (Sharma and Madan, 1988), strawberry (Singh *et al*., 2008), petunias (Arancon *et al*., 2004), marigold, pepper, cornflower, tomato (Bachman and Metzger, 2008), blackgram and pepper (Arancon *et al*., 2004). Sundararasu and Neelanarayanan (2012) clearly indicated that small proportion of vermicompost can effectively enhance growth and yield of tomatoes by improving various physico-chemical properties of the soil. Jain (2016) reported that flower waste vermicomposting is an excellent and ecofriendly method to get valuable products which will lead to a healthier and waste free environment. Therefore, the present investigation was undertaken to study comparative assessment of the quality of flower waste vermicompost and cattle dung vermicompost on the growth and development of bhindi plant.

EXPERIMENTAL

Temple wastes were procured from the Shri Mansapuran Hanuman ji Maharaj temple near to railway station, Gwalior (M.P), India. The 100 kg amount (approx.) of temple flowers waste generated daily while amount of flower waste increases on Tuesday and Saturday up to 500 to 1000 kg. Cattle dung was collected from different dairy farm. The waste management was conducted in the Charak Udyan, Jiwaji University, Gwalior (MP), India. Experiments were conducted in 12 same size cemented flower pots having capacity 5-6 kg. In each pot a hole was made at bottom for removing excess water. Experiments were carried out in triplicate to reduce variation. Four set of combination were prepared in first treatment (TR-1) Soil alone control (8:0), Treatment-2 (TR-2) Soil + Temple waste vermicompost (8:1), Treatment-3 (TR-3) Soil+ Cattle dung vermicompost (8:1) and Treatment-4 (TR-4) Soil+ Dung (8:1). Two seed of bhindi plant were sown in the each pot, marked as plant-1 (P1) and plant-2 (P2). From above experiment a comparative effect of temple waste and cattle dung vermicompost was assessed on growth and development of bhindi plants for 77 days (11 weeks).

RESULTS AND DISCUSSION

On the basis of the results of this study, it can be concluded that, out of four treatments *i.e.* TR-1, TR-2, TR-3 and TR-4 (which were taken in 8:1 ratio), S+TWVC (TR-2) was observed best than comparison to S+CWVC (TR-3) and control (TR-1) in terms of growth and different parameters of development (shoot length, numbers of leaves, numbers of flowers and numbers of fruits) of the bhindi plants (*Hibiscus esculentus*). In the treatment of S+TWVC (TR-2) combination, values of shoot length of bhindi plants were obtained as 45.79±0.38 cm and 42.8±0.33 cm for plant P1 and P2 respectively. Number of leaves were counted for plant P1 20.37±0.48 and for P2 20.80±0.48. Numbers of flowers were calculated to be 5.09±0.06 and 5.47±0.66 for plant P1and P2 respectively and the quantity of fruits were observed for plant P1 4.71±0.19 and for P2 4.61±0.26, whereas in the treatment of S+CWVC (TR-3) combination, the values of different growth and developmental parameters of bhindi plants P1 and P2 were recorded to be 40.12±0.44cm and 37.96±0.40cm for shoot length, 20.04±0.56 and 20.71±0.50 for number of leaves, 5.04±0.04 and 4.95±0.08 for numbers of flowers and 4.18±0.20 and 4.23±0.17 for numbers of fruits respectively. The results of both control plants of bhindi were calculated for different parameters such as for shoot length 36.74±0.38cm and 36.10±0.34cm, number of leaves 17.09±0.32 and 17.14±0.37, numbers of flowers 4.33±0.06 and 4.00±0.00 and numbers of fruits 3.18±0.09 and 3.37±0.17 for P1 and P2 respectively. On comparison, observations of both the treatments *viz.* S+TWVC (TR-2) and S+CWVC (TR-3) were found significantly higher from control bhindi plant's results.

