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Comparison of Garden Soil with Nitrogen and Potassium for Growing Lettuce (*Lactuca sativa L.*) in Glass House.

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Abstract

The experiment was conducted during the year 2019-20 by Vegetable Section, Agriculture Research Station (ARS) Baffa Mansehra to compare garden soil with nitrogen (Urea) and potassium (Murate of Potash) for lettuce production in glass house. Lettuce is an important summer off-season and high valued crop cultivated at District Mansehra in the months of July-August. The produce is transported to other metropolises with handsome earning, but excessive use of minerals and synthetic fertilizers may render the produce less profitable in one or another way. Hence this experiment was designed to compare garden soil with nitrogen and potassium doses. It is evident from the statistical analysis that garden soil has a significant effect on number of leaves, leaf area, seed per plant, yield per plant and yield per acre. Seed production is noticeable for garden soil when the prevailing temperature during seed formation was 25^0C. In terms of leaf area maximum leaf area 576.10 $cm^2$was recorded for garden soil while minimum leaf area 303.43 cm^2 was recorded with nitrogen applied @ 200 kg ha^{-1} and potassium applied @ 100 kg ha^{-1} respectively. Maximum number of leaves 28.03 was recorded for garden soil while the minimum number 21.96 was recorded for nitrogen applied @ 200 kg ha^{-1} and potassium applied @ 100 kg ha^{-1}. Seed formation was successful with mean temperature 25^0C in glass house for 30 days, here again garden soil surpassed nitrogen and potassium with 4.03gm $plant^{-1}$. Yield per plot 3.69 kg was recorded for garden soil and the minimum value 1.1843 kg was recorded for nitrogen and potassium applied @ 200 kg ha^{-1} nitrogen while potassium applied @ 100 kg ha^{-1}. Garden soil gives maximum yield of 13600 kg $acre^{-1}$ compared with the lowest production 6070.5 kg $acre^{-1}$ of nitrogen and potassium applied @ 200 kg ha^{-1} nitrogen while potassium applied @ 150 kg ha^{-1}.
Keywords:, Lettuce, garden soil, leaf area, seed production, glass house
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Introduction

Lettuce (*Lactuca sativa* L.) is one of the most important commercial vegetables, it is an annual plant belongs to the family Compositeae one of the important vegetable in salad crop *Lactuca sativa* is a member of the *Lactuca* (lettuce) genus and family Asteraceae. The species was first described in 1753 by Carl Linnaeus.. It is the most relish salad crops in the world. It is native to Europe, Asia and Northern Africa and has been cultivated for 5000 years. The term lettuce also is used to refer to the edible, succulent leaves of L. sativa, which are commonly eaten raw in salads, but also may be eaten cooked (Katz and Weaver, 2003). In Brazil, lettuce is the major vegetable produced and commercialized. It is of utmost importance to conduct research on techniques to optimize the production and guarantee the environmental sustainability. The use of mineral fertilizers in lettuce growth is a common agricultural practice that brings satisfactory results in terms of yield, however, consumer's health, production cost and product quality may be given due consideration.

Currently, organic fertilizers are used in lettuce production from various sources, which provide improvement M. A. Moreira *et-al.* (2014). The majority of lettuce cultivation is carried out on family farms using cattle, goat, or sheep manure as fertilizer. If organic fertilizers are sourced from outside the properties, production costs increase or technical restrictions might apply (Silva *et-al.,* 2011). Organic farming practices involved on the management of soil organic matter (SOM) and nutrient availability include crop rotation, cover cropping and soil amendment with compost and/or manures (Brito *et-al*., 2012). Many studies showed that organic fertilizers can supply macronutrients (Eriksen et al., 1999), and could also improve the physical, chemical and biological soil characteristics because they contain high levels of organic matter (Albiach et al., 2001). Organic amendments are preferred to commercial fertilizers because it helps to recycle waste materials and can mitigate environmental hazards resulting from intensive agriculture (Pant *et al*., 2004). The use of natural fertilizers from the property itself is of fundamental importance for these agricultural production systems, especially in terms of green manuring. This technique includes incorporation of plant debris, produced on site or sourced from other farms, in order to preserve and/or restore soil organic matter and nutrients (Oliever *et-al*., 2011). Organic farming practices involved on the management of soil organic matter (SOM) and nutrient availability include crop rotation, cover cropping and soil amendment with compost and/or manures (Brito et al., 2012). The application of conservative agro-techniques organic amendments, could usefully sustain plant performances and increase soil fertility, thus playing an important role in the sustainable agriculture.(Montemurro and Maiorana, 2008). Organic compound has a positive effect on fresh weight plant as pointed by an experiment (Villas Boase *et al*., 2004), which tested three doses (30, 60 and 120 t ha-1). The experiment "comparison of garden soil with nitrogen and potassium for growing lettuce (*Lactuca sativa L.*)" was designed to grow lettuce in glass house; garden soil was evaluated to see the difference in comparison with nitrogen (urea) and potassium (SOP).

