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Interaction effect of nitrogen and vermicompost in the presence of herbicide (Clodinafop propargyl) on nitrogen transformation in a sandy soil

Hardeep Singh Sheoran* and B.S. Duhan

Department of Soil Science, CCS Haryana AgriculturalUniversity, Hisar-125004 (Haryana), INDIA
*Corresponding author. E-mail: sheoranhardeep2008@gmail.com

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Abstract: A laboratory experiment with three levels of nitrogen (0, 100 and 200 mg kg^{-1}), two levels of vermicompost (0 and 1 % on dry wt. basis) and two levels of herbicide (0 and 60 g a.i. ha^{-1}) was conducted with sandy soil of Hisar to study the interaction of nitrogen and vermicompost in the presence of herbicide (clodinafop propargyl) on nitrogen transformation during 2014. NH_4^+-N contents increased upto the 14th day in soil and then declined up to 56th day under control. NO_3^--N content in soil increased significantly throughout the incubation study under control. With conjunctive use of nitrogen along with vermicompost, NH_4^+-N contents increased significantly in the soil upto 14th day of incubation with an increase from 44.49 to 73.22 mg kg^{-1} and 64.00 to 102.87 mg kg^{-1}, whereas NO_3^--N content in soil significantly increased throughout the incubation study over control and the increase was from 13.68 to 101.36 mg kg^{-1} and 23.19 to 115.48 mg kg^{-1}. However, NH_4^+-N and NO_3^--N decreased significantly at all incubation periods with the application of herbicide alone and in presence of nitrogen as well as vermicompost. The study revealed that judicious use of N, leads to more availability of N to crop and prevents the environmental pollution. Higher levels of N application may increase the risk of ground water pollution due to more availability of NO_3^- ion which can be subjected to leaching losses. Vermicompost proved to be the important source of nutrients as it has narrow C:N ratio and decompose more quickly than other organic manures such as FYM etc. Among commonly used herbicides, clodinafop propargyl is most commonly used herbicide and may have negative impact on the microbial population and thus may hinder the transformation processes particularly in sandy soils which have low organic matter content and thereby affecting the availability of nutrients to crop and play decisive role in crop yields.

Keywords: Clodinafop propargyl, Nitrogen, Nitrogen transformation, Vermicompost

INTRODUCTION

Interest in nitrogen transformations in soils has increased greatly now-a-days, particularly with increased usage of urea-containing fertilizers because proper synchronization of nutrient release and crop uptake needs a detail study of nutrient mineralization behaviour from different sources. Secondly, content of mineral nitrogen ($N_{min.}$) in the soil is one of the most important factors with a decisive role in high crop yields and a potential risk of environmental pollution. An accurate prediction of N that is mineralized from soil organic matter during a growing season would result in a more efficient use of N fertilizer and decrease the potential surface and groundwater contamination (Haney *et al.* 2001). The balanced nutrition involves systematic exploitation of potential soil resources, chemical fertilizers, biofertilizer and organic manures. When manures are applied in conjunction with urea for efficient growth of crop, decline in organic carbon was arrested and gap between potential and actual yield was bridged to a large extent (Singh *et al.* 2001). Microbial communities in the soil are enhanced and stimulated by the addition of organic manures, especially due to the presence of readily available nutrients and C compounds. In general, organic manures has high levels of macronutrients such as N, P, K, Ca and micronutrients such as B, Zn and Mn. Since the application of organic manures can affect soil processes, including nitrogen (N) mineralization, can change biological and biochemical indicators, studies are needed to measure the effect of this practice on soil (Tejada *et al.* 2006).Transformation of nitrogen is a complex process brought about by succession of different micro -organisms in the soil which affect the soil fertility, whereas herbicide application may inhibit various processes such as nitrification, denitrification and N fixation (Jolankai *et al.* 2006). To understand the behavior of integrated use of organics and mineral N in this regard, it is essential to monitor the availability of NH_4^+-N and NO_3^--N in the soil solution and exchange complex. Mineralizable N in the soil plays a dominant role in the nutrition of crops. Incorporation of organic materials along with fertilizer N affects the amount and distribution of N fractions considerably in soil (Santhy *et al.*1998). With advancement of agricultural technology use of herbicides is now-a-days a common practice to manage weeds to get higher production and profit. Clodinafop propargyl is such a commonly used soil applied herbicide which is used to manage weeds. However, this chemical may alter the balanced soil ecology and result into altered mineralization pattern.