Table 1: Effect Of Temple Waste Vermicompost (TWVC), Cattle Dung Vermicompost (CWVC) And Dung (Du) On the Shoot Length in Bhindi Plants (*Hibiscus esculentus*)

Weeks / Ratio	WEEK 1		WEEK 2		WEEK 3		WEEK 4		WEEK 5		WEEK 6		WEEK 7		WEEK 8		WEEK 9		WEEK 10		WEEK 11	
Plants	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2
TR-1 S control (8:1)	6.2 ± 0.91	5.85 ± 1.00	11.09 ± 0.26	11.26 ± 0.39	13.65 ± 0.27	13.72 ± 0.24	16.75 ± 0.31	15.8 ± 0.25	19.46 ± 0.32	18.23 ± 0.36	22.27 ± 0.35	21.39 ± 0.35	25.08 ± 0.38	24.52 ± 0.42	28.33 ± 0.36	27.95 ± 0.34	31.14 ± 0.27	30.77 ± 0.32	34.55 ± 0.80	33.54 ± 0.28	36.74 ± 0.38	36.1 ± 0.34
TR-2 S+TWVC (8:1)	7.22 ± 1.06	6.35 ± 1.16	13.67 ± 0.35	12.68 ± 0.31	16.13 ± 0.32	15.29 ± 0.33	19.17 ± 0.46	17.63 ± 0.27	22.97 ± 0.46	20.33 ± 0.36	27.33 ± 0.52	23.68 ± 0.33	31.67 ± 0.49	27.92 ± 0.67	35.65 ± 0.42	32.92 ± 0.47	39.16 ± 0.37	36.6 ± 0.43	42.47 ± 0.31	39.32 ± 0.38	45.79 ± 0.38	42.38 ± 0.33
TR-3 S+CWVC (8:1)	6.51 ± 0.92	6.26 ± 1.07	12.11 ± 0.29	11.86 ± 0.30	14.55 ± 0.31	14.31 ± 0.28	17.18 ± 0.26	17.02 ± 0.33	19.88 ± 0.38	19.7 ± 0.27	22.96 ± 0.32	22.21 ± 0.32	26.25 ± 0.47	25.49 ± 0.45	30.97 ± 0.35	29.41 ± 0.40	34.24 ± 0.38	33.52 ± 0.35	36.72 ± 0.26	35.12 ± 0.27	40.12 ± 0.44	37.96 ± 0.40
TR-4 S+DU (8:1)	6.43 ± 0.96	6.03 ± 1.00	11.55 ± 0.33	11.52 ± 0.39	14.35 ± 0.29	14.03 ± 0.23	16.93 ± 0.29	16.16 ± 0.27	19.64 ± 0.31	19.12 ± 0.34	22.68 ± 0.44	21.74 ± 0.35	25.32 ± 0.36	24.8 ± 0.42	28.85 ± 0.36	28.32 ± 0.36	31.59 ± 0.31	31.99 ± 0.44	33.99 ± 0.26	34.88 ± 0.29	37.03 ± 0.39	37.53 ± 0.35

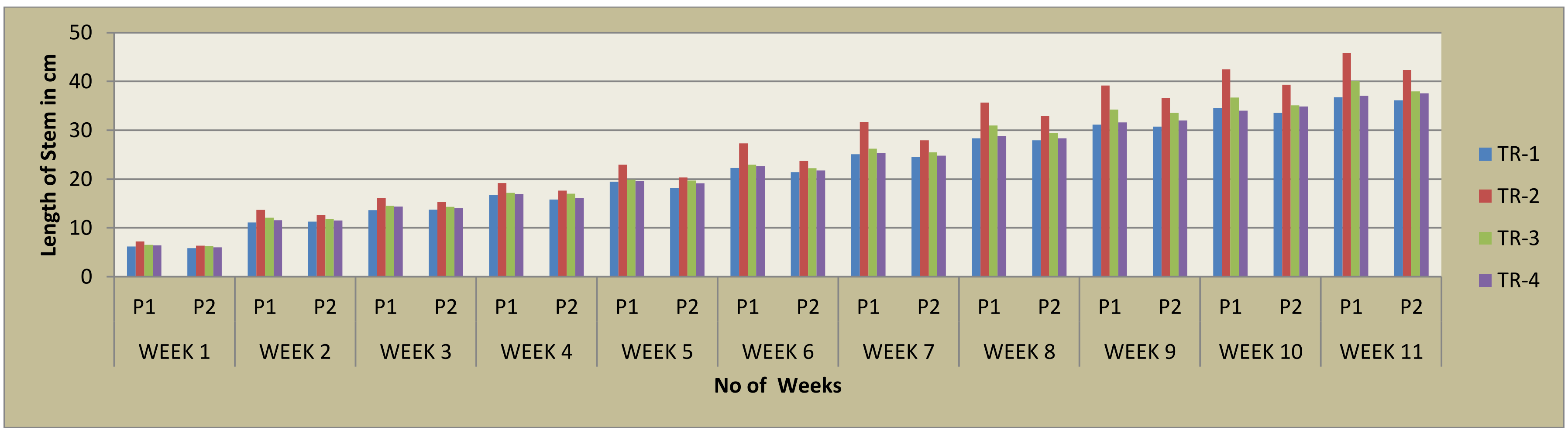

Figure 1. Showing week wise shoot length of Bhindi (*Hibiscus esculentus*) plants

