SWINE LAGOON EFFLUENT AND N-P-K FERTILIZER EFFECTS ON YIELD, NUTRIENT REMOVAL, AND RESIDUAL SOIL LEVELS OF N AND P.

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INTRODUCTION

Application of swine lagoon effluent to cropland can be an effective method of utilizing nutrients contained in effluent if rates do not result in groundwater and surface-water pollution. In the past, land application of animal waste to soil was considered an economic liability because disposal costs exceeded the value of nutrients in the waste (McKenna and Clark 1970). With increasing inorganic fertilizer costs, the use of swine lagoon effluent for crop production can be a viable plant nutrient resource (Sutton et al. 1978).

Forage crops have been shown to respond favorably to swine effluent application in terms of yield and can assimilate large quantities of applied nutrients (Burns et al. 1987). In research conducted by Burns et al., (1990) three effluent loading rates were evaluated on 'Coastal' Bermudagrass for 11 years where 335, 670, and 1340 kg N/ha/yr were applied. It was found that annual dry matter yields of 11 and 15 Mg/ha were realized at rates of 335 and 670 kg N/ha. No further yield advantage was found using 1340 kg N/ha/yr compared to the lower rates.

It is also evident that animal waste increases the fertility status of soil and, if correctly managed, livestock waste can serve as an alternative source of plant nutrients. Cummings (1975) reported the effects of swine lagoon effluent applied to 'Coastal' Bermudagrass in North Carolina and concluded that lagoon effluent increased soil reserves of several nutrients. King et al. (1990) found that soil test P levels increased dramatically in the 0 to 15-cm depth and accumulation was noted down to a depth of 76 cm. It was also found that swine waste increased soluble soil P to a greater proportion than either beef or poultry waste.

Since nutrient content in lagoon effluent, especially N and P, are of prime importance for both supplying crop nutrient requirements and as a potential source of pollution, this investigation is concerned with the proper management of the swine lagoon effluent. Also, societal concerns about ground and surface water pollution have increased in recent years and have caused livestock producers to reevaluate waste management strategies. Thus, proper and efficient management of swine lagoon effluent on cropland may improve crop production economics but must not result in degradation of water quality. Given this background, the objective of this study was to evaluate the agronomic and environmental aspects of various rates of swine lagoon effluent on forage yield, nutrient uptake, and residual soil levels of N and P relative to inorganic fertilizer.

MATERIALS AND METHODS

Experimental Design

Research Sites. Two experiments were initiated in 1994 on two different soil types at a commercial hog facility located near Brooksville, Mississippi. One experiment was established on a Vaiden silty clay (very-fine, montmorillonitic, thermic Vertic Hapludalf) and the other on an Okolona silty clay (Fine, montmorillonitic, thermic Typic Chromudert), both of which are representative Blackbelt soils. Initial soil test results indicated that P and K levels were low.

Plot Treatments. A randomized complete block design with four replications and seven treatments was used. Johnsongrass was seeded at a broadcast rate of 30 kg/ha. Treatments consisted of an irrigated check (fresh water), swine lagoon effluent applied at rates equivalent to approximately 100 kg N-12 kg P, 200 kg N-26 kg P, and 286 kg N-39 kg P/ha, or 2.5, 5.0, and 7.5 ha-cm. The first irrigation was applied to the Vaiden site at a rate of 0.64 ha-cm/plot on 23 June 1994. Scheduling irrigation was difficult due to excessive rainfall received during July 1994 (Table 1). Additional plots in each replication received commercial fertilizer at rates of 112 kg N-14 kg P, 224 kg N-28 kg P, and 336 kg N-42 kg P/ha for comparison of soil compositional changes and yield responses resulting from swine lagoon effluent. The effluent and fertilizer were surface-applied. The delivery of clean irrigation water and lagoon effluent was accomplished by using a 400 gallon slurry-wagon. Commercial fertilizer was applied in 100 kg N/ha increments for the same period or day that 2.5

ha-cm of effluent was to be applied. Individual plot sizes at both experiments were 3.6- by 3.6-m with a 3-m alley between the plots. To keep swine effluent inside the plots and to prevent cross-contamination, each plot had an enclosed perimeter during irrigation. Swine effluent was applied at a rate of 0.64 ha-cm/application. For every application of swine effluent, 0.64 ha-cm of clean irrigation water was applied to fertilizer and check plots. Therefore, growth differences caused by water from swine effluent irrigation were minimized.

