

EFFECT OF DIFFERENT WEEDICIDES ON THE NITRIFICATION OF $\text{NH}_4\text{-N}$, ADDED IN THE SANDY CLAY LOAM SOIL

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Effect of four weedicides viz. N-(I-ethylpropyl)-2, 6-dinitro-3, 4-xylidine (stomp), N-(3-chloro-4-ethyl-phenyl)- N,N-dimethylurea (dicuran), I-(2-benzothiazolyl)-I; 3-dimethylurea (tribunil) and 3-(4-iso-propyl-phenyl)-I, I-dimethylurea (arelon) applied @ 0.0001 to 0.1% A.I. content, in the sandy clay loam soil, was studied on the nitrification process of 150 ppm. $\text{NH}_4\text{-N}$ added as ammonium sulphate. All the four chemicals behaved similarly. At the dose 0.0001 to 0.001% no inhibitory effect was noticed and the nitrification was 85-90% in the first 16 days and the process was completed between 16-24 days. Further increase in dose showed adverse effect, depressing nitrification; being 27-38% in the first 32 days and completed between 32-64 days at 0.01% dose while 15-18% upto 32 days and only 36% till 64 days when the dose was increased to 0.1%.

Key words: Weedicides, Nitrification, Sandy clay loam soil.

INTRODUCTION

The extensive use of weedicides in agriculture to get rid of weeds for having maximum production of crops made it desirable to know whether these chemicals may have adverse effects on the soil microbiological processes, influencing the soil fertility and plant nutrition. These chemicals may be bactericidal or inhibitors to any group of soil micro-organisms, interfering in the normal processes resulting in inadequate nutrition of crop plants. It is also important to know how long such adverse effect can be noticed. Smith [9] found picloram the most phyto-toxic and persistent herbicide. Goring *et al.* [3] reported that conversion of NH_4^+ to NO_2^- in soil was 50% inhibited at 1000 ppm, but was not effected at 100 ppm of Picloram. Brown, Mendoza and Stephen *et al.* [1,8, 10] did not find any adverse effect of insecticides when applied at normal rate in the field. But Farmer *et al.* [2], and Keller [7] reported the inhibitory effect of insecticides. It is, therefore, very necessary to examine the new toxicants, being introduced, for their adverse effects on favourable forms of life specially when these chemicals exhibit a very long persistence in soils - Kearney *et al.* [5]. Kuzminskaya *et al.* [6] concluded in field experiments that herbicide application increased potato yields by 15.0-28.5 q/ha in 1980. Also found out in laboratory studies dalapon, TCA and prometryne did not significantly effect the numbers of soil micro-organisms linuron @ 6 kg/ha sapped the growth of all the micro-organisms studied for a period of three

months. This pot experiment was also designed to find out the effects of dicuran MA, tribunil, stomp and arelon on the nitrification of $\text{NH}_4^+ - \text{N}$ added to the soil.

MATERIALS AND METHODS

The experiment was conducted on surface soil having depth of (0-15 cm) collected from the area of Cotton Research Station, Multan. Some of the important characteristics of the soil used are given in Table 1. To 500 gms of air dried soil, the wettable forms of the four herbicides in water, were added at different rates and on drying were mixed thoroughly. Similarly 150 ppm, $\text{NH}_4^+ - \text{N}$ was added after dissolving in water and upon drying the soil was mixed well and put in the plastic containers. The whole experiment was incubated at room temperature for 64 days at field capacity moisture level. About 10 gms. Soil

Table 1. Physico chemical analysis of soil.

Determinations	Unit	Contents
Texture	—	Sandy clay loam
pH	—	7.95
Total soluble salts	%	0.18
Organic matter	%	0.45
Cation exchange capacity	me/g of soil	0.25
Total - N	ppm	1000
$\text{NH}_4 \pm \text{N}$	ppm	58.00
Available-P	ppm	8.00

*Plant Protection Institute, Faisalabad.

sample was taken from each container after 8 days interval and analysed for ammonium nitrogen colorimetrically Jackson [4] (NH_4 was steam distilled before colorimetry). The containers were brought upto the original weight daily with the addition of distilled water. This experiment was repeated thrice during the year, 1986 with three repeats each time.