Table 2. Effect of Temple Waste Vermicompost (TWVC), Cattle Dung Vermicompost (CWVC) And Dung (Du) On the Leaves of Bhindi (*Hibiscus esculentus*)

Weeks / Ratio	WEEK 1		WEEK 2		WEEK 3		WEEK 4		WEEK 5		WEEK 6		WEEK 7		WEEK 8		WEEK 9		WEEK 10		WEEK 11	
Plants	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2
TR-1 S Control (8:1)	2.38 ± 0.18	2.38 ± 0.18	3.66 ± 0.17	3.71 ± 0.17	4.28 ± 0.17	4.28 ± 0.18	5.33 ± 0.15	5.33 ± 0.17	6.85 ± 0.17	6.71 ± 0.15	8.42 ± 0.25	8.57 ± 0.25	10.33 ± 0.25	10.66 ± 0.29	12.09 ± 0.17	12.23 ± 0.16	13.66 ± 0.23	13.47 ± 0.16	15.38 ± 0.17	15.09 ± 0.17	17.09 ± 0.32	17.14 ± 0.37
TR-2 S+TWVC (8:1)	2.38 ± 0.18	2.38 ± 0.18	3.66 ± 0.17	3.66 ± 0.17	4.71 ± 0.21	4.52 ± 0.16	5.85 ± 0.16	5.66 ± 0.17	7.61 ± 0.30	7.18 ± 0.21	9.56 ± 0.26	9.18 ± 0.26	11.47 ± 0.22	11.13 ± 0.23	13.71 ± 0.25	12.8 ± 0.26	15.42 ± 0.18	14.8 ± 0.21	16.99 ± 0.20	16.99 ± 0.30	20.37 ± 0.48	20.8 ± 0.48
TR-3 S+CWVC (8:1)	2.42 ± 0.20	2.38 ± 0.18	3.66 ± 0.17	3.66 ± 0.17	4.75 ± 0.23	4.66 ± 0.19	5.75 ± 0.09	5.8 ± 0.10	7.13 ± 0.19	7.09 ± 0.27	8.9 ± 0.36	9.28 ± 0.27	10.94 ± 0.21	11.09 ± 0.22	12.71 ± 0.22	12.66 ± 0.17	14.66 ± 0.37	14.56 ± 0.23	16.8 ± 0.12	16.9 ± 0.36	20.04 ± 0.56	20.71 ± 0.50
TR-4 S+DU (8:1)	2.38 ± 0.18	2.38 ± 0.18	3.66 ± 0.17	3.66 ± 0.17	4.38 ± 0.17	4.28 ± 0.18	5.37 ± 0.15	5.42 ± 0.17	6.8 ± 0.17	6.75 ± 0.15	8.47 ± 0.25	8.61 ± 0.25	10.56 ± 0.25	10.47 ± 0.29	12.33 ± 0.17	12.18 ± 0.16	13.85 ± 0.17	13.71 ± 0.23	15.75 ± 0.22	15.61 ± 0.21	17.75 ± 0.32	17.52 ± 0.37

