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Effect of Chicken Manure, Sheep Manure and Inorganic Fertilizer on Yield and Nutrients Uptake by Onion

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Abstract: The current study aims at investigating the effect of chicken and sheep manure at rates of 20,40, and 80 t ha^{-1}, as well as inorganic fertilizers at rate of 400 kg N ha^{-1}, 200 kg P_2O_5 ha^{-1} and 100 kg K_2O ha^{-1} on yields, nutrient content, leaf area and dry weight of onion yield. The results revealed that there was no significant difference in yield of onion bulbs due to chicken manure in both years, but in general the yield increased significantly with sheep manure and inorganic fertilizer. In general the yield of onion bulbs was higher in the second year compared with the first year.
There was a significant difference in leaf area of onion only between sheep manure at level of 20 and 40 t/h with 20t ha^{-1} of chicken manure only in first year. Under certain circumstances it was found that some treatments showed a significant effect on nutrient concentration of plant tissue except potassium.

Key words: Manure, fertilizers, yield, nutrients, onion bulbs

Introduction

Soil organic matter has an important function in improving the soils for plant growth. Soil organic matter supplies available nutrients through its decomposition. Farmers add chemical fertilizers to improve soil fertility, and to increase the yield of their crop, however, extensive application of inorganic fertilizers have some disadvantages on plant environment. Those chemicals may undergo decomposition and may be leached down in soil to the ground water and lakes (Al-Samarrie, 1978). The alternative practice to chemical fertilizer is organic fertilizer added directly to the soil either before or later on after planting. Organic fertilizer such as, animal manure, green manure, compost and sewage sludge may be added to cultivated soil (Splittstoesser, 1990). This kind of fertilization that may improve the physical and biological properties of the soil, may serve as a source of mineral nutrients (El-Koumey and Abu-Agwa, 1993).

The disposal of organic waste on agricultural land is increasing through out the world. It may contain useful agronomical amounts of macro and micro nutrients (Campbell and Beckett, 1988). Several authors predicted that the availability of organic waste derived metals in most soil acidification processes by nitrification and leaching (Roca and Pomares, 1991). Addition of organic waste into soil, resulted in increasing concentration of micronutrients in top soil because organic waste contains higher concentration of essential nutrients than most soils (Campbell and Beckett, 1988; McGrath and Cegarra, 1992). El-Koumey and Abu-Agwa (1993), found that soil application of chicken manure and olive mills waste- water increased the plant yield of cowpea plant (*Vigna sinensis*).

The major objective of present study was to investigate the effect of different levels of chicken manure, sheep manure and inorganic fertilizer on growth, nutritional status and productivity of onion.

Materials and Methods

Field study was carried out during January 1997 and 1998 at Mu'tah University, College of Agriculture, Rubba in southern part of Jordan.

Application of chicken and sheep manure, added at rates of 20,40 and 80 t ha^{-1} to soil was compared with one treatment of inorganic fertilizers (400kg N ha^{-1}, 200kg P_2O_5 ha^{-1} and 100kg K^+ ha^{-1}), in addition to a control treatment.

After preparing the soil for planting by plowing, disking and spreading the drip irrigation system and covering with plastic mulch. Onion *Allium cepa var. Geza* was used in this study. The plants were transplanted at 10-15cm height to the experimental land. Each treatment comprised six rows (50 cm apart) in 2 m long and 6 m^2 of plot area.

Representative compound bulk soil samples were collected randomly from the upper 30 cm of each treatment. The soil was dried, ground and passed through a 2mm sieve. Analysis of manure, irrigated water and soil are shown in Table 1.

The experimental design was randomized complete block design with three replicates. At harvest, two square meters from each experimental unit were harvested and the following components were measured; yield weight of smallest 5 bulbs, weight of largest 5 bulbs, dry weight and leaf area. Bulb samples were dried at 70°C to a constant weight in an oven to determine the dry weight percentage.

The leaf area of three plants for each treatment were measured using leaf area meter Li 310, Li-cor inc. (USA).

Plant tissue samples were digested and analyzed for total N as outlined by Fleige *et al.* (1971). Available phosphorus in soil was determined according to Watanabe and Olsen, (1985). Therefore, H_2PO_4 and K^+ in plant tissue were analyzed according to Meiwes *et al.* (1984).

MSTAT-C statistical package was used to analyze the data that obtained from the experiment. Analysis of variance was the preliminary analysis. Proper mean separation procedure, least significant differences (LSD) test at 0.05 probability level was used (Lentner and Bishop, 1993).