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However, the information regarding the effect of herbicide in conjugation with nitrogen and vermicompost on nitrogen transformation in the soil is very scanty. Keeping this in view, the present study was planned to assess the interaction effect of nitrogen and vermicompost in the presence of clodinafop propargyl on nitrogen transformation in soil.

MATERIALS AND METHODS

An incubation study was conducted under controlled laboratory condition in the Department of Soil Science CCS HAU, Hisar (29^0 05 ′N, 75^0 38 ′E, 222 m elevation) to study the effect of nitrogen, vermicompost and herbicide (clodinafop propargyl) on nitrogen transformation. The soil was sandy in texture, having pH 8.1, EC (1:2) 0.15 dS m^{-1} and organic carbon was 0.15%. Available N, P and K were 54.50, 8.00 and 73.70 mg kg^{-1}, respectively (Table 1). The treatments comprised of three levels of nitrogen (0, 100 and 200 mg kg^{-1}), two levels of vermicompost (0 and 1 % on dry wt. basis) and two levels of herbicide (0 and 60 g a.i. ha^{-1}). After treatment the soil was incubated for 56 days in wide mouth plastic bottles maintaining the soil moisture at field capacity. The soil was analyzed for NH_4^+-N and NO_3^--N contents on 0, 3rd, 7th, 14th, 21st, 28th, 35th, 42nd, 49th and 56th days of incubation (but 0, 7th, 14th, 21stand 56th days of incubation are mentioned in the tables because peak value and end period values were observed on these days). Completely randomized design was followed by keeping three replications. A total of 360 wide mouth plastic bottles were used and thirty grams of air dry soil per bottle was filled. Then vermicompost was added to half the number of bottles and thoroughly mixed with soil. Then solutions of 100 and 200 mg N kg^{-1} soil and herbicide were prepared. The soil samples in each bottle were treated with these solutions, making required combination of nitrogen, vermicompost and herbicide and the moisture was maintained at field capacity. After this total weight of each bottle was recorded and mouth of the bottles were closed with cotton. Then these bottles were put into the incubator at 25 ^{0}C. Moisture level was maintained daily by taking the weight of bottles on top pan balance. One set of 36 bottles at each sampling period was analyzed for different nitrogen fractions (NH_4^+-N and NO_3^--N). For different fractions of nitrogen, soil was extracted with 2 M KCL solution and determined by steam-distillation method (Keeney and Nelson, 1982).

RESULTS AND DISCUSSION

Effect of nitrogen levels and vermicompost at different incubation periods on :

NH_4^+-N: The conjunctive use of nitrogen at the rate of 100 and 200 mg kg^{-1} along with vermicompost, NH_4^+-N contents increased significantly in the soil upto 14thday of incubation and increase was from 44.49 to 73.22 mg kg^{-1} and from 64.00 to 102.87 mg kg^{-1}, respectively over the zero day of incubation (Table 2). Thereafter, it starts declining and this trend was observed till the end of incubation. However, at the end of incubation contents of NH_4^+-N in soil were 30.43 and 43.06 mg kg^{-1}, respectively with two levels of nitrogen. So, peak values (73.22 and 102.87 mg kg^{-1}) were observed on the 14th day of incubation. Duhan *et al*. (2001) reported that application of nitrogen and organic matter significantly increased the NH_4^+-N and NO_3^--N contents in the soil over control. In an another study, Zhang *et al*. (2012) reported that repeated applications of mineral and/or organic fertilizer enhanced mineralization from recalcitrant organic N, the application of organic fertilizers stimulated the mineralization of labile organic N. Gross NO_3^--N production solely resulted from NH_4^+-N oxidation. Moreover, the combined use of nitrogen and vermicompost resulted in higher build up of NH_4^+-N content in soil as compared to their separate use. It means the use of nitrogen also enhanced the decomposition/mineralization of vermicompost. NO_3^--N**:**

The combined use of nitrogen at the rate of 100 and 200 mg kg^{-1} and vermicompost increased NO_3^--N content in soil significantly throughout the incubation study over the control and the increase was from 13.68 to 101.36 mg kg^{-1} and from 23.19 to 115.48 mg kg^{-1}, respectively over initial incubation period (Table 3). However, increase in NO_3^--N contents in the soil were prominent upto 42nd day of incubation and later on contents were almost stable. So, the increase in NO_3^--N released in soils with combined application of nitrogen and vermicompost was continued upto the end of the incubation study. It shows that release of NO_3^--N from the vermicompost was slow and uniform throughout the NO_3^- incubation period. Hence, accumulation of -N increased with the proceeding of incubation upto the end of the incubation periods over control. The NO_3^--N release from the addition of chemical nitrogen was faster as compared to the vermicompost and the highest value (84.32 and 101.96 mg kg^{-1}) was observed on the 56th day of incubation, the accumulation of NO_3^--N was also increased with the addition of nitrogen and vermicompost separately as well as with their combined use.

It shows that nitrogen enhanced the decomposition rate of vermicompost. Duhan *et al*. (2001) reported that application of nitrogen and organic manure both increased the NO_3^--N contents in the soils with the increasing periods at all levels. They further reported that the combination of fertilizer nitrogen and organic manure was better than the fertilizer N or manure alone. It was further reported by Uprawy *et al*. (2011) in his study that application of N-fertilizer along with organic manure caused a significant increase in the nitrate concentration in the surface soil layer.

Effects of nitrogen and herbiside (clodinafop propargyl):

NH_4^+-N: It was ascertained that right from the zero day

Table 1. Physico-chemical properties of soil and vermicompost**:**

Property	Values	Method used
Soil		
Organic carbon (%)	0.15	Walkley and Black Wet oxidation method (Jackson, 1967)
Soil pH	8.10	Glass electrode pH meter (Jackson, 1967)
EC (dS/m at 25 ^{0}C)	0.15	Conductivity bridge meter (Richards, 1954)
Available nitrogen (mg kg^{-1})	54.50	Alkaline per magnate method (Subbiah and Asija, 1956)
NH_4^+-N (mg kg^{-1})	7.10	Steam-distillation method (Keeney and Nelson, 1982).
NO_3^--N (mg kg^{-1})	8.23	Steam-distillation method (Keeney and Nelson, 1982).
Vermicompost		
Total N (%)	1.30	Colorimetric (Nessler's reagent) method (Lindner, 1944)
Total P (%)	0.52	Vanadomolybdophosphoric yellow color method (Koenig and Johnson, 1942)
Total K (%)	1.22	Using flame photometer (directly)
Organic carbon (%)	15.23	Rapid titration method (Walkley and Black, 1934)

Table 2. Effect of nitrogen and vermicompost on NH_4^+-N contents (mg kg^{-1}) of soil

Nitrogen Levels (mg kg^{-1})	Incubation Days														
	0th			**7th**			**14th**			**21st**			**56th**		
	Vermicompost levels			**Vermicompost levels**			**Vermicompost levels**			**Vermicompost levels**			**Vermicompost levels**		
	0	**1%**	**Mean**	**0**	**1%**	**Mean**	**0**	**1%**	**Mean**	**0**	**1%**	**Mean**	**0**	**1%**	**Mean**
0	7.42	15.24	11.33	32.25	45.82	39.04	39.87	56.14	48.01	38.07	41.65	39.86	18.37	23.11	20.74
100	38.36	44.49	41.40	58.01	68.01	63.01	55.49	73.22	64.35	43.14	61.27	52.20	29.64	30.43	30.03
200	58.19	64.00	61.09	75.39	96.69	86.04	72.09	102.87	87.48	69.61	83.70	76.56	37.57	43.06	40.32
Mean	34.65	41.23		55.21	70.18		55.81	77.41		50.27	62.20		28.53	32.20	
N = 0.86 , V.C.= 0.70 and N × V.C. = 1.29				N = 2.05 , V.C.= 1.68 and N × V.C.= 2.91			N = 2.71 , V.C.= 2.21 and N × V.C. = 3.83			N = 1.87, V.C.= 1.52 and N × V.C.= 2.64			N = 1.99, V.C.= 1.62 and N × V.C.= 2.81		

N= Nitrogen and V.C. = Vermicompost

of incubation, application of herbicide decreased the NH_4^+-N content in soil even in the presence of nitrogen and the decrease was from 42.91 to 39.89 mg kg^{-1} and from 62.71 to 59.48 mg kg^{-1}, respectively over nitrogen alone (Table 4). Furthermore, on the 7th day of incubation application of herbicide in the presence of nitrogen at the rate of 100 and 200 mg kg^{-1} decreased the NH_4^+-N content in soil from 64.45 to 61.58 mg kg^{-1} and from 89.88 to 82.18 mg kg^{-1}, respectively. On the 14th day of incubation, application of herbicide in presence of nitrogen with decreased the NH_4^+-N contents in the soil from 66.87 to 62.83 mg kg^{-1} and from 91.76 to 83.20 mg kg^{-1}, respectively over nitrogen alone.

On the 21st day of incubation, application of herbicide with nitrogen levels (100 and 200 mg kg^{-1}) decreased the NH_4^+-N contents from 54.06 to 50.35 mg kg^{-1} and from 80.42 to 72.89 mg kg^{-1}, respectively. Moreover, on the 56th day of incubation, application of herbicide with nitrogen at the rate of 100 and 200 mg kg^{-1} decreased the NH_4^+-N content in soil from 34.45 to 25.62 mg kg^{-1} and from 42.96 to 37.65 mg kg^{-1}, respectively over nitrogen alone. Kucharski *et al.* (2009) demonstrated that the course of ammonification depended on the type and rate of herbicide added to soil, type of an organic compound undergoing ammonification and duration of the treatment. Among the tested herbicides, the strongest inhibitory effect on ammonification process was produced by Mocarz 75WG, which continued to exert negative influence on mineralization of organic substances for 36 hours. The herbicides kill a part of the microbe population and this fact negatively affects transformation of N in soil. It means the use of herbicide suppressed the process of ammonification. The effect of herbicide alone and in combination with the nitrogen (100 and 200 mg kg^{-1}) was spectacular even at this stage of incubation. Further, Parlda *et al.* (2010) reported that NH_4^+-N contents decreased with time with herbicide application. Urea treatments contained higher amount of NH_4^+-N as compared to Urea in combination with pendimethallin. Therefore it was well established that application of pendimethallin caused reduction in NH_4^+-N contents.

NO_3^--N**:**

Application of herbicide in the presence of nitrogen (100 and 200 mg kg^{-1}) decreased the NO_3^--N content from 14.71 to 11.59 mg kg^{-1} and from 22.25 to18.30 mg kg^{-1}, respectively over nitrogen alone on zero day of incubation (Table 5). On the 7th day of incubation,

Table 3. Effect of nitrogen and vermicompost on NO_3^--N contents (mg kg^{-1}) of soil

Nitrogen Levels (mg kg^{-1})	Incubation Days														
	0th			7th			14th			21st			56th		
	Vermicompost levels			Vermicompost levels			Vermicompost levels			Vermicompost levels			Vermicompost levels		
	0	1%	Mean	0	1%	Mean	0	1%	Mean	0	1%	Mean	0	1%	Mean
0	8.57	9.44	9.05	18.21	22.63	20.42	24.84	44.74	34.79	30.93	55.95	43.44	39.04	63.27	51.15
100	12.62	13.68	13.15	31.22	42.65	36.93	60.60	73.40	67.00	76.99	94.04	85.51	84.32	101.36	92.84
200	17.36	23.19	20.28	40.13	55.50	47.82	74.89	83.44	79.17	94.63	108.15	101.39	101.96	115.48	108.72
Mean	12.85	15.44		29.85	40.26		53.45	67.19		67.52	86.05		75.10	93.37	
N = 0.91, V.C.= 0.74 and N × V.C.= 1.28				N = 0.63, V.C.= 0.52 and N × V.C.= 0.90			N = 0.50, V.C.= 0.41 and N × V.C.= 0.71			N = 0.62, V.C.= 0.50 and N × V.C.= 0.88			N = 0.59, V.C.= 0.48 and N × V.C.= 0.84		

N= Nitrogen and V.C. = Vermicompost

decrease in the NO_3^--N content in soil was from 38.69 mg kg^{-1} to 35.18 mg kg^{-1} and from 52.01 to 43.63 mg kg^{-1}, respectively. Further it was revealed that on the 14th day of incubation, application of herbicide in the presence of nitrogen decreased the NO_3^--N content in soil from 69.26 to 64.75 mg kg^{-1} and from 81.38 to 76.95 mg kg^{-1}, respectively over nitrogen alone. On the 21th day of incubation, application of herbicide in the presence of nitrogen at the rate of 100 and 200 mg kg^{-1} decreased the NO_3^--N contents of the soil from 89.93 to 81.10 mg kg^{-1} and from 104.50 to 98.23 mg kg^{-1}, respectively over nitrogen alone. On the 56th day of incubation, NO_3^--N decreased with the application of herbicide along with nitrogen and decrease was from 97.26 to 88.43 mg kg^{-1} and from 111.88 to 105.56 mg kg^{-1}, respectively. Moreover, the highest value of NO_3^--N release in the soil with addition of nitrogen at the rate of 100 and 200 mg kg^{-1} and herbicide (clodinofop propargyl) together was also obtained on the 56th day of incubation. It shows that release of NO_3^--N from nitrogen (at both levels) and herbicide was declined as compared to use of nitrogen alone. Widowati *et al*. (2011) carried a laboratory experiments to study the pattern of nitrogen release from urea fertilizer with biochar application. The results indicated that application of biochar impede the transformation of NH_4^+-N to NO_3^--N. Our study also shows that the NO_3^--N released from the addition of nitrogen was higher as compared to combined application of nitrogen and herbicide. Moreover, Duhan *et al*. (2005) reported that application of metribuzin caused decrease in NO_3^--N contents in the soil. The decrease in NO_3^--N contents or nitrification rate indicated that nitrifying bacteria were sensitive to the application of metribuzin. So, it can be revealed that application of herbicide cause decrease in NO_3^--N contents or nitrification rate, however increased rate of nitrogen application compensate the ill effects of herbicide application on microbes and in turn on NO_3^--N contents in the soil.

Effects of vermicompost and herbicide (clodinafop propargyl):

NH_4^+-N: As in case of use of nitrogen and herbicide, application of herbicide in presence of vermicompost also decreased the NH_4^+-N content of soil from 42.68 to 39.78 mg kg^{-1} over vermicompost alone on zero day of incubation (Table 6). Data further revealed that on the 7th day of incubation application of herbicide in the presence of vermicompost decreased the NH_4^+-N content in soil from 73.28 to 67.07 mg kg^{-1} over vermicompost alone. On the 14th day of incubation, application of herbicide in the presence of vermicompost decreased the NH_4^+-N contents in the soil from 81.10 to 73.72 mg kg^{-1} over vermicompost alone.

Moreover, on the 21st day of incubation, application of herbicide in the presence of vermicompost further decreased in the NH_4^+-N contents and the extent of decrease was from 65.14 to 59.28 mg kg^{-1}. On the 56th

Table 4. Effect of nitrogen and herbicide (clodinafop propargyl) on NH_4^+-N contents (mg kg^{-1}) of soil

Nitrogen Levels (mg kg^{-1})	Incubation Days														
	0th			7th			14th			21st			56th		
	Herbicide levels (g a.i ha^{-1})			Herbicide levels (g a.i ha^{-1})			Herbicide levels (g a.i ha^{-1})			Herbicide levels (g a.i ha^{-1})			Herbicide levels (g a.i ha^{-1})		
	0	60	Mean	0	60	Mean	0	60	Mean	0	60	Mean	0	60	Mean
0	12.93	11.73	12.33	41.53	36.54	39.04	49.86	46.15	48.00	40.74	38.98	39.86	22.01	19.47	20.74
100	42.91	39.89	41.40	64.45	61.58	63.01	66.87	62.83	64.35	54.06	50.35	52.20	34.45	25.62	30.03
200	62.71	59.48	61.09	89.88	82.18	86.04	91.76	83.20	87.48	80.42	72.89	76.65	42.96	37.65	40.32
Mean	39.51	37.08		65.29	60.10		69.49	63.73		58.41	54.07		33.15	27.58	
N= 0.86, Herb.= 0.76 and N × Herb.= 1.21				N= 2.05, Herb.= 1.68 and N × Herb.= 2.91			N= 2.71, Herb,= 2.21 and N × Herb.= 3.83			N= 1.87, Herb,= 1.52 and N × Herb.= 2.64			N= 1.99, Herb,= 1.62 and N × Herb.= 2.81		

N= Nitrogen and Herb. = Herbicide

Table 5. Effect of nitrogen and herbicide (clodinafop propargyl) on NO_3^--N contents (mg kg^{-1}) of soil

Nitrogen Levels (mg kg^{-1})	Incubation Days														
	0^{th}			7^{th}			14^{th}			21^{st}			56^{th}		
	Herbicide levels (g a.i ha^{-1})			Herbicide levels (g a.i ha^{-1})			Herbicide levels (g a.i ha^{-1})			Herbicide levels (g a.i ha^{-1})			Herbicide levels (g a.i ha^{-1})		
	0	60	Mean	0	60	Mean	0	60	Mean	0	60	Mean	0	60	Mean
0	7.77	7.25	7.51	22.10	18.74	20.42	36.92	32.66	34.79	45.72	41.16	43.44	52.86	49.45	51.15
100	14.71	11.59	13.15	38.69	35.18	36.93	69.26	64.75	67.00	89.93	81.10	85.51	97.26	88.43	92.84
200	22.25	18.30	20.28	52.01	43.63	47.82	81.38	76.95	79.17	104.50	98.23	101.39	111.88	105.56	108.72
Mean	14.91	12.38		37.60	32.51		62.52	58.12		80.07	73.50		87.33	81.15	
N= 0.91, Herb,= 0.74and N × Herb.= 1.28				N=0.63, Herb,= 0.52 and N × Herb.= 0.90			N= 0.50, Herb,= 0.41 and N × Herb.= 0.71			N= 0.62, Herb,= 0.50 and N × Herb.= 0.88			N= 0.59, Herb,= 0.48 and N × Herb.= 0.84		

N= Nitrogen and Herb. = Herbicide

day of incubation, application of herbicide with vermicompost decreased the NH_4^+-N content in soil from 36.24 to 28.17 mg kg^{-1} over vermicompost alone. These results are in agreement with the work of Duhan *et al*. (2005) who reported that application of metribuzin caused decrease in NH_4^+-N content in soil as compared to sole application of FYM and control plot. The data suggested that impact of vermicompost on NH_4^+-N status of soil was for longer period and herbicide application alone or in combination with vermicompost decreased the NH_4^+-N contents of soil throughout the incubation study over control (without herbicide). These results are in contrast to those of Lucian *et al.* (1998) who reported a decline in the N mineralization process, which was highly affected by the presence/ application of the herbicides.

NO_3^--N: A perusal of data (Table 7) indicated that on the zero day of incubation, application of herbicide in presence of vermicompost decreased in NO_3^--N content from 16.61 to 14.26 mg kg^{-1} and this effect was observed throughout the incubation periods. On the 7^{th} day of incubation, decrease in NO_3^--N content in soil was from 42.19 to 38.34 mg kg^{-1}, whereas, on the 14^{th} day of incubation, application of herbicide in the presence of vermicompost decreased the NO_3^--N content in soil from 69.32 to 65.07 mg kg^{-1}. On the 21^{th} day of incubation, decrease in the NO_3^--N contents of the soil was from 90.24 to 81.85 mg kg^{-1}, whereas on the 56^{th} day of incubation, with the application of herbicide in the presence of vermicompost decreased the NO_3^--N content in soil from 97.56 to 89.18 mg kg^{-1}. The highest value of NO_3^--N release in the soil with addition of vermicompost and herbicide together was also obtained on the 56^{th} day of incubation. Nagaraja *et al*. (1998) reported that in an incubation study, atrazine application cause a significant decrease in NO_3^--N content in soil even in the presence of organic manure. The nitrification process was inhibited by atrazine and inhibition increased with increase in concentration of atrazine. These results indicated that release of NO_3^--N from vermicompost was suppressed in presence of herbicide as compared to alone vermicompost application. Duhan *et al*. (2005) also found a negative impact of metribuzin application on NO_3^--N contents in the soil and reported a significant decrease in NO_3^--N contents in the soil.

Note: There is not interpretation of the Data. All the findings are similar to the the findings of previous workers. Then what is new to your work ? Justify it for publication of thework.: Similar findings are reported but as we know N is the macro-nutrient and is deficient in almost all the Indian soils, therefore its keen management particularly in sandy soils is of utmost importance where availability is low from soil under intensive cropping systems. Physical constraints such as low retention of water and nutrients as in case of sandy soils are major problems in crop production and leads to low yields, other authors carry similar work with other soil types where leaching losses of N are not a problem. Soil texture determines the potential risk of environmental pollution (ground water pollution). As leaching losses are higher in case of sandy

Table 6. Effect of vermicompost and herbicide (clodinafop propargyl) on NH_4^+-N contents (mg kg^{-1}) of soil

V.C. Levels	Incubation Days														
	0^{th}			7^{th}			14^{th}			21^{st}			56^{th}		
	Herbicide levels (g a.i ha^{-1})			Herbicide levels (g a.i ha^{-1})			Herbicide levels (g a.i ha^{-1})			Herbicide levels (g a.i ha^{-1})			Herbicide levels (g a.i ha^{-1})		
	0	60	Mean	0	60	Mean	0	60	Mean	0	60	Mean	0	60	Mean
0	36.35	34.29	35.32	57.29	53.13	55.21	57.89	53.74	55.81	51.67	48.87	50.27	30.06	26.99	28.53
1%	42.68	39.78	41.23	73.28	67.07	70.18	81.10	73.72	77.41	65.14	59.28	62.20	36.24	28.17	32.20
Mean	39.51	37.03		65.29	60.10		69.49	63.73		58.41	54.07		33.15	27.85	
V.C.= 1.24, Herb.= 1.24 and V.C. × Herb.= 1.95				V.C.= 0.68, Herb.= 0.68 and V.C. × Herb.= 1.12			V.C.= 0.86, Herb.= 0.86 and V.C. × Herb.= 1.22			V.C.= 0.84, Herb.= 0.84 and V.C. × Herb.= 1.19			V.C.= 0.74, Herb.= 0.74 and V.C. × Herb.= 1.05		

V.C. = Vermicompost and Herb. = Herbicide

Table 7: Effect of vermicompost and herbicide (clodinafop propargyl) on NO_3^--N contents (mg kg^{-1}) of soil

V.C. Levels	**Incubation Days**														
	0th			**7th**			**14th**			**21st**			**56th**		
	Herbicide levels (g a.i ha^{-1})			**Herbicide levels (g a.i ha^{-1})**			**Herbicide levels (g a.i ha^{-1})**			**Herbicide levels (g a.i ha^{-1})**			**Herbicide levels (g a.i ha^{-1})**		
	0	**60**	**Mean**	**0**	**60**	**Mean**	**0**	**60**	**Mean**	**0**	**60**	**Mean**	**0**	**60**	**Mean**
0	13.21	10.50	11.85	33.01	26.69	29.85	55.72	51.17	53.45	69.90	65.14	67.52	77.10	73.11	75.10
1%	16.61	14.26	15.44	42.19	38.34	40.26	69.32	65.07	67.19	90.24	81.85	86.05	97.56	89.18	93.37
Mean	14.91	12.38		37.60	32.51		62.52	58.12		80.07	73.50		87.33	81.15	
V.C.= 0.74, Herb.= 0.74 and V.C. × Herb.= 1.05				V.C.= 0.52, Herb.= 0.52 and V.C. × Herb.= 0.74			V.C.= 0.41, Herb.= 0.41 and V.C. × Herb.= 0.60			V.C.= 0.50, Herb.= 0.50 and V.C. × Herb.= 0.71			V.C.= 0.48, Herb.= 0.48 and V.C. × Herb.= 0.68		

V.C. = Vermicompost and Herb. = Herbicide

soils thus it is important to study the transformation of nitrogen in sandy soils while other authors not emphasized on soil texture. Secondly, vermicompost can be prepared from on-farm and marketable wastes and results showed that it has narrow C:N ratio thus leads to easy decomposition and readily availability of nutrients. While other authors use organic manure like FYM which has two major problems. One is its availability as it is used as fuel in villages and second is that it has wide C:N ratio that makes its decomposition rate slow and low availability of nutrients to crop. Thus, vermicompost is potential source of nutrients which can be easily prepared from urban and farm waste. Now if talk about herbicide, none of the author who carried out similar work used clodinafop propargyl, which is most commonly used herbicide in wheat, in there experiment. So, present research focus on the effect of herbicide that is used by farmers in large proportion in present day situation and results imply that it may affect the microbial population and hinder the transformation of nutrients in soil and thereby their availability to crop during growing season.

Conclusion

The study showed that organics and fertilizer nitrogen are not only complimentary but also synergistic since organic inputs have beneficial effects beyond their nutritional components and enhance the effect of applied mineral fertilizers. Conjugative application of nitrogen and vermicompost significantly increased the NH_4^+-N as well as NO_3^--N contents in soil whereas NH_4^+-N and NO_3^--N contents in soil decreased significantly at all incubation periods with the application of herbicide (clodinafop propargyl) in presence of nitrogen as well as vermicompost. These results imply that the integrated use of mineral fertilizers with vermicompost represents a sound practice for sustaining N (NH_4^+-N and NO_3^--N) reserves in soil and hence enhancing N availability and crop yields under intensive cropping systems particularly in light textured soils. Moreover, herbicide selection and its dose needs to be study more intensively as it affects the microbes and in turn transformations of nutrients in soil.

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