Sampling and Analysis

Lagoon Effluent. Swine effluent samples were obtained at each irrigation. Soluble salts (Electrical Conductivity) and pH were determined immediately, then samples were acidified with concentrated H_2SO4 (2ml/l) and frozen for later analysis. Analysis of effluent included total Kjeldahl N (TKN), inorganic NH_4^+-N and NO_3^--N, total-P, ortho-P, Ca, Mg, K, Na, Cu, Zn, and total solids. Total N was determined using the colorimetric indophenol blue procedure as described by Cataldo et al. (1974). Total inorganic N (NH_4^+ + NO_3^-) was determined via steam distillation using a method described by Bremner and Keeney (1965). Phosphorus was determined using a colorimetric procedure developed by Murphy and Riley (1962) which utilizes ascorbic acid as the reducing agent. Potassium, Ca, Mg, Na, Cu, and Zn were determined by atomic absorption spectroscopy. Effluent samples were centrifuged prior to determination of ortho-P and cations. Total solids were determined on a weighed quantity of swine lagoon effluent dried at 105°C.

Plant Tissue. Forage grass was harvested at a desirable growth stage and dry matter yield was determined. To determine the nutrient content, subsamples were taken, oven-dried at 65°C, ground in a Wiley mill, dry ashed, and diluted to a final concentration of 0.19 N HCL. Phosphorus, K, Ca, Mg, Na, Cu, and Zn were determined using the same colorimetric and atomic absorption procedures as previously mentioned. Nitrogen in plant tissue was measured using a dry combustion technique.

Soil Analysis. Initial soil samples were taken randomly from each plot at depths of 0 to 5-, 5 to 15-, and 15 to 30-cm to characterize the nutrient levels of both soils. Soil samples were air-dried for 24 hours on greenhouse benches. After air drying, soil samples were ground to pass a 2-mm sieve and stored for later analysis. Extractable P was determined via the Mississippi Soil Test Method (Lancaster 1970). Calcium, Mg, K, and Na were also extracted with 1M NH_4OAc buffered at a pH of 7 using a method outlined by Knudsen et al. (1982). Total inorganic N was determined by steam distillation (Bremner and Keeney 1965) and NH_4^+-N was determined using the indophenol blue method (Cataldo et al. 1974). Soil pH was measured to determine the possible effects of treatments on soil acidity.

Statistical Analysis. An analysis of variance was performed by using SAS statistical software (SAS Institute 1985). Mean comparisons between treatments were performed using Least Significant Difference. Trend analysis was performed by regressing each measured variable against effluent and fertilizer rates. All statistical results are reported at the 0.05 probability level.

RESULTS AND DISCUSSION

Analysis of Anaerobic Swine Effluent

Swine Lagoon effluent analysis for each treatment and soil type are shown in Table 2. All pH measurements were found to be near 8.0 and are likely influenced by the ammonia-ammonium equilibrium. Total solids in swine effluent remained fairly constant for each application. Total N analysis included NH_4^+-N, NO_3^--N and organic N compounds. The majority of the N in the effluent existed as NH_4^+-N with minimal NO_3^--N, reflecting the anaerobic nature of the decomposition of swine waste in the lagoon. Sutton et al. (1978) reported that NH_4^+-N concentrations were substantially elevated in well-established anaerobic lagoon compared to aerobic lagoon. Total P included organic and inorganic compounds. Similar to N, most of the P existed as inorganic ortho-P. This indicates it is chemically similar to commercial fertilizer. The level of K and Na in the swine were more than Ca, Mg, Cu, and Zn. High Na content of the swine effluent might be reflected by the level of salt fed to the pigs. The concentration of Cu with a potential role as a toxic element in the soil and the possibility of its uptake by growing crops was low in the swine lagoon effluent (Table 2).

Dry Matter Yield and Nutritive Value

Swine lagoon effluent and inorganic fertilizer applications significantly increased (P=0.01) dry matter yield compared to the check plot for both Vaiden and Okolona soils (Tables 3 and 4). Dry matter yield from plots receiving medium and high swine lagoon effluent and inorganic fertilizer rates were not significantly different (P=0.05) from each other, but these rates significantly increased dry matter yield more than the low rate (P=0.05). Generally in all cases, swine lagoon effluent applied at an equivalent rate of N and P as inorganic fertilizer, resulted in greater yield (P=0.05).