These leafy greens are the Golden State's biggest vegetable crop, bringing in $1.6 billion annually Agri-business (2013). Research on the effects of utilization of organic fertilizers on lettuce yield is still insufficient. Horticultural crops, as lettuce, have a demand for N over a short time period, and, as a consequence, the commercial organic fertilizers, that are able to quickly supply available N (although rather expensive), are often used to ensure yields at competitive levels (Raviv *et al.,* 2008). This commodity is also diminishing in local market, because of

purchasing power of low income households. The market has been capture by a handful of growers; using injudicious synthetic fertilizers the produce is supplied to only metropolises of Pakistan. Keeping in view, growers negligence and consumers taste the experiment was designed to bring this commodity back with reasonable price. Moreover, organic farming is also the need of the day, that is why the experiment was designed to see the performance of lettuce using organic resources.

Materials and Methods

The experiment "comparison of garden soil with nitrogen and potassium for growing lettuce (*Lactuca sativa L.*)" was conducted at Agriculture Research Station Baffa Mansehra, experimental design was RCBD with three replications and four treatments. Lettuce variety "emperor" was used for this purpose. Data was analyzed through Statistixs 8.1 using linear model ANOVA with $P \leq 0.05$. Lettuce variety emperor was transplanted in the month of November 2019, in a square pattern 9 inch x 9 inch plant to plant and row to row distance respectively. Each plot size was maintained as 0.7 m^2, each replication is with four treatments.

Field layout

Treatment	**Replications**		
	R1	**R2**	**R3**
T1=Garden Soil	T1R1	T1R2	T1R3
T2=N+P(100+50 Kg h^{a-1})	T2R1	T2R2	T2R3
T3=N+P(200+100 Kg h^{a-1})	T3R1	T3R2	T3R3
T4=N+P(300+150 Kg h^{a-1})	T4R1	T4R2	T4R3

Data was recorded for the following parameters.

1. ***Leaf area***

   Leaf area was measured using Can and Castor formula (Maximum width cm x Maximum length cm). Leaf length was measured with the help of 30 cm ruler. Three plant were randomly selected with three leaves per plant and the data was averaged. Leaf area is measured in square centimeter.

2. ***Number of leaves***

   For counting number of leaves three plants were selected at random for each treatment and averaged.

3. ***Seed per plant***

   Seed per plant were collected from the selected plants and weighed in grams and averaged for each treatment.

4. ***Yield per plot***

Yield per plot consists of two picking of the whole plot, leaves collected were weighed in fresh form. Yield per plot was measured in kilogram of the fresh produce with the help of digital balance.

5. ***Yield per acre***

Yield per acre is the conversion of yield per plot. Yield per plot of 0.7 m^{-2} was converted into4000m^2

Results and Discussion

Table 1: Mean table for comparison of garden soil with different levels of Nitrogen and potassium.

Treatment	**Leaf Area**	**Number of Leaves**	**Seed per Plant (gm)**	**Yield per Plot (0.7 m^2) Kg**	**Yield per Acre Kg**
T1	576.10 a	28.033 a	4.0333 a	3.6903 a	13600 a
T2	365.10 ab	24.367 ab	3.3000 b	2.0840 b	9712.8 b
T3	303.43 b	22.600 ab	2.6667 c	1.7453 bc	8498.7 b
T4	289.00 b	21.967 b	2.3333 c	1.1843 c	6070.5 c
LSD at 5 %	247.24	5.5101	0.4455	0.8469	3245.7

Table No.1 compares levels of garden soil with nitrogen and potassium for lettuce production in glass house. It is evident from the statistical analysis that garden soil has a significant effect on number of leaves, leaf area, seed per plant, yield per plant and yield per care. Seed production is noticeable for garden soil when the prevailing temperature during seed formation was 25 ^{0}C.

