Effects of Cow Manure on Growth and Yield of Lettuce (Lactuca sativa L.) In salty affected soil and drip irrigation system, Bahrain kingdom

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ABSTRACT

To get benefit of the available resources (FYM), save environment and to reduce the production cost the present study is focused on the response of lettuce (Lactuca sativa L.) to the application of caw manure. Experiment was laid in a Complete Block Design (RCBD); four rates of farm caw manure 00,8,16 and 24 tons/acre were added in the open research farm, Budaiya, Bahrain Kingdom.

Plant height, head diameter (core length), number of leaf, leaf area index(LAI), marketable yield and the nutrient composition of fresh lettuce were measured

The result indicated that lettuce grown in a sand soil amended with relatively higher amounts of organic manures (24t/acre) exhibited some good growth.
Leaf area index, Avg. core length and yield (marketable yield) were significantly responded. while number of leaf and Plant height were not.
In term of quality; generally, amounts of calcium, zin and iron were increased with increasing rate of organic fertilizer but the calcium content was increased significantly.

Lettuce can be grown better using 24 t/acre caw manure, for higher yield and quality.
Further study on even higher levels of caw manure is suggested

Introduction.

type of fertilizer applied, soil status and the type of preceding crops.

Excessive application of fertilizers has negative environmental impacts on water quality, leaching and runoff ((Heckman, 2007; Heckman et al., 2003; Sims et al., 1998,). However, chemical fertilizers, have significant contributions to increase crop and food yields (Fageria, 2009; Wang et al., 2008) to meet an increasing demand due to an increasing world population.

The risks of using chemical fertilizers and increasing people's awareness of environmental and health risks have made a growing demand for naturally produced vegetables.

Organic fertilizers are generally used for long periods of time. It is an integral part of sustainable agriculture; improve physical and chemical soil properties and reduce needs for mineral fertilizers.

In addition of being a soil conditioner (Costa et.al (9208), Cabecinhaet.al., (2010)), organic fertilizer is used as a source of nutrients, especially nitrogen (Guerrero, et.al., (2002) Brito, et.al., (1999)). Its use is influenced by the surrounding environment and the heat and humidity and according to the degree of decomposition. Organic matter added to the soil can take effect immediately in the soil and/or residual effect by means of a slower process of decomposition (Vidigal,et.al., 1997)

Fresh manure from caw and poultry residues, among the most common organic fertilizers in Bahrain. Caw manure contains active digestive enzymes that give it an added advantage. These enzymes contribute to accelerating the heating of the fertilizer, which accelerates the decomposition of organic matter by

microorganisms in the soil and faster release of nutrients to the plant.

Studies on lettuce response to different fertilizers have reported widely varying results, as some of them recommending usefulness of using chemical fertilizers, others tended to prefer organic fertilizers and third ones suggested mix forms.

Rodrigues,et.al., (1999) stated that the application of organic fertilizers in lettuce cause increases in production and nutrient content in plants.
In a comparative study done by Masarirambi, M. et.al. (2010,), for some fertilizers, the caw manure ranked second after chicken manure while the compost and inorganic fertilizers came last. On the contrary Brito L. et.al (2016) noted that the growth of lettuce decreased with increasing organic fertilizer.

Some studies suggest that high lettuce yields can be achieved with low rate application of N, (Soundy and Smith, (1992); Tei et al., (2003)). Others, suggested that high N rates may be needed to maximize productivity (Carling et al., (1987); Hoque et al., (2010)).

Much of this variability may be attributed to field-specific factors and or low fertilizer efficiency (Bottoms, T. G.,2012). Other causal factor reported by Nakagawa, et.al., (1992) that insufficient mineralization of organic compound can cause lower yield

It is therefore important to determine fertilizers and its application rates that maximize productivity while reducing environmental pollution (Fontes et al., 1997; Heckman et al., 2003).
In attempt to get benefit of the available resources (FYM), save environment and to reduce the production cost the present study is focused on the response of lettuce (Lactuca sativa L.) to the application of caw manure at different rates;00, 2kg, 4kg and 6kg/m3 (00,8,16 and 24t/acre) in research farm, Budaiya, Bahrain Kingdom

Materials and Methods

The experiment was conducted in the open research farm at Budaiya, Bahrain kingdom.