Results from our experiment were in agreement with the findings of Westerman et al. (1983) who found anaerobic swine effluent substantially increased yield over inorganic fertilizer. Inorganic fertilizer and swine lagoon effluent significantly (P=0.01) increased N concentration in the forage grass when compared to the check plot for both Vaiden and Okolona soils (Tables 3 and 4). Tissue -N concentration on the Okolona soil significantly increased with increasing swine lagoon effluent and fertilizer N applications (P=0.05), while there was no significant trend (P=0.05) for the Vaiden soil. Tissue-N concentration for the check plots was 8.3 g/kg and 13.0 g/kg for the Vaiden and Okolona soils, respectively.

Swine effluent and fertilizer significantly (P=0.05) increased P and K concentration in the grass when compared to the check plot for both Okolona and Vaiden soils (Table 3 and 4). Forage grass on the Vaiden and Okolona soil had significantly greater K concentration at all effluent levels, except for the low rate on the Okolona soil. This could be related to the extra K supplied to the soil by the swine lagoon effluent (McIntosh and Varney 1973).

Nutrient Removal and Recovery

Swine lagoon effluent and inorganic fertilizer significantly increased N, P, K, Ca, Mg, and Na uptake compared to check plots for both Vaiden and Okolona soils (Tables 5 and 6). On the Vaiden soil, N and P removal by the grass for the medium (224 kg N-28 kg P ha) and high (336 kg N-42 kg P ha) rates were not significantly different from each other (P=0.05), but these rates significantly increased N and P removal more than the low rate (P=0.05). On the Okolona soil, N removal was significantly increased (P=0.05) by increasing swine effluent and fertilizer rates (Tables 5 and 6). In most cases, swine lagoon effluent applied at an equivalent rate of N and P as inorganic fertilizer resulted in greater nutrient uptake. Results from our experiment were in agreement with the findings of Burns et al. (1990) who found that anaerobic swine effluent increased nutrient uptake.

The efficiency of N and P recovery by the grass were significantly (P=0.05) decreased with increasing rates of swine lagoon effluent and inorganic fertilizer (Table 7). Lower N recovery for the Okolona soil than on the Vaiden soil could be related to greater ammonia volatilization. The alkaline soil pH of the Okolona soil could cause NH_4^+-N to be converted to ammonia which is then subject to volatilization (Tisdale et al. 1985). It appears that application of animal wastes at excessive rates can result in N losses and reduced efficiency. This indicates a possible problem with soil accumulation of P and movement of N to groundwater at high rates.

Soil N and P

Initial results indicated an average of 15 Kg P/ha in the Okolona soil and 12 Kg P/ha in the Vaiden soil; both testing low in soil P as determined by the Mississippi Soil Test Procedure (Table 8).

For each soil, extractable NH_4^+-N and NO_3^--N were significantly (P=0.01) decreased with increasing soil depth for the Okolona and Vaiden soils (Tables 9 and 10). The NO_3^--N levels in the soil were roughly proportional to the amount of N input from fertilizer or swine lagoon effluent. Ammonium-N and NO_3^--N for the Okolona and Vaiden soils were not significantly increased (P=0.05) by swine lagoon effluent or inorganic fertilizer applications in the 5 to 15-, and 15 to 30-cm depths. Ammonium-N and NO_3^--N increased the most in the 0 to 5-cm depth of the Okolona and Vaiden soils due to the application of inorganic fertilizer and swine lagoon effluent, but the only significant (P=0.05) effect when compared to the zero check was the high rate of inorganic fertilizer application. Low soil NO_3^--N in all treatments at the 15 to 30-cm depth for both soils could be related to denitrification losses of nitrate or leaching of nitrate, which may account for the lack of NO_3^--N build-up in these soils even at the highest rates of fertilizer and swine lagoon effluent. The high soil NH_4^+-N in all treatments for the 15 to 30-cm depth particularly in the Vaiden soil could be related to a lack of nitrification. Possible reasons for this in the Vaiden soil would include high clay content in the subsoil (71%), high soil water holding capacity, and high soil acidity.