Results and Discussion

Leaf area, dry weight and number of plants/m^2 are presented in Table 2. Data indicates a slight increase in dry weight of bulbs for 1998 season. There were no significant differences between the values of dry weight produced by different treatments of fertilization. The dry weight ranged between 15.6% (Sheep manure at level of 40 t ha^{-1}) and 17.6% (control).

Leaf area of the plants was significantly affected by the application of different fertilizers. The 20 t ha^{-1} of sheep manure gave the highest leaf area for 1997 season (1806.3m^2), while 40 t ha^{-1} of chicken manure gave the highest for 1998 season (2729 m^2). Leaf area was higher at 1998 than at 1997 season in general. This could be attributed to the decomposition of residue of organic matter in the same field and might be due to the fact that manure provides suitable nutrients to the plants (Lekasi *et al.*, 1998). Organic matter content was found to be a reliable index of crop productivity in semi arid regions due to its positive effect on soil water-holding capacity (McDaniel and Munn, 1985).

The total yield response to soil treatments with manures and inorganic fertilizer at 1997 and 1998 were significantly different. Higher total yield was obtained from sheep manure (58. 5 t ha^{-1}) by using 20 t ha^{-1} manure in 1997. On the other hand the highest yield was found using 40 t ha^{-1} sheep manure in 1998 (Table 3). Total yield varied with type of manures and levels. However, total yield was not significantly affected by chicken manure during both seasons. Total yield of sheep manure was significantly higher at the similar levels of chicken manure. This might be attributed to

Table 1: Characteristics of soil, irrigated water and organic fertilizer of the investigated area

Characteristics	Soil	Irrigated water	Organic manure	
			Chicken	Sheep
Texture	Sandy clay loam	n.d	n.d	n.d
pH	7.8	7.1	n.d	n.d
pH Ec (mS/cm)	1.3	1.2	n.d	n.d
SAR	n.d	2.43	n.d	n.d
$CaCO_3$(%)	32	n.d	n.d	n.d
Total-N	0.2 %	n.d	29 (mg/g)	16 (mg/g)
Available (P)	315 ppm	n.d	n.d	n.d
Available(K)	387 ppm	n.d	n.d	n.d
Organic matter	1.7 %	n.d	n.d	n.d
Total (P)	n.d	n.d	8.6 (mg/g)	4.2(mg/g)
Total (K)	n.d	n.d	14.0 (mg/g)	6.9(mg/g)

n.d= not determined

Table 2: Effect of soil treatments with chicken manure, sheep manure and inorganic fertilizer on leaf area and dry weight of onion. During 1997 and 1998

Treatments	1997		1998		
	Leaf area (cm^2)	No. plants /m^2	Leaf area (cm^2)	Dry weight (%)	No. plant /m^2
Chicken manure					
20 t ha^{-1}	1167.7 b	22.0 ab	1566.7 b	17.6 a	15.0 b
40 t ha^{-1}	1533.0 ab	22.7 ab	2729.0 a	15.8 a	15.3 b
80 t ha^{-1}	1485.0 ab	17.7 b	1523.0 b	15.8 a	16.3 ab
Sheep manure					
20 t ha^{-1}	1806.3 a	24.0 a	1927.0 ab	16.3 a	17.7 ab
40 t ha^{-1}	1789.3 a	22.7 ab	2070.3 ab	15.6 a	18.3 ab
80 t ha^{-1}	1697.7 ab	19.0 ab	2050.7 ab	16.5 a	15.0 b
Inorganic fertilizer	1562.3 ab	21.7 ab	2253.0 ab	17.0 a	19.7 a
Control	1272.3 ab	24.0 a	1910.0 ab	17.3 a	19.7 a

Table 3: Effect of soil treatments with chicken manure, sheep manure and inorganic fertilizer on total yield and bulbs weight of onion during 1997 and 1998.

