1997 Municipal Sludge Trial

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The utilization of sewage wastes to enhance crop production has been an age-old practice with accounts dating back to the Roman Empire and ancient China. Wastes were usually applied directly to the land without processing. With concerns for human health, the practice was largely discontinued in the twentieth century and treatment facilities were built to contain wastes. Sludge from these facilities are commonly discharged into large water bodies, dumped into landfills or incinerated. The cost associated with transporting this material is often prohibitively high especially if transported over a long distance. Rural communities may have an advantage in being able to spread this material onto adjacent agricultural land whereby reducing disposal fees for the municipality and possibly benefitting crop production at the disposal site. Little regard has been placed on its value in modern agriculture.

This trial was developed to study the effects of soil applied municipal sludge as it relates to soil fertility and to study the effects of municipal sludge on selected agronomic, yield and quality factors of four small grain crops, Amidon hard red spring wheat, Medora durum, Bowman barley and Otana oats.

Municipal sludge from the Hettinger City waste lagoons was applied in the Fall of 1996 to the test site (Sludge) at a rate that covered the soil surface to a 3 to 4 inch depth (about 11,000 cubic feet per acre). A portion of the test site was cordoned off and was not treated with sludge (untreated). The material was incorporated with a heavy field cultivator prior to freeze up in the Fall of 1996. In the Spring of 1997 two passes with an offset disc, set at a 5 inch depth, were performed. Prior to planting, soil samples were taken from both treated and untreated areas and comprehensive analysis performed. Those results show the following:

	SLUDGE			UNTREATED		
Depth/Inches	0-6	6-24	24-48	0-6	6-24	24-48
N lb/ac	72	54	104	4	18	16
P ppm	27	--	--	3	--	--
K ppm	290	--	--	135	--	--
pH	7.0	--	--	7.1	--	--
EC mmho	1.20	0.61	0.54	0.25	0.30	0.29
OM %	2.7	--	--	1.7	--	--

S lb/ac	141	423	--	7	35	--
Zn ppm	14.0	--	--	0.4	--	--
Fe ppm	93	--	--	19	--	--
Mn ppm	22	--	--	8	--	--
Cu ppm	6.3	--	--	0.5	--	--
Cl lb/ac	25	142	--	3	18	--

The test site was planted on May 5, 1997 using a randomized complete block design with 4 replications and harvested on August 13, 1997. Results of this trial are shown in the following tables.

HARD RED SPRING WHEAT

Trt	Grain Yield	Test Weight	Grain Protein	PlantHt
	bu/ac	lbs/bu	%	inch
Untrt	20.1	57.6	14.7	28
Sludge	26.6	58.2	16.5	26
CV	12.8	0.8	2.1	8
LSD 5%	5.4	ns	0.6	ns
LSD 1%	ns	ns	0.9	ns

DURUM

Trt	Grain Yield	Test Weight	Grain Protein	PlantHt
	bu/ac	lbs/bu	%	inch
Untrt	26.2	58.8	15.0	26
Sludge	25.5	55.9	17.1	25
CV	26.3	3.2	3.5	8
LSD 5%	ns	ns	1.0	ns
LSD 1%	ns	ns	1.6	ns

OATS

Trt	Grain Yield	TestWt	PlantHt
	bu/ac	lbs/bu	inch

BARLEY

Trt	Grain Yield	TestWt	GrainProt	PlantHt
	bu/ac	lbs/bu	%	inch

Untrt	82.9	35.0	29	Untrt	41.5	45.6	14.8	17
Sludge	90.4	32.8	29	Sludge	54.2	46.9	16.6	17
CV	14.2	1.0	9	CV	16.8	0.9	2.0	12
LSD 5%	ns	0.6	ns	LSD 5%	ns	0.8	0.6	ns
LSD 1%	ns	1.0	ns	LSD 1%	ns	1.2	0.9	ns

Grain yields did not change significantly for any crop except for HRS wheat where there was a significant yield increase over the untreated. The lack of a yield response may be due to drought conditions during the early growing season and possible toxicity caused by salt accumulations from the added sludge. Test weight increased significantly from the untreated to the treated barley , was not significantly different for the HRS wheat and durum and decreased significantly for the oats. This may again be a crop response relating to salt accumulations. The addition of municipal sludge resulted in a significant two percentage point boost in grain protein over the untreated for all crops tested. Plant height was not affected.

The quantity of sludge applied in this study was excessive. It did however demonstrate the sheer amount of plant nutrients, especially micro-nutrients, contained in this material and its potential value as a source of fertilizer. The addition of municipal sludge contributes significantly to the level of available plant nutrients and this had a direct impact on grain protein content. It is also obvious that soil organic matter was significantly enhanced. The elevated level of electrical conductivity would indicate an accumulation of salts which may have been detrimental to plant growth. Excessive levels of some plant nutrients are known to be phytotoxic and this may have been true in this study also. Further research should address optimizing application levels for optimum plant health and the human nutritional quality of harvested grains from crops being treated with municipal sludge.