For each soil, available P was significantly increased in the 0 to 5-cm depth (P=0.01) for the high rates of swine lagoon effluent and commercial fertilizer when compared to the check and other application rates (Table 11). Swine lagoon effluent and fertilizer rates did not significantly increase extractable P in the 5 to 15- and 15 to 30-cm depths for either soil. Phosphorus applied to the soil surface in no-tillage cropping systems generally remains in the soil surface (Eckert and Johnson 1985). Results from our experiment are in agreement with these findings and those of Booram et al. (1974) who reported that the magnitude of P accumulation in soils has been shown to increase with increasing rates of swine waste and Humenik et al. (1972) who found no significant downward movement of P in the soil profile. Thus, the potential for P to contaminate ground water from P leaching should be minimal, but accumulation of P at the soil surfaces raises concerns that P may be transported into aquatic systems in runoff events.

SUMMARY AND CONCLUSION

Two experiments were initiated on two different soil types at a commercial hog facility located near Brooksville, Mississippi, to evaluate the agronomic and environmental aspects of various rates of swine lagoon effluent on forage grass relative to inorganic fertilizer. In most cases, swine lagoon effluent applied at an equivalent rate of N and P as inorganic fertilizer resulted in greater dry matter yield and nutrient removal. Due to the cost of commercial fertilizer, swine lagoon effluent can be used as an excellent source of plant nutrients for hay production. Dry matter yield increased with increasing application rates, but there was little advantage in dry matter production and nutrient removal from applying N and P above the medium rate. Also, a quadratic response in tissue nutrient concentration to increasing swine effluent rates indicated a decrease in the efficiency in nutrient uptake at higher application rates. Swine effluent is capable of increasing crop yields by serving as a feasible substitute for conventional fertilizers. It was concluded that forage crops are capable of utilizing plant nutrients contained in animal wastes and help to reduce nutrient accumulation within the soil; therefore, limiting the risk of environmental contamination. The efficiency of N and P recovery significantly decreased with increasing swine lagoon effluent and inorganic fertilizer rates, indicating a possible problem with soil accumulation of P and movement of N to ground water at high rates. Swine lagoon effluent significantly increased soil P concentration in the 0 to 5-cm depth for both Okolona and Vaiden soils. Given the low mobility of P in most soils, the shallow surface soil may become highly enriched in P relative to the rest of the soil profile. The zone of interaction between surface runoff and soil is normally less than 5-cm (Sharpley et al. 1994). High P concentrations in the surface soil can increase the potential for runoff of P. The highest potential for surface-water pollution would occur if the area were planted to a clean-tilled crop and erosion occurred. It was concluded that application of swine lagoon effluent which does not exceed plant requirements minimizes the concentration of P in runoff water and prevents the contamination of surface water.

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Table 1. Monthly precipitation for experimental site.

Month	1994	30-Year Average[*]
	------------------------------ mm ------------------------------	
March	174	129
April	102	110
May	52	93
June	117	68
July	180	108
August	65	77
September	53	60
October	145	66
November	108	98
December	160	112

[*]30-Year average data for the Blackbelt Branch Experiment Station.

Table 2. Anerobic swine lagoon effluent analysis for each irrigation in 1994.

Irrigation Rate	Soil type	pH	EC	TS	TKN	NH_4^+	NO_3^-	TOT-P	Ortho-P	K	Na	Ca	Mg	Cu	Zn
cm			(mmho/cm)	(g/l)	µg/ml										
2.5	Vaiden	8.08	3.72	2.6	395	351	5	50	43	436	180	87	36	0.21	0.29
5.0		7.77	3.73	2.5	369	292	7	65	57	411	165	133	47	0.58	0.6
7.5		7.82	3.40	2.5	364	303	11	41	36	274	195	101	31	0.45	0.4
2.5	Okolona	8.11	3.49	2.6	389	343	6	45	38	420	175	96	32	0.26	0.4
5.0		7.81	3.74	2.6	367	296	8	54	46	402	162	83	37	0.33	0.2
7.5		7.82	3.40	2.5	364	303	11	41	36	274	195	101	31	0.45	0.4

TS = Total Solids

TKN = Total N

Table 3. **Dry matter yield and nutrient concentration of forage grass as influenced by swine lagoon effluent or fertilizer application on an Okolona soil.**

Treatment (N-P-K)	Yield	N	P	K	Ca	Mg	Na
Fertilizer (kg/ha)	(kg/ha)	------------------------		gkg^{-1}	------------------------		
0-0-0	2169	13.0	2.15	12.6	12.2	2.05	1.95
112-14-34	3588	13.7	1.73	12.5	13.6	1.75	2.00
224-28-68	3795	19.1	1.78	14.6	11.8	1.85	2.30
336-42-102	4021	23.0	1.92	14.7	11.5	1.90	1.85
Effluent (kg/ha)							
100-12-100	3204	13.8	1.88	14	11.7	1.80	2.42
200-26-200	4746	15.2	1.78	19.3	11.0	1.70	2.00
285-39-274	4845	20.3	2.0	22.3	12.5	1.80	2.20
CV%	8.3	8.9	8.4	14.3	18.5	12.4	25.7
LSD (0.05)	463	2.23	.24	3.3	3.3	.34	0.80

Table 4. **Dry matter yield and nutrient concentration of forage grass as affected by swine lagoon effluent or fertilizer application on a Vaiden soil.**

Treatment (N-P-K)	Yield	N	P	K	Ca	Mg	Na
Fertilizer (kg/ha)	(kg/ha)			gkg^{-1}			
0-0-0	2145	8.3	1.5	18.0	8.3	1.8	1.5
112-14-34	3113	15.7	1.7	23.4	10.0	3.7	1.4
224-28-68	3500	17.4	1.7	22.4	9.9	3.7	1.4
336-42-102	3262	17.5	1.8	24.8	10.8	5.0	1.5
Effluent (kg/ha)							
100-12-100	4105	15.1	1.9	30.7	10.5	4.7	1.6
200-26-200	4398	16.5	2.1	30.6	8.0	4.7	1.4
285-39-274	4257	16.0	2.0	30.0	6.0	4.8	1.6
CV%	11.7	7.3	11.4	7.9	17.5	19.9	16.3
LSD (0.05)	615	1.65	.30	3.05	2.4	1.16	NS

Table 5. **Nutrients removed by forage grown on Okolona soil as influenced by fertilizer and effluent application rates in 1994.**

Treatment	N	P	K	Ca	Mg	Na	Cu	Zn
N-P-K (kg/ha)	----------	----------	----------	kg/ha	----------	----------	------- g/ha	-------
0-0-0	28.0	4.7	27.1	26.7	4.4	4.3	16.0	124
112-14-34	49.0	6.2	44.5	48.6	6.3	7.1	22.5	152
224-28-68	72.2	6.8	55.0	45.2	7.0	8.7	19.0	94
336-42-102	93.0	7.8	58.8	46.2	7.7	7.5	29.5	191
Effluent (kg/ha)								
100-12-100	43.9	6.0	44.8	37.4	5.7	7.7	16.0	143
200-26-200	72.6	8.4	92.2	52.1	8.1	9.5	24.0	270
285-39-274	93.9	9.5	103.3	56.6	8.3	10.1	35.5	210
LSD $_{(0.05)}$	14.3	1.3	18.4	12.9	1.4	3.0	NS	NS

Table 6. **Total nutrients removed by forage grass on a Vaiden soil as influenced by fertilizer and effluent application in 1994.**

Treatment	N	P	K	Ca	Mg	Na	Cu	Zn
N-P-K (kg/ha)	---------- kg/ha ----------						--- g/ha ---	
0-0-0	35	7.2	59	28	8.2	4.1	589	1060
112-14-34	69	8.9	84	42	15.4	5.5	612	1295
224-28-68	104	9.2	104	54	19.4	7.4	662	1304
336-42-102	115	10.8	124	57	26.5	7.2	799	1528
Effluent (kg/ha)								
100-12-100	76	11.5	121	54	19.5	7.9	1021	1412
200-26-200	98	13.1	146	50	24.7	7.8	797	1487
285-39-274	111	13.6	164	55	28.4	10.1	758	1601
$LSD_{(0.05)}$	13.7	1.6	16.4	10.8	5.4	2.7	311	359

Table 7. **Effects of swine lagoon effluent, N-P-K fertilizer rates and soil type on N and P recovery in 1994.**

Treatment	Vaiden		Okolona	
(N-P-K)	N recovery	P recovery	N recovery	P recovery
(Fertilizer) kg/ha	%			
112-14-34	62	64	44	44
224-28-68	48	33	33	24
336-42-102	34	26	28	19
Effluent (kg/ha)				
100-12-100	68	96	44	54
200-26-200	43	46	37	32
386-39-271	33	34	33	25
LSD (0.05)	7.0	8.2	6.4	6.5

Table 8. **Initital Chemical and Physical Properties of Vaiden and Okolona Soils.**

Parameter	Soil depth, cm					
	0 to 5	5 to 15	15 to 30	0 to 5	5 to 15	15 to 30
		Vaiden			Okolona	
pH	5.4	5.3	5.1	7.8	7.6	7.7
P(ug/g)	12.1	4.2	2.2	14.7	5.2	2.4
K(ug/g)	139	83	75	169	147	115
Ca(ug/g)	2678	2714	2433	7510	7300	7360
Mg(ug/g)	240	190	170	120	98	80
Na(ug/g)	54	55	71	49	53	57
CEC ($Cmol_c/kg$)	------- 15-------		14	------- 34-------		30
Sand, %	14	13	10	20	17	22
Silt, %	36	33	19	30	30	30
Clay, %	50	54	71	50	53	48

Table 9. Soil ammonium concentration as influenced by fertilizer and swine lagoon effluent rates.

Treatment (N-P-K)	Soil depth (cm)					
	0 to 5	5 to 15	15 to 30	0 to 5	5 to 15	15 to 30
	Okolona			Vaiden		
Fertilizer (kg/ha)	ug NH_4^+/g					
0-0-0	3.8	2.7	1.33	2.71	2.60	2.25
112-14-34	4.1	2.6	1.20	2.91	2.69	2.40
224-28-68	4.3	2.7	1.64	5.17	3.10	2.40
336-42-102	5.2	2.7	1.69	4.48	2.87	2.63
Effluent (kg/ha)						
100-12-109	4.3	2.7	1.21	3.01	2.72	2.18
200-23-214	3.8	2.7	1.30	3.10	2.64	2.55
286-38-273	4.4	2.9	1.30	2.82	2.68	2.48
Mean	4.3	2.7	1.38	3.46	2.76	2.41
LSD (0.05)	.67	NS	NS	.74	NS	NS

NS not significant

Table 10. **Soil nitrate concentration as influenced by fertilizer and swine lagoon effluent rates.**

Treatment (N-P-K)	Soil depth (cm)					
	0 to 5	5 to 15	15 to 30	0 to 5	5 to 15	15 to 30
	Okolona			Vaiden		
Fertilizer (kg/ha)	ug NO_3^-/g					
0-0-0	1.38	1.03	0.99	1.67	1.56	0.80
112-14-34	1.94	1.11	1.03	1.83	1.43	0.94
224-28-68	2.22	1.19	1.10	1.94	1.39	1.05
336-42-102	2.71	1.57	1.43	2.81	1.50	1.20
Effluent (kg/ha)						
100-12-109	1.58	1.08	.89	1.72	1.70	0.73
200-23-214	2.16	1.29	.85	1.76	1.51	0.73
286-38-273	2.32	1.28	.83	2.18	1.66	0.74
Mean	2.03	1.33	1.06	1.99	1.5	0.91
LSD (0.05)	.92	NS	NS	1.07	NS	NS

NS not significant

Table 11. **Soil phosphorus concentration as influenced by fertilizer and swine lagoon effluent rates.**

Treatment (N-P-K)	Soil depth (cm)					
	0 to 5	5 to 15	15 to 30	0 to 5	5 to 15	15 to 30
	Okolona					Vaiden
Fertilizer (kg/ha)	ug P/g					
0-0-0	14.3	6.5	4.2	8.7	4.1	0.70
112-14-34	15.2	6.8	4.0	9.9	4.4	0.90
224-28-68	16.6	6.9	4.0	10.5	4.2	0.63
336-42-102	22.1	7.9	4.0	14.5	3.9	0.55
Effluent (kg/ha)						
100-12-109	16.5	8.3	4.2	10.5	4.3	0.70
200-23-214	18.6	7.8	4.5	12.3	4.3	1.01
286-38-273	23.2	7.9	4.7	14.6	4.00	0.90
Mean	18.07	7.4	4.4	11.6	4.2	.78
LSD (0.05)	3.6	NS	NS	2.8	NS	NS

NS not significant