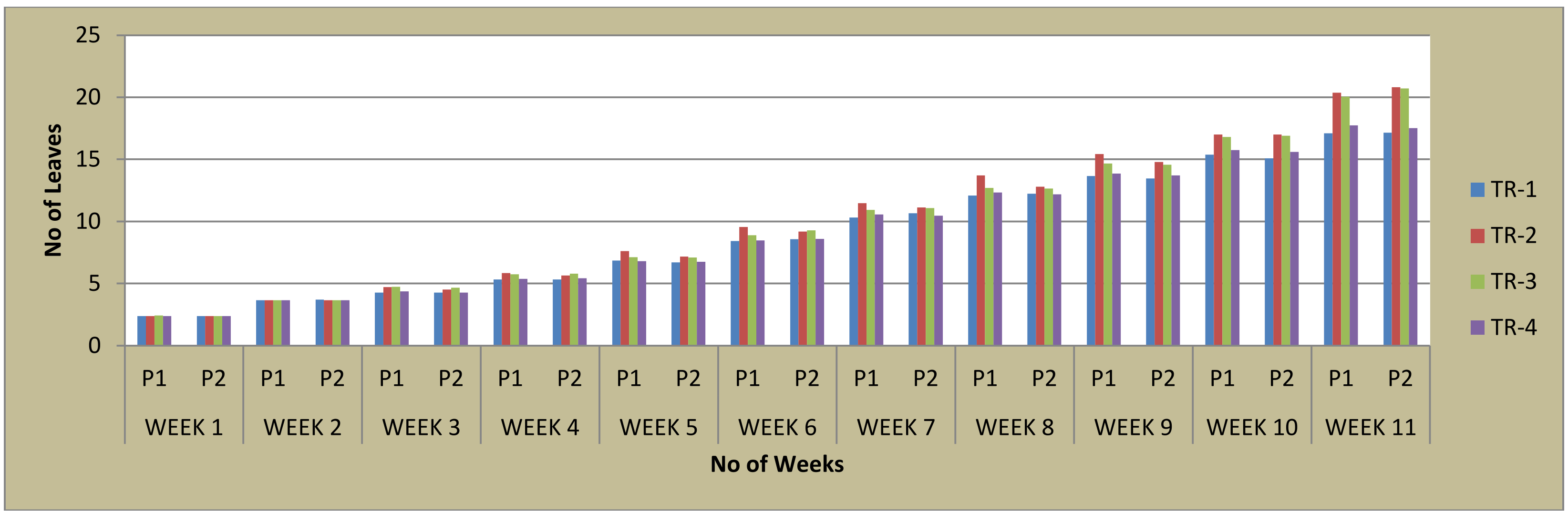

Figure 2. Showing week wise number of leaves in Bhindi (*Hibiscus esculentus*) plants

Table 3. Effect of Temple Waste Vermicompost (TWVC), Cattle Dung Vermicompost (CWVC) And Dung (Du) On the Number of Flower in Bhindi (*Hibiscus esculentus*)

Weeks / Ratio	WEEK 1		WEEK 2		WEEK 3		WEEK 4		WEEK 5		WEEK 6		WEEK 7		WEEK 8		WEEK 9		WEEK 10		WEEK 11	
Plants	**P1**	**P2**	**P1**	**P2**	**P1**	**P2**	**P1**	**P2**	**P1**	**P2**	**P1**	**P2**	**P1**	**P2**	**P1**	**P2**	**P1**	**P2**	**P1**	**P2**	**P1**	**P2**
TR-1 S control (8:1)	--	--	--	--	--	--	0.95 ± 0.35	1.04 ± 0.37	2.18 ± 0.12	2.04 ± 0.04	2.9 0 ± 0.06	2.61 ± 0.08	3.33 ± 0.10	3.28 ± 0.11	3.66 ± 0.00	3.66 ± 0.00	4.09 ± 0.09	3.66 ± 0.00	4.33 ± 0.00	3.66 ± 0.00	4.8 ± 0.06	4.00 ± 0.00
TR-2 S+TWVC (8:1)	--	--	--	--	--	--	1.14 ± 0.40	0.99 ± 0.35	2.71 ± 0.13	2.42 ± 0.17	3.61 ± 0.13	3.23 ± 0.06	4.09 ± 0.06	3.66 ± 0.10	4.56 ± 0.06	4.00 ± 0.00	4.66 ± 0.00	4.33 ± 0.00	4.85 ± 0.06	4.75 ± 0.06	5.09 ± 0.06	5.47 ± 0.06
TR-3 S+CWVC (8:1)	--	--	--	--	--	--	1.14 ± 0.40	1.04 ± 0.37	2.85 ± 0.19	2.71 ± 0.21	3.85 ± 0.99	3.37 ± 0.04	4.33 ± 0.10	3.95 ± 0.13	4.66 ± 0.00	4.56 ± 0.06	4.66 ± 0.00	4.66 ± 0.00	4.66 ± 0.00	4.66 ± 0.00	5.04 ± 0.04	4.95 ± 0.08
TR-4 S+DU (8:1)	--	--	--	--	--	--	1.14 ± 0.40	1.14 ± 0.40	2.00 ± 0.00	2.09 ± 0.06	2.76 ± 0.23	2.75 ± 0.12	3.8 ± 0.12	3.33 ± 0.00	4.00 ± 0.00	3.52 ± 0.09	4.00 ± 0.00	4.00 ± 0.00	4.00 ± 0.00	4.00 ± 0.00	4.47 ± 0.06	4.23 ± 0.09