RESULTS AND DISCUSSION

All the results are the averages of three experiments of three repeats each. The ammonium sulphate added to the pots where no herbicide was used (control), was nitrified completely within 24 days of its application which shows that the soil has good nitrifying capacity. Wahhab and Alam [11] studied the nitrification of ammonium sulphate in some West Pakistan soils and found that nitrification took 2-6 weeks for completion depending upon texture, salinity level and pH of soils.

The results presented in Table 2 showed that lower concentrations of weedicides i.e. 0.0001 to 0.001% did not affect the nitrification process and gave the similar results as obtained in the control pots. Here about 45% of the

added NH_4^+ -N was nitrified in first 8 days and about 85-90% within 16 days and the process was completed within 24 days. This trend was similar with all the four weedicides with a slight difference in the rate of nitrification. Brown [1] and Kearney *et al.* [5] also reported difference in the effect of different chemicals. When the dose was increased to 0.01%, the depressing effect on the nitrifying process appeared with all the four weedicides. This effect was more pronounced in tribunil and stomp where only 26.6% and 28% of added NH_4 -N was nitrified upto 32 days and this process was completed by the end of experiment i.e. in 64 days. But in case of Dicurand and Arelon, it was 38% and 34% respectively in 32 days and completed 64 days. However, further increase in dose i.e. 0.1% had severe detrimental effect and only 15-18% of the added NH_4 -N was nitrified in the first 32 days where as it was only 35-36% on the close of the experiment i.e. after 64 days. Similar effect was noticed by Mendoza [8] and Stephen *et al.* [10]. Higher doses of weedicides had a detrimental effect on nitrification. The higher dose of weedicides suppressed the growth of soil micro-organisms for a period of three months Kuzminskaya *et al.* [16].

Table 2. Effect of different weedicides on the nitrification of NH_4 -N added in sandy clay loam soil

(Results are in ppm of NH_4 -N remained un-affected and that of % converted).

Rate of weedicide %	8 days		16 days		24 days		32 days		64 days	
	pre	con.	pre.	con.	pre.	con.	pre	con.	pre.	con.
(i) Control										
	140.3	45	78.5	90	47.2	100	45.2	—	46.3	—
(ii) Dicuran-M.A.										
0.0001	140.2	45	73.4	90	47.4	100	44.0	—	47.2	—
0.001	140.2	45	73.0	90	47.3	100	45.3	—	46.2	—
0.01	160.1	32	162.5	30	161.2	31	151.0	38	50.6	100
0.1	199.9	5	201.3	4.6	192.0	10.5	178.0	20.	150.0	36.6
(iii) Tribunil										
0.0001	143.6	43	75.1	86.7	47.4	100	44.3	—	48.3	—
0.001	143.5	43	75.6	86.0	47.4	100	45.4	—	48.2	—
0.01	174.7	22	175.6	22.3	174.2	22	168.3	26.6	48.6	100
0.1	205.0	2	203.3	2.6	194.0	9.3	186.3	14.8	164.4	36

(Continued.....)

(Table 2, continued)

(iv) Stomp

0.0001	142.6	44	74.5	86	47.3	100	43.4	—	48.0	—
0.001	142.3	44	74.3	85	48.2	100	44.6	—	48.1	—
0.01	171.6	24	172.9	22.3	170.6	25	165.4	28.4	48.9	100
0.1	206.4	1	202.5	3.6	197.0	7	181.2	15.0	155.2	35

(v) Arelon

0.0001	140.6	44.9	75.2	88.6	47.2	100	41.6	—	46.7	—
0.001	141.8	44.0	77.4	87.0	48.6	100	43.4	—	46.8	—
0.01	165.0	28.1	163.7	29.3	162.1	30.6	157.4	35	48.6	100
0.1	205.0	2	200.5	5	198.5	6.3	182.0	18	156.3	34.5

*pre. = present; **con. = converted.

This study revealed that higher doses of weedicides had a detrimental effects on the nitrification whereas lower doses do not interfere in these processes. Moreover, there is not much difference in this effect among different herbicides at lower doses where nitrification process was nearly completed within first 24 days. However, this adverse effect is more clear and also different at higher doses and in different herbicides.

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