Bahrain receives little precipitation. The average annual rainfall is 70.8 mm. The average low and highest temperature are about 23.3 ° C and about 30.8 ° C respectively.

The lettuce is moderately sensitivity to soil salinity but cultivated good in most types of well-drained soil. The following table showing the soil characteristics of the research farm (Table.1)

Table.1: Soil characteristic of Budaiya research farm,Bahrain

Texture			Class	H.C	SP	PH	EC	soluble anions and cations							$CaCO_3$	$CaSO_4$	OM	CEC
Sand	Silt	Clay						HCO_3	Cl	SO4	Ca	Mg	Na	K				
87.7	5.4	6.9	ls	34.2	22	7.3	21.10	2.93	10	43.6	34.5	6.8	14.3	0.85	17	11.8	0.47	1.5

Variety: Kaiser cultivar, brought from local market, seeds were planted into nursery 4 weeks prior to be transferred to permanent land. Seedlings were exposed to hardening for one week.

Before transplanting, the soil was prepared to be loose, excess moisture was removed and raised beds were built up. The planting on the sides of each hose at a distance of 25-30 cm between the seedling and the seedling distance from the dropper by about 5 cm.

The experiment was laid in a Complete Block Design (RCBD). Four rate of farm yard manure (caw manure); 00, 2,4,6 kg/m^2 (00,8,16 and 24 ton/acre) were added one week before the transplanting with four replications. (Table2)

Table 2: Chemical characteristic of caw manure

pH	Nitrogen (N)	Phosporus (P) (mg/kg)	Potassium (K)
6.52	1.35	2.86	0.2

Irrigation: Lettuce has a shallow root system and as such requires frequent but lighter irrigations. The roots penetrate the soil to a depth of only 30cm; so water been applied throughout the growing period and reduced when the heads

become full. (A water shortage tends to promote bolting) .

Weed control: Weeds are controlled manually, removed by hand hoeing or pulling between plants in the rows.

The data collected included the following parameters: plant height, head diameter (core length), number of leaf, leaf area index(LAI), marketable yield and the nutrient composition of fresh lettuce (leaf tissue analysis).

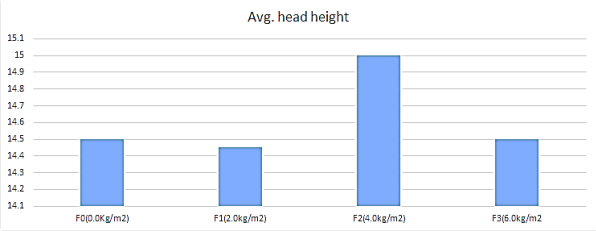
All data were collected on five plants selected randomly from each plot.

The data collected were analyzed using SPSS statistical package. Analysis of variance (ANOVA) was undertaken on the data collected.

Result

Plant Height and Number of Leaves: The results showed no significant (P<0.05) differences. The highest plants were obtained of lettuce applied with 16 t/acre caw manure while The lowest were obtained when applied with 4.0kg/m2 (8t/acre) fertilizer; the result was not consistent with a particular system (Fig. 1).

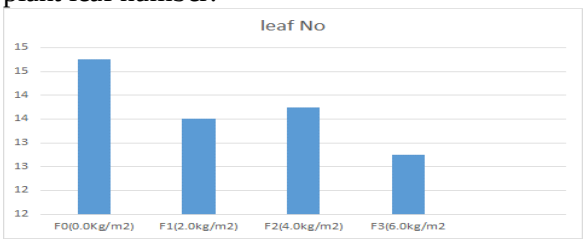
Fig.1: Effect of caw manure application rate on plant height



Means with different colors are significantly different at P<0.05

The highest number of leaves was obtained from lettuce applied with 00 t/acre (control) caw manure (Fig. 2). Number of leaves decreased with each increase in level of caw manure applied. The lowest number of leaves was obtained from lettuce supplied with 24t/acre fertilizer.