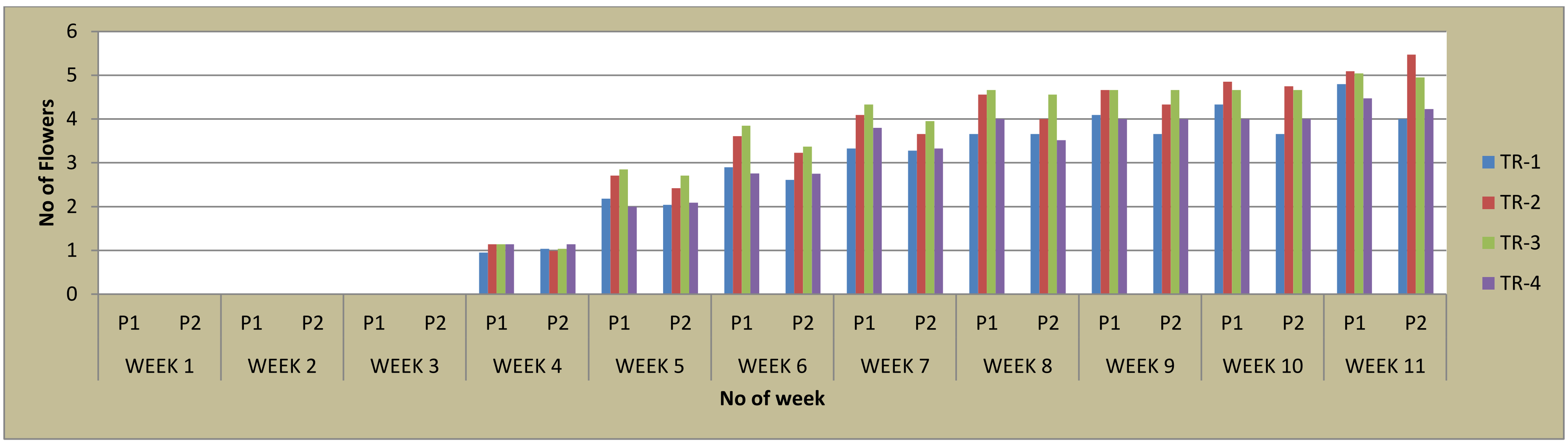

Figure 3. Showing week wise number of flower in Bhindi (*Hibiscus esculentus*) plants

Table 4. Effect of Temple Waste Vermicompost (TWVC), Cattle Dung Vermicompost (CWVC) and Dung (Du) on the Fruits of Bhindi (*Hibiscus esculentus*)

Weeks / Ratio	WEEK 1		WEEK 2		WEEK 3		WEEK 4		WEEK 5		WEEK 6		WEEK 7		WEEK 8		WEEK 9		WEEK 10		WEEK 11	
Plants	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2
TR-1 S control (8:1)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.42 ± 0.20	0.18 ± 0.06	1.00 ± 0.00	0.90 ± 0.09	2.14 ± 0.09	1.47 ± 0.12	3.18 ± 0.09	3.37 ± 0.17
TR-2 S+TWVC (8:1)	--	--	--	--	--	--	--	--	--	--	--	--	0.33 ± 0.16	0.33 ± 0.16	1.47 ± 0.12	1.33 ± 0.72	2.37 ± 0.11	2.37 ± 0.11	3.09 ± 0.09	3.14 ± 0.06	4.71 ± 0.19	4.61 ± 0.26
TR-3 S+CWVC (8:1)	--	--	--	--	--	--	--	--	--	--	--	--	0.37 ± 0.11	0.37 ± 0.13	1.09 ± 0.09	1.33 ± 0.07	1.95 ± 0.08	1.80 ± 0.06	2.85 ± 0.12	2.52 ± 0.12	4.18 ± 0.20	4.23 ± 0.17
TR-4 S+DU (8:1)	--	--	--	--	--	--	--	--	--	--	--	--	0.04 ± 0.47	0.04 ± 0.47	0.80 ± 0.06	0.90 ± 0.06	1.04 ± 0.04	1.04 ± 0.04	2.18 ± 0.09	1.56 ± 0.14	3.52 ± 0.14	3.37 ± 0.21

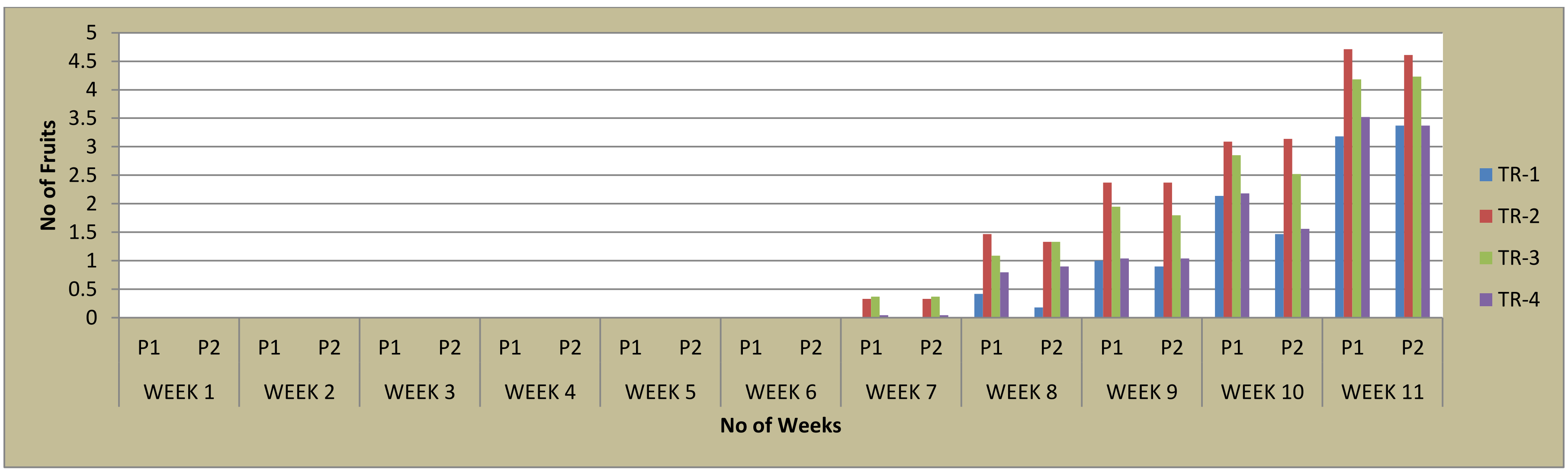

Figure 4. Showing week wise number of fruits in Bhindi (*Hibiscus esculentus*) plants

The observations of growth and developmental parameters of this investigation of bhindi plants (*Hibiscus esculentus*) were in accordance with the results of Prabha *et al.,* (2007), where they had tested vermicompost on different plants of vegetables (*Hibiscus esculentus* and *Solanum melongena*) and medicinal plants (*Adhatoda vasica* and *Solanum trilobatum*) for growth parameters *viz.* root length, shoot length and number of leaves. In that study, vermicompost was found to be superior in terms of mannuring potential than comparison of inorganic fertilizer and farm yard manure (FYM). This type of superior efficacy of temple waste vermicompost (TWVC) was also noticed in the present investigation on bhindi plants. Results of temple waste vermicompost (TWVC) on bhindi plants were also supported by the observation of Gutierrez-Miceli *et al*., (2007) where they found, on addition of different concentrations of sheep manure vermicompost in soil, a noticeable increase in mean stem diameter and mean plant height of tomato. Singh *et al*., (2007) reported that the administration of vermicompost increased the yield of marigold (*Calendula officinalis*) than other organic manures. Atiyeh *et al*., (2001) and Zaller, (2007) showed that the vermicompost influenced the growth and productivity of a variety of plants such as cereals and legumes and ornamental flowering plants at higher rate. Other the other hand, the efficacy of vermiwash (by product of vermicompost) exerted beneficial effects on the growth and developmental parameters of tomato plants when sprayed directly as well as mixed with a definite ratio of vermicompost (Samadhiya *et al.,* 2013). On the basis of present study, temple wastes vermicompost may play a role as an effective and potential tool to protect the degradation of environment and pollution of pond/river.

CONCLUSION

Present investigation drawn conclusion that temple waste and cattle dung vermicompost were found to be statistically significant than control plants where they deprived from any treatments except watering. On comparison temple waste vermicompost was observed to be better than cattle dung vermicompost in terms of growth and developmental parameters.

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