Organic production of lettuce (*Lactuca sativa* L.)

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Abstract :-

An experiment was conducted during 2008 growing season at agricultural field, Al-Kefil, Babylon Governorate, Iraq. The objective of this investigation was to improve the head performance of lettuce grown on soils supplemented by 0, 40, and 60 m^2/h with spraying humus at rates of 0, 1.5, and 3m/l. Results showed that spraying lettuce plants by 3ml/L humus was the superior. It exceeded 0 and 1.5 m/L rates by 13.2 and 15.4% in marketable fresh weight of head, respectively. Soil supplemented with 60 m^2/h of sheep manure resulted in the best marketable head fresh weight. It exceeded these of 0 and 40 m^2/h rates by 112 and 25%, respectively. Plants lettuce grown on soil supplemented with 60 m^3/h of sheep manure and sprayed by3 m/L humus was the best. It gave the highest fresh weight of marketable head (1294 g).

الخلاصة:-

نفذت التجربة في الموسم الزراعي (2008) فـــي حقل الخضراوات / منطقة الكفل التابعة لمحافظة بابل لدراسة تأثير مستويات سمـــاد الأغنام (صفر ، 40 ، 60) م^3/ هكتار . بالتداخل مع الرش الورقي لسماد الهيومس العضوي بمستويات (صفر ، 1.5 ، 3)مل /لتر . أظهرت النتائج تفوق الرش بمستوى 3مل/لتر في الوزن التسويقي الرطب للرؤوس .

وإن إضافة 60م^3/هكتار من سماد الأغنام أعطت أفضل وزن تسويقـــــي رطب للرؤوس مقـارنة مــــع إضافـــــة المستـويين (صفر ، 40) م^3/هكتار من سماد الأغنام وأن معاملة التداخل الناتجة مـــــن إضافة 60 م^3/هكتار من سماد الأغنام مع الرش بالمستوى 3مل/لتر من سماد الهيومس العضوي قد تفوقت على بقية المعاملات حيث أعطت أعلى وزن تسويقي رطب للرؤوس بلغ 1294غم/رأس .

Introduction :

Lettuce, (*Lactuca sativa* L.) is an herbaceous annual that is unique among vegetables in that it is used almost exclusively as a fresh, relatively unprepared part of salads.

Organic production was defined as an ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity. It is based on minimal use of off-farm inputs and on management practices that restore, maintain and enhance ecological harmony. Livestock manures are the most traditional and widely recognized organic fertilizers. Under ideal circumstances, livestock enterprises are integrated into the whole farm operation, and manure becomes part of a closed system of nutrient recycling. This is still strongly encouraged in organic operations (Kuepper and Gegner, 2004).

Previous fertilization with manure or organic compost and phosphorus, 8-10 days before

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transplanting young lettuce plants, will also aid in a better development (United Nation, 2003).

Recycling livestock manures onto the land is a common organic practice. It works to close the cycle of nutrient flows on mixed crop and livestock farms, keeping the purchase of additional fertilizers and soil amendments at a low level. Farms without livestock often buy manure, considering them to be among the best fertilizers available, Importing. and applying animal manures, composts, rock powders, and other allowed fertilizers is agronomical sound, permitted in organic production, and necessary in most organic systems especially those in early transition as long as no pollution or contamination occurs. The long term objective, however, should be to shift reliance to more sustainable practices as the farm matures (NCAT, 2003).

A liquid humus composition within the approximate weight percentage of between 5-15% of overall mixture is included and a water soluble nutrient from the group consisting of carbohydrate and enzymes with the approximate weight of 10-20% of the foliar growth promoting mixture (Rutherford, 1983).

The dynamics of humus, which are among the most widely distributed organic materials on the terrestrial ecosystem, are important for the global carbon cycle. It was considered that humus consists of a labile fraction and a more stable fraction . Nevertheless, it was reported that microorganisms have the capability of growing on humic substances, which served as the only source of carbon or nitrogen. These results suggested that stable humus was regarded as bio-available. In the foregone study, it was considered that several enzymes actually take on the microbial degradation of humic substances. Thus, in our study, we investigate the activity of enzymes to humic substances, that will be a key for the availability of humic substances (Yanagi et al., 2003). .Humic acid has an efficiency in the growth of plants the availability of the elements ,the using of humic acid even though with little concentration lead to increase permeability of the cellular membrane. It is one of the important features which is done by the acid ie, making auto –activation to the enzymes of plants. This can be interpreted with the presence of guanine in the humic acid .this will operate as a receipt to the Hydrogen with the same time the Oxygen will be as a chemical factor to the oxidation (ching 1977).

Materials and methods :

This experiment was conducted during 2008 lettuce growing season at agricultural field, Al-Kefil, Babylon Governorate, Iraq. The objective of this investigation was to improve the head performance of lettuce grown on soils supplemented by 0, 40, and 60 m^2/h by the aid of spraying humus at rates of 0, 1.5, and 3m/l . Split Plots within Factorial Randomized Complete

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Block Design (Split F-RCBD) was adopted in this trail where the main plot (A) was the application of sheep manure at rates of 0, 40 and 60 m^2/h to represents a1, a2 and a3,respectivelt, whereas the sub main plots (B) was humus rates 0, 1.5 and 3m/l to represents b1, b2, b3, respectively. Therefore, the experiment contained 9 treatments each was replicated three times and one replicate was represented by a furrow of 10m length and 0.7m width planted with plant intra space of 30cm.

Soil was plowed and then dissected according to the chosen design.. On (9/ 15, 2008) lettuce seedlings were transplanted in to the permanent field. On (11/ 15 / 22 , 2008) plants were sprayed with humus. Other cultural practices were manually made during the growing season. Finally 9 plants were taken to represent one treatment. On (1/ 20, 2009 plants were harvested, kept in plastic bags, and brought to laboratory to record the plant height, plant fresh weight, stem diameter, head circumferences, leaf area, leaf number per plant. Plant samples were weighed then oven-dried at 70C̊ for 48 hours, and reweighed to calculate the dry matter percentages.

Results and discussion :

Lettuce plants treated with 3m/l humus appeared to be the most effective treatment (table1). It substantially exceeded the untreated check in leaf number per plant (32.7%), leaf dry matter percentage (7.9%), head length (13%), stem diameter (8.1%), and marketable leaf fresh weight (13.2%). Furthermore, this treatment was superior over lettuce plant sprayed by 1.5 m/l treatment in leaf number per plant (29.9%), stem diameter (25%), and marketable leaf fresh weight (12.5%). The next effective treatment was lettuce plants sprayed by.5 m/l treatment (table1), as it passed the check in leaf area (12.3%), leaf dry matter (4%), and head circumference (10.2%). Moreover, it was better than 3ml.l-1 treatment in leaf area (1.8%0), and head circumference (4.8%). However, untreated control displayed higher plant fresh weight in relation to 3ml.l-1 treatment (15.5%) and 1.5m/l treatment (17.3%). The advantages of humus application might be referred to its enzymes. Yanagi et al. (2003) found that laccase and peroxidase were diminished the absorbance of humic acid by 14% and 6%, respectively. In contrast, esterase increased the absorbance of it by 10%, to its nitrogen content. Calace, et al. (2005)found that the sedimentary humic acids in Antarctic marine environment have some peculiar characteristics such as a high nitrogen (4–8%) and oxygen content (35–45%) and a predominance of carboxylated and hydroxylated aliphatic structures respect to those found in sedimentary humic acids in temperate zone of the planet (N and O ranges are 1–3% and 30–40%, respectively).12,13 These structural features make Antarctic humic acids particularly interesting to study their role in biogeochemical cycles of metals.

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Table (1) Influence of humic acid rates on growth and yield of lettuce.

Leaf area $(cm)^2$	Marketable Leaf fresh weight (g)	Leaf fresh weight (g)	Fresh weight (g)	Leaf dry matter percentage (%)	Head circumference (cm)	Stem diameter (cm)	Head length (cm)	Leaf number	Humus Ml/l
307.778	0.479	0.601	433.78	10.4884	41.622	3.267	33.444	29.111	b1 0
349.222	0.815	1.204	662.11	12.833	52.722	3.756	41.556	40.778	b2 1.5
446.000	1.019	1.409	785.89	15.933	56.856	3.833	39.889	37.556	b3 3
3.3	0.045	0.039	117.42	0.529	0.787	0.161	1.109	0.932	L.S.D5 %

Addition of 60m3.h-1 manure appeared to be the most potent treatment, as compared to check treatment, since it manifested significantly higher leaf number per plant, leaf area, leaf dry matter percentage, head length, stem diameter, head circumference, plant fresh weight, leaf fresh weight and marketable leaf fresh weight, by 29.2, 44.9, 51.4, 18.9, 16.2, 36.8, 134.4, 81.2, and 112%, respectively. In addition to that 60m3.h-1 treatment marketable exceeded that of 40m3.h-1 treatment by 27.7, 24.2, 8 19, 14.5, and 25% in terms of leaf area, leaf dry matter percentage, head circumference, leaf fresh weight, plant fresh weight, and marketable leaf fresh weight, respectively, (table2).

Table(2) Influence of manure rates on growth and yield of lettuce .

Leaf area $(cm)^2$	Marketable Leaf fresh weight (g)	Leaf fresh weight (g)	Fresh weight (g)	Leaf dry matter percentage (%)	Head circumference (cm)	Stem diameter (cm)	Head length (cm)	Leaf number	Manure m^2/h
341.989	0.743	1.182	670.00	12.567	48.022	3.733	35.333	32.111	a1 0
383.935	0.729	1.008	611.11	13.122	52.789	3.167	39.667	32.778	a2 40
377.075	0.841	1.023	600.67	13.567	50.389	3.956	39.889	42.556	a3 60
3.3	0.045	0.039	117.42	0.529	0.787	0.161	1.109	0.932	L.S.D5 %

40m3.h-1 treatment comes next, as it significantly exceeded the untreated control in leaf number per plant (40.2%), leaf area (13.5%), head length (4.3%), stem diameter (2%), head circumference (26.7%), leaf fresh weight (52.6%), plant fresh weight (100.3%), and head marketable fresh weight (6.1%). In addition to that this treatment gave higher leaf number per plant (8.5%), and head length (24.6%), as compared to $60m^2/h$ treatment (table3). Peat organic

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matter additions to a soil will increase its ability to hold nutrients in an available state. Organic matter additions will also increase soil biological activity which will affect the availability of nutrients in the soil. Soil which has received organic matter has increased microbial populations and more varied fungal species than soils receiving synthetic fertilizer applications.

The long-term objective of organic matter addition is to build up soil humus. Humus is the more or less stable fraction of the soil organic matter remaining after decomposition of plant and animal residues. Nitrogen, the most unstable nutrient in manure, can easily be lost by volatilization in the form of ammonia gas. For example, when manure is spread on frozen ground, 25 percent of the nitrogen can be lost immediately and 75 to 80 percent can be lost within two weeks. Delaying application until manure can be immediately incorporated into the soil will lessen the amount of nitrogen lost. Manure imports physical and chemical improvements on soils. The organic matter rich soils have a stimulating tendency in the process of nitrification as well as in the availability of P and K (Tyler et al. 1974). The high content of OC and CEC confer upon the soil, the capacity to hold the essential plant nutrients in sufficient amounts so as to provide the nutrient demanded by the crops. The increased OC and CEC could be made possible through effective management of soils. Inclusion of organic materials such as humic acid found to bring about conducive changes in nutrient availability (Bamak et al., 2003).

Lettuce plants sprayed by3m/l humus grown on soil supplemented with 60 m^2/h manure was the superior dual interaction treatment (table 3). It manifested the highest leaf number per plant (51), head length (43.33 cm), stem diameter (4.4 cm), head circumference (59.6 cm), leaf dry matter percentage (17.2%), leaf fresh weight (789 g), and fresh weight of marketable head (1294g). The yield improvement that performed from the combination of humus and manure might be attributed to vast factors for instance mineral availabilities. Bama et al. (2003) found .

a linear trend in the release of N,P and K was observed for the application of HA. The release of N was significant upto 20 kg of HA ha-1, whereas for P and K it extended upto 40 kg ha-1. The N and P were released for a longer period of 60 days, while K release attained a plateau on 45 days after incubation. At the end of incubation period, there was a steep and significant increase of organic carbon and CEC upto 40 kg ha-1.

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Table (3) Influence of humic acid and manure rates on growth and yield of lettuce.

Leaf area $(cm)^2$	Marketable Leaf fresh weight (g)	Leaf fresh weight (g)	Fresh weight (g)	Leaf dry matter percentage (%)	Head circumference (cm)	Stem diameter (cm)	Head length (cm)	Leaf number	Humus x manure
289.900	0.413	0.508	415.00	8.900	34.367	2.700	28.000	21.000	a1b1
392.533	0.920	1.900	810.00	13.700	56.200	4.300	40.667	39.667	a1b2
343.533	0.894	1.138	785.00	15.100	53.500	4.200	37.333	35.667	a1b3
310.467	0.510	0.680	461.33	11.367	47.433	3.333	35.000	30.333	a2b1
338.967	0.809	0.847	588.33	12.367	53.433	3.267	45.000	42.000	a2b2
502.367	0.868	1.497	783.67	15.533	57.500	2.900	39.000	26.000	a2b3
322.967	0.513	0.614	425.00	11.100	43.067	3.767	37.333	36.000	a3b1
316.167	0.716	0.864	588.00	12.433	48.533	3.700	39.000	40.667	a3b2
492.100	1.294	1.591	789.00	17.167	59.567	4.400	43.333	51.000	a3b3
5.499	0.074	0.063	200.31	0.992	1.325	0.262	1.838	1.651	L.S.D5%

References :

Abdel C. G. (2005). Water relation in lettuce (Lactuca sativa var. Longifilia). Mesopotamia J. of Agric. 33, (4) : 2-16.

Bamak. S., G. Selvakumari, R. Santhi and P. Singaram (2003). Effect of humic acid on nutrient release pattern in an Alfisol (Typic Haplustalf). Madras Agric. J., 90 (10-12) : 665-670 Oct-Dec 2003.

Calace N., C. Cremisini,b M. Galletti,b S. Mirantea and B. M. Petronio (2005). Copper and other trace elements strongly bound to humic acids along sediment cores in the Ross Sea, Antarctica. J . E n v i r o n . M o n i t . , 2 0 0 5 , 7 , 1 2 8 1 – 1 2 8 6.

Ching, B. T. 1977. Soil organic matter as plant nutrient. In soil organic sweet cherry. Amer. Soc. Sc. 33(4).

Kerns, D.L., M.E. Matheron , J.C. Palumbo , C.A. Sanchez, D.W. Still , B.R. Tickes , K. Umeda and M.A. Wilcox (2001). Guidelines for Head Lettuce Production in Arizona. The University of Arizona, Cooperative Extension. Guidelines for Head Lettuce Production in Arizona. IPM Series Number 12. Publication number az1099. Cooperative Extension, College of Agriculture and Life Sciences, University of Arizona, Tucson, Arizona. URL: "http://cals.arizona.edu/crops/vegetables/cropmgt/az1099.html"

Kuepper G. and L. Gegner (2004). Orgnic crop production overview. Nat Agriculture

ISSN 2072-3875

Specialists Aug 2004 ©NCAT 2004

MacDougall N. A. (2005). The Certified Organic Seed Market: Implications of Delayed Development. A report prepared for the California Institute for the Study of Specialty Crops (CISSC) 2005.

NCAT (2003).Organic Crops Workbook. A Guide to Sustainable and Allowed Practices. Scat's Organic Crops Workbook.

Rutherford J. P. (1983). Foliar growth mixture. United State Patent [19].Sergeants A. S. (2008). Operational Considerations for Harvest. Florida Greenhouse for Harvest . Florida Greenhouse Vegetable Production Handbook ,IF AS EXTENSION , Vol 31 .

Tyler , G . , Mornsio , B. and Nilsson , B. (1974) . Heavy metal pollution on soil available nutrients . Pl. Soil , *40 : 237-159* .

United Nation (2003) . Organic Fruit and Vegetables from the tropics , market Certification and Production Information for producers and International trading companies . pp196 .

Yanagiy ., K. Kitayama, T. Suzuki , H. Fuitake (2003) . Reactivity of enzymes to humic substances . Goldschmidt Conference Abstracts 2003,A558 .

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