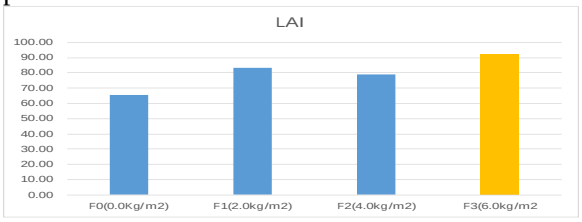
Fig.2: Effect of caw manure application rate on plant leaf number.



Means with different colors are significantly different at P<0.05

Leaf area Index (LAI), Avg. core length and Head weight: The results is significantly differences(P<0.05); the highest leaf area index was obtained from lettuce applied with 24 t/acre caw manure (Fig. 3). The lowest leaf area index was obtained from lettuce applied with 00t/acre fertilizer.

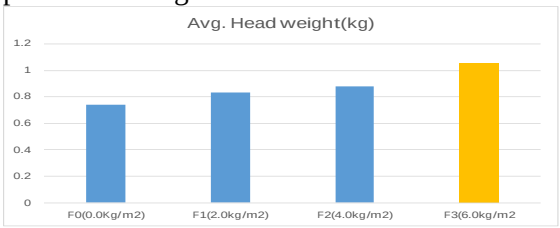
Fig.3: Effect of caw manure application rate on plant LAI



Means with different colors are significantly different at P<0.05

Marketable yield is shown by (Fig. 4). Yield increased with each increase in level of caw manure application. The lowest marketable yield was obtained from lettuce supplied with 00t/acre fertilizer.

Fig.4: Effect of caw manure application rate on plant head weight.

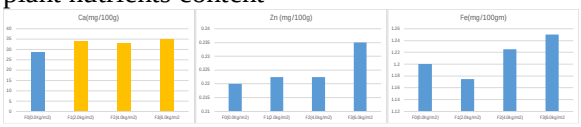


Means with different colors are significantly different at P<0.05

Quality (Calcium, Iron and Zinc): There was significant (P<0.01) differences with calcium

content in the fresh samples of lettuce among treatments. The highest Ca content was obtained from lettuce provided by with 24t/ acre of caw manure. There was no significant (P> 0.05) different in iron nor zinc content for all the treatments (Fig 5). Minerals content was increased with each increase in level of caw manure application.

Fig.5: Effect of caw manure application rate on plant nutrients content



Means with different colors are significantly different at P<0.05

Discussion

Plants which had been fertilized by higher levels of caw manure (24t/acre) exhibited higher yields than those applied with lower level, this could be attributed to the relative quantities of available nitrogen. Available potassium and phosphorous are low to very low successively in the manure (Table 2).

However, as perceived vegetables grown with higher levels of organic manures better than those grown on lower amounts. Rao (1991) and Xu et al. (2005) have proved that organic fertilizer effects on crop yield and nutrient uptake and they stated that higher amounts of organic materials being added into the soil before planting will boost crops yield

Fertilization had significant effects in calcium content of the lettuce. This can be attributed to relatively ample amounts of calcium in the soil which may be affected by the caw manure. The organic matter improves soil tilth, retention of water and nutrients and promotes growth of beneficial organisms. Agreed with this finding are reported by (Stamatiadis et.al.,1999) in lettuce and (Ouda, and Mahadeen, 2008) in broccoli but they attributed the effect to amount of calcium in organic fertilizers.

No variations in plant height and leaf number per plant of lettuce were observed amongst the treatments plants. That probably due to the high temperature making lettuce vegetative live short. However, the type of manure and method of application determine the quantity of nutrients available to the plant growth.

CONCLUSION

The use of manure as fertilizer has been beneficial to vegetables and crop production.

Lettuce grown in a sand soil amended with relatively higher amounts of organic manures exhibited some good growth (leaf area index and Avg. core length) and yield (marketable yield) than those with lower levels of organic fertilizers. Some of growth parameter did not respond such as Number of leaf and Plant height.

Similarly, higher amount of calcium is shown with higher amount of organic fertilizer. There were no differences in iron or zinc content in the lettuce.

Based on the results, the following suggestions can be made:

Lettuce can be grown better using 24 t/acre caw manure, for higher yield and quality.

Further study on even higher levels of caw manure should be carried out.

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