Leaf area

In terms of leaf area maximum leaf area 576.10 cm^2 was recorded for garden soil while minimum leaf area 303.43 cm^2 was recorded with nitrogen applied @ 200 kg/ha and potassium applied @ 100 kg/ha respectively. Similarly maximum leaf area was obtained in lettuce provided with poultry manure as compare to chemical fertilizer (Michael *et-al*., 2012).

Number of leaves

Maximum number of leaves 28.03 was recorded for garden soil while minimum number 21.96 was recorded for nitrogen applied @ 200 kg/ha and potassium applied @ 100 kg/ha. An increase in number ofleaves $plant^{-1}$ was also obtained with poultry followed by cattle manure (Michael *et- al.,* 2012). The increase in vegetative growth of plant may be due to its role in enhancing soil physical condition and availability of more nutrients. This result is

in harmony with Ayeni *et-al.* (2010). It is also similar to the findings of (Fagmi and Odebode, 2007) who reported that increased number of leaves of pepper resulting from application of high rate of organic fertilizer.

Seed per plant

Seed formation was successful with mean temperature 25^0C of glass house for 30 days, here again garden soil surpassed nitrogen and potassium with 4.03 gm per plant. Ziyad *et-al* (2012) reported that highest seed number has been obtained in carrot crops while using cow dung vis-à-vis control using no fertilizers, there is a direct relation of soil organic matter and seed production.

Yield per plot and yield per acre

Yield per plot 3.69 kg was recorded for garden soil and the minimum value 1.18 kg was recorded for nitrogen and potassium level four with nitrogen applied @ 200 kg/ha while potassium applied @ 100 kg/ha. Garden soil gives maximum yield of 13600 kg per acre compared with the lowest production 6070.5 kg per acre of nitrogen and potassium level four. These results are in compliance with findings of Hossain and Ryu (2017). They found similar trend of increased yield of lettuce crop with application of recommended dose of organic fertilizer (13 ton ha^{-1}). Plant fertilized with poultry manure had the highest growth parameter and marketable yield. Similar results have been reported by (Uddin *et-al.,* 2009).

Conclusions and future research directions

It is concluded from the preceding discussion that garden soil is has a significant effect on leaf area, number of leave, seed per plant and fresh yield. The experiment may be carried out on farmer's field in the off-season vis-à-vis the application of synthetic nutrients to minimize cost of inputs while expanding area under lettuce cultivation. The venture may prove to burgeon farmers income with little efforts and resources.

Lettuce (*Lactuca sativa L.*) is 26th among 39 vegetables and of high nutrition value and is fourth of consumption. It is mainly a cold loving crop that grows well in day temperature of 18 to 25°C and the night temperature of 10 to 15°C (Prota, 2010). Lettuce is a rich source of antioxidants, Vitamin A and C and phytochemicals which are anti-carcinogenic. Lettuce is grown successfully in the agro-climatic condition of district Mansehra for truck gardening but due to high price and lack of proper production technology farmers have low tendency to grow lettuce however, garden soil may minimize cost of production and boost income on the other hand that needs further research and development on commercial scale bringing fertile land under lettuce cultivation only using natural soil condition.

References

Albiach, R., R. Canet, F. Pomares and F. Ingelmo. 2001. Organic matter components and aggregate stability after the application of different amendments to a horticultural soil. Bioresource Technology 76: 125–129.

Ayeni, L. S., T. O. Omole, E. O. Adeleye and S. O. Ojeniyi. 2010. Integrated application of poultry manure and NPK fertilizer on performance of Brito, L.M., Pinto, R., Mourao, I., and Coutinho, J. (2012). Organic lettuce, rye/vetch and Swiss chard growth and nutrient uptake response to lime and horse manure compost. Organic Agriculture, 2(3-4), 163-171.

Eriksen, G. N., F. J. Coale, and G. A. Bollero. 1999. Soil nitrogen dynamics and maize production in municipal solid waste amended soil. Agronomy Journal 91: 1009–1016.

Fagimi, A.A and C.A. Odebode. 2007. Effect of poultry manure on pepper veinal mottle virus (PVMV), yield and agronomic parameters of Pepper (Capsicum annum) in Nigeria. East Africa J. of Sci., 1(2): 104-11.

M. A. Moreira*et-al.,*AgriculturalSciences Lettuce production according to different sources of organic matter and soil cover 5 (2014) 99-105100physical and chemical soil properties.

M.b. Hossain and k.s. