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PHYTOTOXICITY ASSESSMENT OF FOUR DIFFERENT SEASON'S KITCHEN WASTE COMPOST AT DIFFERENT LEVEL OF CONCENTRATION ON MUNG BEANS (*VIGNA RADIATA*(L.))

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Abstract

Present study deals with the phytotoxicity assessment of different season's kitchen waste compost (kwc) at different level of concentration on seed germination, root elongation and germination index of *Vigna radiata* (L.). Result showed that 60% (C4) of compost water extract was found not highly significant in promoting seed germination as it may be due to higher concentration of salt content and excessive mineral content , while other concentration showed significant result at 20%(C2) and 40% (C3) of every season's kwc. 20% concentration of autumn season compost followed by summer , winter and spring. 20% to 40% level of concentration of every season's kwc showed positive result due to the presence of optimum level of primary and secondary level of plant's vital nutrients.

Key words: Phytotoxicity , kitchen waste compost, concentration , *Vigana radiata* (L.)

Introduction

In the current worldwide situation and future prospects, the cyclization of natural matter from waste from different sources becomes necessary for the quest for maintainability and conservation of natural resources. (Hottle *et al*., 2015).

Composting is describe as the most effective techniques for this action, a procedure in which oxygen consuming microorganisms mineralize substrates making them reasonable for consolidation into the soil without degrading the condition (Zhang *et al*., 2012). Furthermore, it contributes fundamentally to the issue of sustenance security, as it advances a reuse of natural assets, a decrease in the cost of nourishment by diminishing the import of manures and, subsequently, expanding nearby financial advancement (Hosetti and Frost, 1995; Correa *et al*., 2012; Fels *et al*., 2014).

Kitchen waste is described as left-over organic rely from eating places, lodges and families. Kitchen waste paperwork a considerable a part of domestic waste. (Chaudhary and Mishra, 2018).

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The composting procedure has an intricate elements with interconnected parameters that specifically impact the finished product, for example, dankness, microbial load present, pH, natural (organic) carbon among others, which, if outside the guidelines required by the enactment, can lead to activities destructive to the soil flora and fauna. (Mendes *et al*., 2016).

Phytotoxicity is the most essential criteria for assessing the reasonableness of compost for farming purposes and to maintain a strategic distance from ecological dangers before these fertilizers can be reused back to agricultural land. (Tiquia *et al*., 1996; Brewer and Sullivan, 2003 and Cooperband *et al*., 2003). Past research work has shown that utilization of immature manure onto the soil causes negative impacts on seed germination, plant development and improvement. These impacts occur because of the fact that a immature compost instigates high microbial action (which lessen oxygen level in the soil), obstructs the current soil available nitrogen (Zucconi *et al*., 1981a). Immature compost additionally present phytotoxic mixes, for example, substantial metals (Tam and Tiquia, 1994). Phenolic mixes (Wong, 1985), ethylene and alkali (Tam and Tiquia, 1994), abundance gathering of salts (Tam and Tiquia, 1994), and natural acids (Manios *et al*., 1989) which could hinder seed germination and plant development. Acetic Acid is presumably the most harming natural acid discharged immature manure, however there are likewise different compounds that add to the phytotoxic impact (Ozores-Hampton, 1998).

Infact, application on soil of no stablized natural materials could influence the both crops and the environment on account of the presence of phytotoxic material (Butler *et al*., 2001). High level of salt and the release of natural acids into the manures are additionally related to hindrance of germination and development.

Phytotoxicity is frequently best assessed by leading germination or development tests (Gariglio *et al*., 2002 and Brewer and Sullivan, 2003), yet the test plants must be chosen with consideration (Emino and Warman, 2004).

Germination Index (GI) is the most ideal approach to test the phytotoxicity of manure to plant development because the results of it are quite accurate and reliable.

Germination bioassays are broadly used to test for saltiness, soil pathogens, lethal substances and some other chemical properties of compost (Zucconi *et al*., 1985 and Gajdos 1997), which could be the significant potential reasons of phytotoxicity. A few specialists detailed that phytotoxic compounds are progressively eliminated of amid the composting procedure, which could clarify the GI increments with composting time.

The Germination Index (GI), which combines of relative seed germination (G%) and relative root lengthening (L%), has been utilized to assess the harmfulness of manure. (Tam and Tiquia, 1994, Tiquia *et al*., 1996 also, Wong *et al*., 2001). It has been noticed that a GI value of 80% showed the vanishing of phytotoxins in compost (Zucconi *et al*., 1981b and Tiquia *et al*., 1996). Utilized this value not just as sign of the vanishing of phytotoxicity but also as a sign of the maturity of compost.

The germination index is a maturity test based on seed germination and starting plant growth utilizing an aqueous concentrate from the compost (Zucconi, *et al*., 1981b). It shows the phytotoxicity of the manure extricates at diverse phases of composting. The compost is considered mature when the germination index is higher than 60 %, contrasted with the control with distilled water (Zucconi and De Bertoldi, 1987).

The most well known germination test utilized by researchers is from cress test (Zucconi *et al*., 1981a and Erhart and Burian, 1997). In their view, the compost is non-dangerous when the germination rate is over 85% or on the other hand the plant seedling weights are over 90%. Adjacent to, composting researchers discovered that GI at each composting time did not demonstrate any noteworthy changes with the dilutions of the concentrate, or notwithstanding when the concentrate was diluted up to 75% with distilled water. They conducted that ammonia salts and low atomic weight natural acids were two phytotoxic substances proposed and plant development expanded as these vanished. (Wei *et al*., 2000) revealed that when the GI is more than 80% Compost is considered develop and basically free of phytotoxic substances.

An expanded GI is demonstrative of diminished phytotoxicity and in this manner of a more mature product (Tiquia *et al*., 1996; Bernal *et al*., 1998; Tiquia and Tam, 1998 and Wong *et al*., 2001). Obtained utilizing the GI index ought to be translated with consideration since they are influenced by the kind of seed utilized and the source of compost (Bernal *et al*., 1998; Tiquia and Tam, 1998; and Brewer *et al*., Sullivan, 2003). Utilization of undecomposed squanders or non-stablized compost to land may prompt immobilization of plant nutrients and cause phytotoxicity (Butler *et al*., 2001 and Cambardella *et al*., 2003). Infact, germination index is the most senstive parameter used to assess toxicity of compost to seedlings, and to test if compost is develop (Zucconi *et al*., 1981a; Wong *et al*., 2001 and Meunchang *et al*., 2005). Tang *et al*. (2006) detailed that extraction rate is a critical factor that impacts GI. They directed that a 10:1 extraction rate is appropriate for assessing the GI change during the maturity of cattle manure compost. They also revealed that distinctive extraction rates gave unique changing patterns of GI during the maturity process.

Therefore, this study deals with the toxicity and maturity assessment of kwc of different seasons at different level of concentration by using mung beans *Vigna radiata* (L.) in terms of seed germination.

Material and methods

Feedstock preparation

Kitchen waste become gathered from the main hostel mess of Baba Saheb Bhim Rao Ambedkar University Campus Lucknow, India often for one week in order to get a homogenous aggregate of feedstock. The collective meals waste changed into considered as a representative sample of the waste produced in hostel mess due to all styles of meals waste. The total wide variety of people input into mess for breakfast is round 150 according to day, whereas during the lunch time the entire variety exceeds 300 in step with day. The moisture content material (MC) of the accrued sample become 82.6%, and the use of such moisture wealthy waste aggregate in the composting manner can create waterlogged or anaerobic situations (Brinton, 2000]. Therefore, the sample was solar-dried for 24 h to attain the preferred MC (70%) for composting process, as consistent with popular suggestions of Brinton (2000) and EPA (2014).

Experimental setup

A laboratory scale in-vessel compost bioreactor made of plastic with a complete running potential of 10 kg become commissioned and used. Dimensions of the reactor have been: top 63.5, diameter 66.6 cm and thickness 10 mm. The vessel turned into blanketed with aluminum foil and styrofoam to prevent warmness losses. The reactor became filled with combined and ground feedstock as much as 70%, while 30% of the place was saved as a head area. The thermometer was fixed in the center of the compost bioreactor to display the temperature changes during the method. After loading the feedstock, the bioreactor lid became closed. Air flow changed into done through pores located at the lid of the bioreactor. Shredding of the compost combination was performed robotically through an agitator for attaining uniform mixing and oxygen (O_2) supply in the course of the experiment as encouraged by way of (An *et al*, 2012). The method of aerating the compost materials via turning and combining become followed consistent with the system defined by Singh and Kalamd had (2014), (Jindo *et al.,* 197 and Singh *et al*, 2014). The samples have been then transported in sealed aluminum foil to the laboratory, wherein stones, plastic and metals have been removed, oven dried at 700degree Celsius and the compost is homogenized via a 2 mm sieve. The compost samples were saved within the dark bottles until similarly analysis.

a. Chemical analysis:

Nitrogen was estimated by the Kjeldahl Method (Bremner, 1960). The $N\text{-}NH_4^+$, $N\text{-}NO_3^-$ and the available portion of $P_{(CAT)}$, $K_{(CAT)}$ and $Mg_{(CAT)}$ was estimated in CAT solution (0.01 mol L^{-1} $CaCl_2$ and 0.002L diethylene triamine penta acetic acid) at the rate of 1:10 (w/v) according to the International BSI Standard EN 13651, 2001.

b. Statistical analysis:

One-way analysis of variance (ANOVA) (L. Ott; 1984) was employed to test the data variability and validity of the results using the Microsoft excel 2007.

2.4. Compost water extracts:

A water extract of each compost was prepared by shaking the samples with distilled water at 1:10 w/v ratio for 1 hour, and then percolated (Zucconi *et al*., 1981b).

Based on the above method, the water extract of different season's compost was prepared by shaking the samples with distilled water at different concentration level (ratio) 2:10w/v as 20% (C2) , 4:10w/v as 40%(C3) and 6:10w/v as 60%(C4) respectively for one hours and then filtered.

Phytotoxicity evaluation:

The phytotoxicity of compost extracts was assessed by the seed germination technique (Zucconi *et al.* 1981b, Tam and Tiquia, 1994 and Tiquia *et al*., 1996). Mung seeds (*Vigna radiata L.*) surface were sterilized by immersion in 75% alcohol for three minutes followed by transferring in 0.001 $HgCl_2$ solution for two minutes with periodical agitation and then thoroughly washed with sterilized distilled water to get rid of toxic chemicals (Rovira, 1956). Subsequently, 10 seeds of *Vigana Radiata* (L.) were placed in sterilized petriplates of uniform size lined with two filter paper of Whatman No. 1. These filter paper were then moistened with 10 ml of prepared water compost extract of different seasons at different ratio was applied in a Petriplate. All experiments were run in triplicate. The Petri dishes were sealed with tape to reduce water loss while allowing air penetration and then were incubated in the dark for 24, 48 & 72 hours at room temperature, the seeds that germinated were counted and removed from petriplate at the time of initial count on each day for 3 days that is for 72 hours. The criteria of germination which we have taken was the visible protrusion of radical from seed coat and it was expressed in percentage. The germination index was estimated for seeds kept at ambient temperature at every 24 hours of time interval of incubation duration up to 72 hours. The germinated seeds were counted to the initial appearance of the radical by continuous visual observation for 72 hours. The seed germinated in distilled water was used as control (C1). The percentage of seed germination, root elongation and germination index (GI) was calculated according to (Zucconi *et al*., 1981b) as follows:

$$Seed\ germination = \frac{No. of\ seeds\ germinated\ compost\ extract}{No. of\ seeds\ germinated\ in\ contorl} \times 100$$

$$Root\ elongation = \frac{Mean\ root\ length\ in\ compost\ extract}{Mean\ root\ length\ in\ contorl} \times 100$$

$$Germination\ Index = \frac{Seed\ Germination(\%) \times Root\ elongation}{100}$$

Results and discussion

Nitrogen content

Based on the table 1 transition in several parameter discussed .During composting, ideal nitrogen concentration is required which is around 0.3 to 1.5% for

Table 1: Chemical parameter of kitchen waste compost of 4 different season and their variation at different weeks.