Treatments	1997			1998		
	Total yield (t ha^{-1})	Weight of smallest 5 bulbs(kg)	Weight of largest 5 bulbs(kg)	Total yield (t ha^{-1})	Weight of smallest 5 bulbs(kg)	Weight of largest 5 bulbs(kg)
Chicken manure						
20 t ha^{-1}	50.7 ab	0.592 ab	1.600 a	32.5 d	0.558 ab	1.317 b
40 t ha^{-1}	45.3 ab	0.519 b	1.583 a	36.9 cd	0.550 ab	1.367 b
80 t ha^{-1}	37.7 b	0.667 ab	1.617 a	35.4 cd	0.383 b	1.350 b
Sheep manure						
20 t ha^{-1}	58.5 a	0.683 ab	1.700 a	48.5 abc	0.495 ab	1.680 ab
40 t ha^{-1}	53.3 ab	0.633 ab	1.750 a	59.8 a	0.633 a	1.875 a
80 t ha^{-1}	49.8 ab	0.667 ab	1.758 a	39.2 bcd	0.508 ab	1.447 b
Inorganic Fertilizer	55.0 ab	0.767 a	1.869 a	55.8 a	0.700 a	1.633 ab
Control	52.0 ab	0.650 ab	1.667 a	51.9 ab	0.583 ab	1.567ab

Table 4: Effect of soil treatments with poultry manure, sheep manure and inorganic fertilizer on the availability of some nutrients

Treatments	1997						1998		
	Soil analysis after harvesting			Tissue analysis of onion bulbs			Tissue analysis of onion bulbs		
	N mg/g	K (ppm)	P (ppm)	N mg/g	K(ppm)	P(ppm)	N mg/g	K(ppm)	P(ppm)
Chicken manure									
20 t ha^{-1}	1.700 b	238.10 abc	85.13 bc	16.233 bc	21.933 a	16625 c	21.267 a	10624.0 a	5039.0 a
40 t ha^{-1}	1.567 bcd	242.23 abc	101.50 b	16.550 b	23.933 a	16375 c	19.833 a	10394.3 a	4200.0 ab
80 t ha^{-1}	3.000 a	215.70 d	128.33 a	25.577 a	27.543 a	18000 abc	19.397 a	10928.7 a	3942.0 b
Sheep manure									
20 t ha^{-1}	1.333 cd	247.37 ab	73.83 c	13.313 cd	20.267 a	16792 bc	16.200 a	10347.7 a	4287.7 ab
40 t ha^{-1}	1.567 bcd	241.57 abc	86.68 cb	15.337 bcd	25.430 a	20083 abc	18.367 a	11199.7 a	5435.3 ab
80 t ha^{-1}	1.667 bc	227.23 cd	125.20 a	17.763 b	29.423 a	23250 ab	19.267 a	16382.0 a	4534.7 ab
Inorganic fertilizer	1.261 d	253.67 a	74.13 c	12.763 d	24.427 a	16165 c	15.987 a	10375.0 a	4005.7 b
Control	1.333 cd	233.20 bc	69.93 c	12.873 d	22.587 a	23875 a	16.933 a	10127.3 a	4947.3 ab

the stimulating effect of the sheep manure that supplies plants with nutrients required for better yield.

According to Table 3 the chicken manure tend to reduce the yield for all the three levels (20,40 and 80 t ha^{-1}) in comparison with fertilizer and control. This could be due to the harmful effect of chicken manure resulting from the increase in electrical conductivity of the soil at high level of application. It could also be attributed to the high mineralization process triggered in concentration of salt in soil there after solubilization of organic nitrogen from organic matter present in sheep manure by soil microorganisms compared with chicken manure. Havlin *et al.* (1999) found that adding organic matter into soil has positive effect on soil microorganisms.

One of the significant findings is that the yields level in 1997 and 1998 were closed in both years. This could be due to the fact that organic matter needs rather long time to decompose by soil microorganisms before it becomes ready to be absorbed by plant roots. As a result those yield values remained too close to the yields resulting from inorganic fertilizers as well as control treatments for both years of experiment. These results are in consistency with the results of El-Koumey and Abu-Agwa (1993) and Aqeel (2001).

All nutrient contents in soil increased with increasing application rates of chicken manure and sheep manure, except with potassium which gave the reverse (Table 4). This phenomena could be attributed to the fact that potassium fixed in soil, particularly those soils with higher percentages of clay minerals at which composed of two layers of silica teterahedra and one layer of Alumina octahedra (i.e. 1:2) as mica illite or vermiculite which has voids or spaces just fit in size with potassium size Bohn *et al.* (1985) For a given application rate, the effect of treatment was found in the order : chicken manure > sheep manure > Diammonium phosphate. It is well known that chicken manure has higher nutritional values than sheep manure.

Nitrogen content in onion tissues increased with increasing application rates of fertilizer in general. On the other hand more nutrient contents were obtained in 1998 season than in 1997 season except when using 80 tons ha^{-1} where the values decreased in 1998. These results are in agreement with total yield (Table 3).

Potassium and phosphorous content in onion tissues increased but not significantly with increasing application rates of manure and chemical fertilizer treatments but all the values decreased in 1998 than in 1997. In general there was no significant difference between treatment and the control treatment in plant tissue.

Onion yield from chicken manure in 1997 and 1998 did not differ significantly. However, the yield was increased significantly on sheep manure and inorganic fertilizer. The yield of onion was higher in second year compared with the first year. It could be due to plant residue in the soil from the previous years, which help the increase of nitrogen content of the soil through the nitrogen mineralization (Liucero *et al.,* 1995). In general under south region conditions of Jordan, using manures coupled with drip irrigation and plastic mulches is an alternative cropping system that can provide high yields and reduce inorganic fertilizer inputs in vegetable productions. This was with agreement with the findings of Singogo *et al.* (1996).

References

Al-Samarrie, A.A., 1978. "Cultivation effects on nitrification in potato soils". M.Sc. Thesis. Colorado State University, USA.

Aqeel, A.M., 2001. " Nutritional status of several legumes and Gramineae plant growth in soil supplemented with olive Mills by-products". M. Sc. Thesis. Jordan University of Science and Technology, Irbid: Jordan.

Bohn, H.L., B.L. Mcneal and G.A.O. Connord, 1985. Soil chemistry. 2nd edition. John Wiley and Sons. USA

Campbell, D.J. and P.H.T. Beckeft, "The soil solution in a soil treated with digested sludge". J. Soil Sci., 39. pp: 283-298.

El-Koumey, B.Y. and F.E. Abu-Agwa, 1993. Effect of chicken manure and waste water on some soil properties and nutrients uptake by cowpea plants". Menofiya J. Agric. Res., 18: 581-596.1991.

Fleige, H.B., B. Meyer and H. Scholz, 1971. Fraktionierung des Bodenstickstoffs fuer N-Hushalts-Bilanzen. Goettinger Bodenkundl Ber., 18: 1-37.

Havlin, J., J.D. Beaton, S.L. Tisdale and W.L. Nelson, 1999. " Soil fertility and fertilizers". Sixth ed. Prentice hall, New Jerzey.

Lekasi, J. K, J.C. Tanner, S.K. Kiamni and P.J.C. Harris, 1998. Manure management in the Kenya Highland: Practices and potential. The Henry doubledy research association. HDRA publication. Printed and bounded by Emmerson press, Kennilworth, UK

Lentner, M. and T. Bishop, 1993 " Experimental and design analysis". 2nd edition. Valley Book Company. Virginia. U.S.A.

Liucero, D.W., D. C. Martens, J.R. Mekenna and D.E. Starner, 1995. Poultry litter effect on unmanaged pasture field. Nitrogen and phosphorus up take, and Botanical composition common. Soil and Plant Sci., 26: 861-881.

McDaniel, P.A. and L.C. Munn, 1985. Effect of temperature on organic carbon-texture relationships in Mollisols and Aridisols. Soil Sci. So. Am. J., 49: 1486-1489.

Mc Grath, S.P. and J. Cegarra, 1992. "Chemical extractability-term application of sewage sludge to soil. "J. Soil Sci.,43 pp: 313-321.

Meiwes, K.J., N. Koenig, P.K. Khanah, J. Prenzel and B. Ulrich, 1984. Chemische Untersuchungsvrfahren fuer Mineralboden, Auflagehumus und Wurzelnzur Charkterisierung und Bewertung den Versauserung in Waldsterben. Berichte des Forshungszentrums Waldekosysteme/Waldsterben, 7: 1-67.

Roca, J. and F. Pomares, 1991. "Prediction at available heavy metals by six chemical extraction in a sewage sludge-amended soil". Commun. Soil. Sci. Pl. Anal., 22: 2119-2136.

Singogo, W., J.L. William and W. Marr, 1996. Full-planted cover crops support good yields of Muskmelons. Hortscience, 31: 62-64.

Splittstoesser, W.E., 1998. Vegetable growing handbook: Organic and traditional method". 3rd edition. An AVI Book. New York. USA. 1990.

Watanabe, F.S and S.R. Olsen, 1985. Test for an ascorbic acid method for determining phosphors in water and $NaHCO_3$ extract from soil. Soil Sci. Soc. Amproc., 29: 677-678.