

NITROGEN MINERALIZATION FROM POTATO SLUDGE AND ONION SLUDGE

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Introduction

Potato sludge is a by-product of the potato processing industry. While some of the potato waste has excellent feed value for livestock, the feed value of sludge is too low to be economical to feed. Onion sludge is generated as a by-product from the distillation of oil from onions. Both potato sludge and onion sludge are generated in large amounts and disposal can be a problem. A practical solution is to use these materials as organic fertilizer. Since growers need to monitor the amount of fertilizer they apply to maintain crop quality as well as to protect the environment, it is important to be able to predict the amount of nitrogen that will be released from these materials. With knowledge of nitrogen release, sludge can be utilized properly as organic fertilizer.

Materials and Methods

On April 7th, 100 lbs. of silt loam soil was collected from the Malheur Experiment Station and thoroughly blended in a portable cement mixer. Check samples of about 0.5 lbs. each were collected, then the remaining soil was split into two parts. One part was mixed with potato sludge at a rate of 1:80 sludge to soil ratio by weight to approximate a sludge soil application rate of 25 ton/acre and 1:40 sludge-to-soil ratio to approximate a sludge application rate of 50 ton/acre. The onion sludge was applied at ratios of 1:25 and 1:12.5 to approximate soil application rates of 80 and 160 ton/acre respectively.

Each of the treatments were bagged in plastic bags containing about 0.5 lbs. each, with enough bags for four replications for each of the months of April, May, June, July, August and September. The April bags were analyzed for nitrate and ammonium nitrogen, the other bags were buried in the soil to a depth of six inches in an onion field where the samples could be under field conditions. On the seventh of each month, four replications of each treatment were dug up and analyzed for nitrate and ammonium nitrogen content. The analysis was performed by Western Laboratories in Parma. The onion sludge contained about five percent solids, and was difficult to mix. There was a tendency for the soil to roll into small balls and not blend evenly. The difficulty of blending properly plus the high moisture content may have affected the results of the onion sludge treatments.

Results and Discussion

The potato sludge mineralized similarly to previous years, with the higher sludge rate releasing the higher amount of nitrogen. The highest rate of increase of mineralized nitrogen for the potato sludge was between August 7th and September 7th. Almost twice the amount of nitrogen was released from the 50 ton /acre sludge rate as compared to the 25 ton /acre rate with 29.7 ppm and 53.5 ppm nitrate plus ammonium nitrogen. The onion sludge mineralization was less than or only equal to the check soil mineralization rate for most of the season. This could be due to the higher moisture content of the onion sludge bags compared to the potato sludge bags. The onion sludge bags may have been under anaerobic conditions not suitable for proper mineralization. It is also possible that the microbes decomposing the onion sludge may have used excess nitrogen released from the soil to establish a proper carbon/nitrogen ratio before decomposition could begin. It is more likely that the excess moisture hindered proper mineralization. Care should be taken to dry the onion sludge before mixing to obtain more uniform mix with less moisture in the bags. Under field applications, the excess moisture would not be a problem.

Table 1. Amount of mineralized nitrogen (ppm) resulting from various sludge mixtures buried in the soil and analyzed during the growing season as compared to an untreated soil check, Ontario, Oregon, 1997.

Treatment	rate	7 Apr	7 May	7 Jun	7 Jul	7 Aug	7 Sep
	ton/acre	---	---	---	ppm	---	---
Check		18.5	16.5	18	29.3	32.8	32.8
Potato Sludge	25	17.5	37.2	25.3	36.8	44	62.5
Potato Sludge	50	15.3	36.5	28.3	44.5	54.8	86.3
Onion Sludge	80	7.2	16.3	25.8	34.5	41.8	43.5
Onion Sludge	160	4.6	12.8	18.3	29.3	35.5	43.5
LSD (0.05)		5.8	NS	7.4	NS	11.4	27.7

NS: not significant

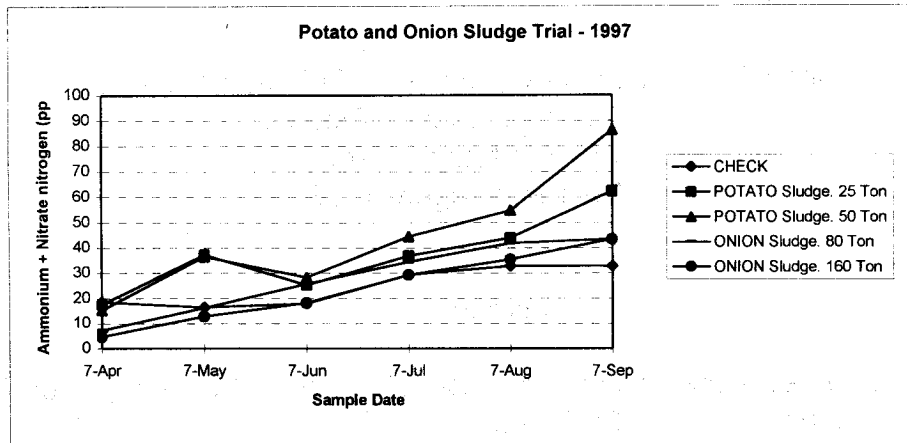


Figure 1. Trend for nitrogen release from buried bags containing potato and onion sludge, Ontario, Oregon, 1997.

Conclusions

The nontreated soil in the trial released 14.3 ppm nitrate and ammonium nitrogen during the growing season. This amounts to 47 lb N/acre-ft. of nitrogen. The 25 ton/acre rate of potato sludge released an additional 98 lbs. of nitrogen and the 50 ton/acre potato sludge rate released 177 lbs. of nitrogen over the non treated soil. Most crops grown in Malheur County require 150–250 pounds of nitrogen per year for adequate yields. Depending on the crop grown it would have taken between 25 and 50 ton/acre of potato sludge to give an adequate amount of available nitrogen.