Parameters /Week	Spring	Summer	Autumn	Winter	Mean	MIN	MAX	CV(%)
Nitrogen	Mean (+SD)	Mean(+SD)	Mean(+SD)	Mean(+SD)				
0	1.54(+0.03)	1.33(+0.03)	0.98(+0.03)	0.89(+0.04)	1.19	0.89	1.54	26
4	1.66(+0.06)	1.45(+0.02)	1.26(+0.04)	1.07(+0.03)	1.36	1.07	1.66	19
6	1.89(+0.16)	1.65(+0.04)	1.60(+0.20)	1.42(+0.08)	1.64	1.42	1.89	12
12	2.26(+0.15)	1 .85(+0.05)	177(+0.13)	1.57(+0.02)	1.86	1.57	2.26	16
$N\text{-}NH_4^+$								
0	419.87(+25.44)	400.30(+1.84)	403.25(+2.63)	370.44(+17. 82)	398.47	370.44	419.87	5
4	76.17(+13.84)	62.09(+4.91)	54.37(+2.84)	42.40(+2.21)	58.76	42.4	76.17	24
6	33.23(+0.92)	28.76(+1.11)	32.66(+2.49)	31.46(+1.25)	31.53	28.76	33.23	6
12	25.77(+4.55)	22.00(+0.42)	26.92(+1.66)	24.28(+2.47)	24.74	22	26.92	9
$N\text{-}NO_3^-$								
0	311.63(+1.50)	374.06(+12. 44)	400.57(+1.60)	339.85(+6.27)	356.53	311.63	400.57	11
4	13.90(+4.26)	56.93(+8.94)	52.78(+4.42)	72.99(+3.87)	49.15	13.9	72.99	51
6	54.87(+2.58)	11.13(+1.11)	5.43(+1.01)	1589(+1.91)	21.83	5.43	54.87	103
12	73.53(+1.22)	13.66(+1.81)	6.40(+0.16)	19.38(+1.00)	28.24	6.4	73.53	109
P_{CAT}								
0	692(+11.59)	1227(+16.50)	737(+24.02)	787(+19.05)	860.75	692	1227	29
4	669(+16.62)	668(+12.29)	615(+25.48)	570(+37.75)	630.5	570	669	8
6	437(+25.17)	456(+18.77)	496(+7.37)	493(+7.57)	470.5	437	496	6
12	296(+4.93)	419(+22.74)	440(+34.78)	399(+1.53)	388.5	296	440	16
K_{CAT}								
0	8788(+12.58)	1 147(+44.50)	7674(+99.67)	5994(+6.43)	5900.75	1147	8788	57
4	10376(+544. 16)	6845(+135.9 6)	8443(+40.51)	6913(+22.54)	8144.25	6845	10376	20
6	11335(+233. 12)	7337(+15.72)	8876(+203.59)	8726(+54.37)	9068.5	7337	11335	18
12	13424(+310. 40)	9943(+48.99)	11504(+204. 16)	8982(+11.53)	10963.25	8982	13424	18
Mg_{CAT}								
0	1040(+26.41)	1393(+6.81)	996(+6.08)	687(+10.54)	1029	687	1393	28
4	626(+24.58)	686(+7.23)	693(+6.66)	618(+23.03)	655.75	618	693	6
6	584(+3.51)	548(+34.59)	614(+15.28)	572(+4.16)	579.5	548	614	5
12	497(+5.13)	550(+11.72)	601(+1.53)	584(+3.51)	550	497	601	8

the absorption of other nutrient. Initial nitrogen concentration of our compost was higher 1.54% during spring season and lowest was in winter season. As mineralization process proceed, there was gradual increase in nitrogen concentration was observed in all four seasons. (De Guardia *et al*., 2008), (Hanc *et al*, Himanen and Hänninen, 2009) reported increasing trend of nitrogen composition in post composting days. but the increasing amount (1.2) was low in comparison with Hanc (1.4) and Himanen and Hänninen (1.5) during spring, summer and winter while it was higher (1.9) during Autumn season.

$N\text{-}NH_4^+$ Transition

The ratio of $N\text{-}NH_4^+$ has been used as maturity index of compost, also this transition during composting process affects compost quality. Highest concentrations of $N\text{-}NH_4^+$ are produced in the first few weeks of composting in all four seasons. Ammonia volatization occurs with increase in pH in conjugation with increase in temperature during spring and summer, which results due to increase nitrogen loss. Increase in moisture content mainly during Autumn and winter season decreases nitrogen volatization, as dissolved ammonia is directly utilized by microorganisms (Li *et al.,* 2013), During initial stage, $N\text{-}NH_4^+$ composition was maximum approx 420 ppm in spring, 400 ppm in summers, 403 ppm during Autumn and lowest was in summer 370ppm which falls rapidly during second and sixth week of composting . These decrease in $N\text{-}NH_4^+$ results were in agreement with (Elkin and Kirchmann, 2000) and (Hanc *et al.,* 2016) Hanc *et al.* reported that rapid decline in $N\text{-}NH_4^+$ content is an efficient indicator of good quality composting

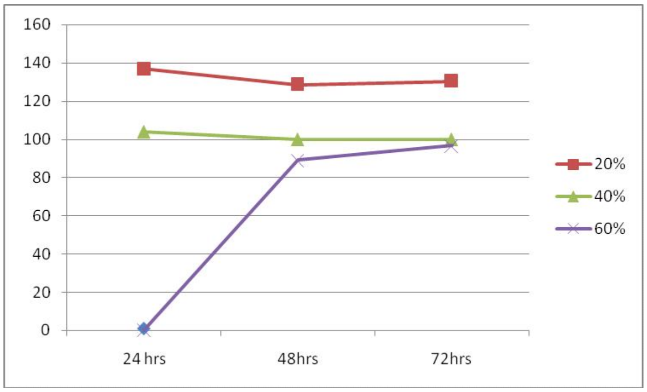

Fig. 1a : Seed Germination% Spring Kitchen waste compost at different level of concentration.

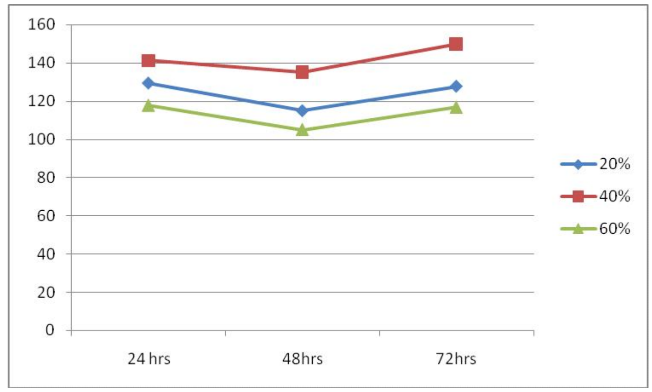

Fig.1b: Seed Germination% Summer Kitchen waste compost at different level of concentration.

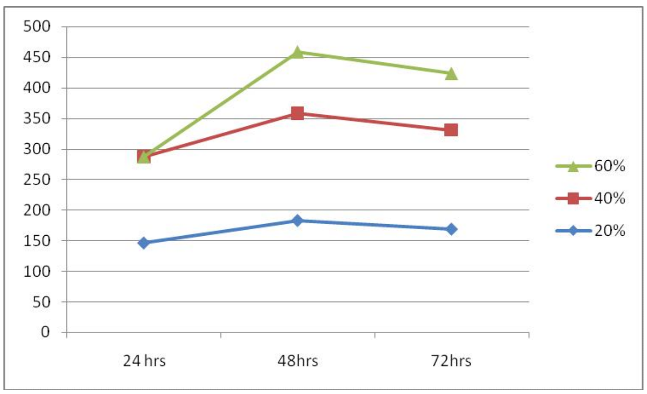

Fig. 1c: Seed Germination% Autumn Kitchen waste compost at different level of concentration.

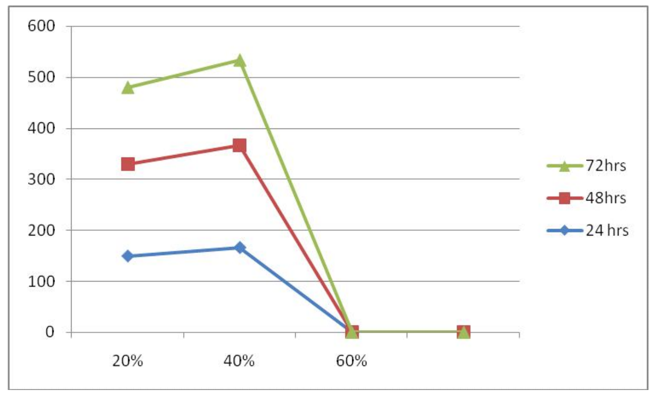

Fig. 1d: Seed Germination% Winter Kitchen waste compost at different level of concentration.

process. The final compost contains lowest N-NH_4^+ transition during summer season which was 22ppm while it was highest in Autumn (approx 27ppm) and intermediate in Spring and winters with approx 25ppm.

N-NO_3^- Transition

Bord na Mona, 2003 provided standard nitrate-nitrogen concentration during composting. It is reported that N-NO_3^- releases during the maturation stage of composting process, thus it is favorable that sufficient amount of Nitrogen content should be present in compost of all seasons.

N-NO_3^- concentration higher than N-NH_4^+ denotes proper maturation and efficient compost material. unfortunately initial concentration of N-NO_3^- was quite low in comparison with N-NH_4^+ concentration in our study N-NH_4^+ and N-NO_3^- ratio depends on dry mass and moisture mass of the compost. It is reported that compost with high dry mass tend to have high N-NH_4^+: N-NO_3^- ratio, while compost having high moisture content tend to have low N-NH_4^+:N-NO3 ratio thus it determines maturity of the compost.

At the 2 weeks of composting, rapid decrease in N-NO_3^- concentration was observed in all four seasons, maximum fall was observed during spring and summer season while it was minimum in winters, which may be due to increase in temperature and high N-NH_4^+ content. At 6th week of composting there were subsequent increase in N-NO_3^- content was observed in spring season which indicates faster maturity of compost, while N-NO_3^- were continuously tend to decrease in summer, winter and Autumn seasons. (Himanen and Hänninen, 2009) also found increase in N-NO_3^- concentration during post composting days, while (Hnac *et al.,* 2016) reported that the concentration of N-NO_3^- varied considerably during the year, with coefficients of variance found between 100% to 110% on average founds similar with our study with 109% coefficient variation. Inverse correlation between decreasing amounts of N-NH_4^+ with increases in the concentration of N-NO_3^- towards the end of composting suggest that intensive biological decomposition has been completed (Pare *et al.,* 1998). High N-NH_4^+: N-NO_3^- ratio was observed during spring season, intermediate during summer and winter while lowest was observed during Autumn season in this study.

Phosphorus ($P_{(CAT)}$)

Initially Higher amount of $P_{(CAT)}$ was observed during

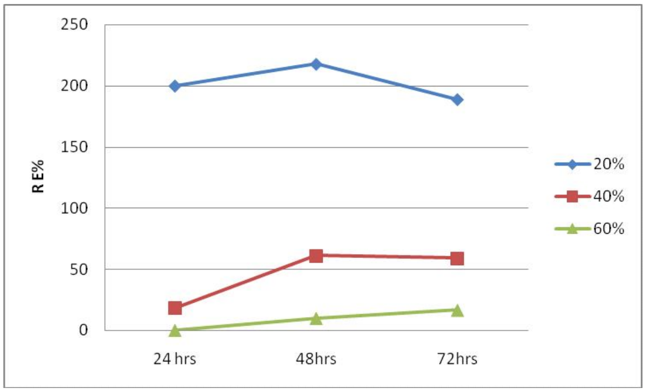

Fig. 2a : Root Elongation(RE)% Spring Kitchen waste compost at different concentration with hours

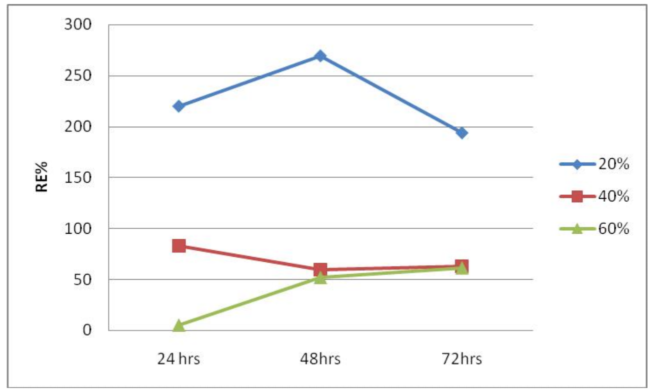

Fig. 2b: Root Elongation(RE)% Summer Kitchen waste compost at different concentration with hours

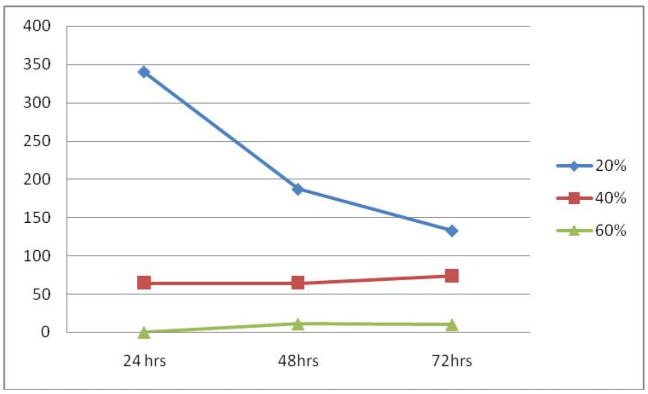

Fig. 2c: Root Elongation(RE)% Autumn Kitchen waste compost at different concentration with hours.

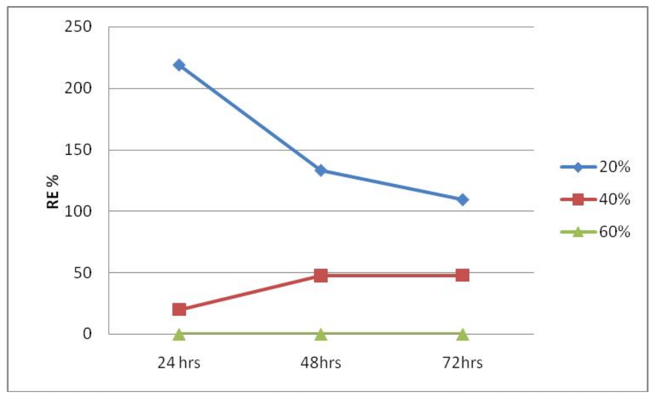

Fig. 2d: Root Elongation(RE)% Winter Kitchen waste compost at different concentration with hours.

summer season followed by winter than autumn and spring seasons. In our study, there were slightly decrease in $P_{(CAT)}$ was observed during all four seasons with significant amount of water absorption. (Iyengar and Bhave, 2006) also found decrease in water soluble $P_{(CAT)}$ during post composting days. Initially $P_{(CAT)}$ showed 29% coefficient variability among four seasons.

Potassium ($K_{(CAT)}$)

In this type of compost, composition process releases highly soluble potassium, Thus absorbs significant amount of water, and maintain structural integrity and porosity which inversely decrease the loss of potassium during composting. in present study, initial concentration of potassium was noted maximum during spring season followed by Autumn, while lowest was noted during summer season, which was exponentially increased during post composting day.

Potassium is considered as essential growth nutritional element, so it helps plants in better growth, also its higher concentration has fewer or now toxic effects on human growth. There was 57% coefficient variability among values of four season of $K_{(CAT)}$. These results were found similar with Hanc *et al.,* (2016).

Magnesium ($Mg_{(CAT)}$)

In kitchen waste compost, food and vegetables, fine earth, pulses and various spices are the principal source of magnesium. This tend to varies magnesium content drastically from region to region. in our compost, magnesium higher in summer season and lower in winter seasons, these concentrations were higher than standard magnesium concentration recommended by Barker *et al.* (1997). The coefficient variation was 28% initially and decreases to 8% while comparing $Mg_{(CAT)}$ in four seasons. $Mg_{(CAT)}$ tend to decrease rapidly and higher percentage of decrease was noted in spring season. However Mgtot ranges from 13% to 0.33% over four seasons, higher was observed during winters and lower was recorded in summer season. Generally, composts produced from kitchen waste contained higher amounts of nutrients extracted from vegetables, fruits oils and by implication exhibit superior agronomic value.

Seed germination: The toxicity and maturity of compost has been estimated in all four seasons in three different composting concentrations by using seed germination and relative root elongation percentages.

During spring season, there was 86% and 90% seed

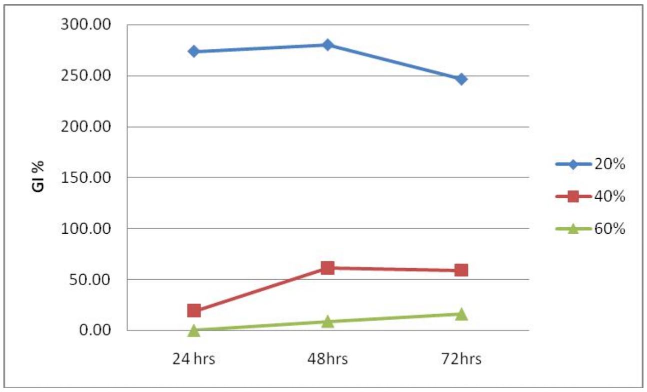

Fig. 3a: Germination Index (GI)% Spring Kitchen waste compost at different concentration with hours.

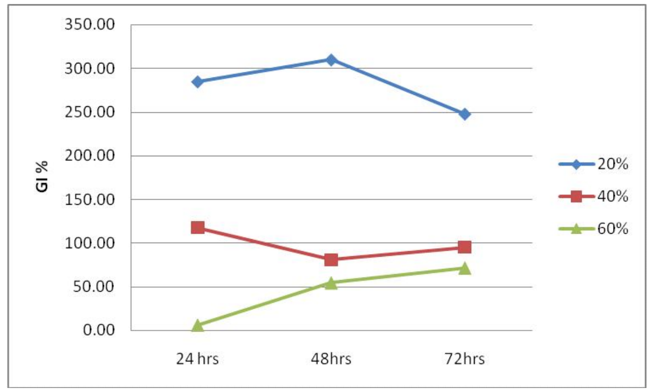

Fig. 3b: Germination Index (GI)% Summer Kitchen waste compost at different concentration with hours.

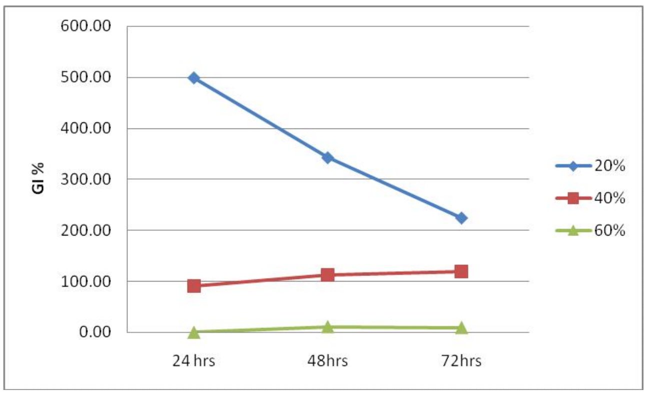

Fig. 3c: Germination Index (GI)% Autumn Kitchen waste compost at different concentration with hours.

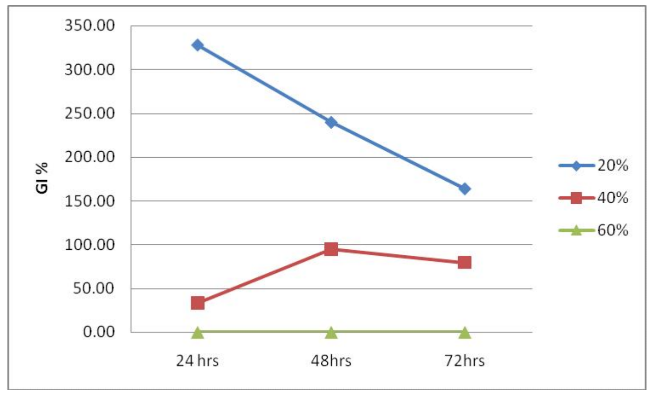

Fig. 3d: Germination Index (GI)% Winter Kitchen waste compost at different concentration with hours.

germination in C2 and C3 compost composition respectively as shown in fig. 1a, which was selectively higher than control compost (63%). The percentage of seed germination was gradually increased in all four compositions, but reaches maximum in C2 and C3 compost after 72hrs of composting. Initially C4 of compost shown no growth, which reveals presence of toxic elements or higher amount of minerals than required for minimal growth. After 72hrs, C2 and C3 compost was found appropriate concentration of matured compost as shown in figure 1.a

During Summer, according to figure 1.b C3 compost shown maximum growth rate (90%) in all four types of compost. Interestingly C4 composition of compost also shown seed growth equivalent to control compost which is may be due to temperature gradient during summers, which enhances activity of thermophiilic bacteria, thus provide minimal growth even at higher mineral concentration. The N- NO_3^- , $P_{(CAT)}$, $K_{(CAT)}$ and $Mg_{(CAT)}$ found maximum in summer.

In Autumn, fig. 1c reveled ,C2 compost provides maximum nutrients for growth, almost 23% higher in comparison with control compost, while C3 compost also found almost similar results as per C2. C4 compost shows no growth initially and minor growth after 72hours.

In winter's when moisture content increases, C3 compost was the best composting concentration as it shows 26% greater than growth provided by control compost, again C2 provide growth concordant to C3 compost and C4 provides no growth throughout the 72 hours as shown in fig. 1d. Thus, C2 and C3 were found for maximal growth in all four seasons.

Root Elongation:

As there were maximum percentage of seed germination was observed in C2 and C3, favorable results were found in their root elongations also. During spring season root length in C2 treated compost was double in comparison with control which was gradually increased with time and remained double as shown in figure 2.a in comparison with control. similar results was obtained in summer season (fig. 2.b) also, were root length was maximum in C2 composition throughout the time . In C2 maximum root length reached in 48hours of composting. C3 also shown significant root length in 48hours and 72hours. while there was no to minimal growth in C4 compost water extract. Similarly Autumn and winter seasons according to fig. 2c, d, shown maximum root length in C2 composition, in autumn season C2 shown 77% greater root length in comparison with control while in winters its 63% greater root length.

Germination Index(GI)

Consistent with the results of seed germination and root elongation in all four seasons, C2 compost shows maximum germination index in all four season as shown in fig. 3a, b, c and d. In the 24 hours GI was around 27% in C2 which was maximum in all four types of compost, this was gradually increased and reaches maximum in 48 hours. But after that, GI in all four types of season's compost extract was tend to decrease. In summer there was 4% decrease in C2 compost, in summer (figure 3.b) its 6% decreased in GI, while in autumn (fig. 3c) GI falls almost 12% in 72hours, and in winter there was 8% decrease in GI was noted. Above results revealed that C2 compost is the most prominent for seed germination and root elongation in at 48hrs of time, thus it is considered as best concentration for seed germination which is significant in comparison with control compost. Thus it would be beneficial to use C2 compost composition as it will provide better agricultural applications. The elimination of phytotoxicity has also been widely used as a measure of compost maturity [Wei *et al.,* 2000; Wu and Ma, 2001; Butler *et al.,* 2001 Cambaradella *et al.,* 2003 and Menunchang *et al.* 2005].

Conclusion

The above study proved that, the toxicity and maturity assessment of Kitchen waste compost of different seasons at different level of concentration directly proportional to seed germination , root elongation and germination index, unmature Kitchen waste compost (high concentration of N-NH_4^+ to N-NO_3^-) inhibiting seed germination and root elongation.

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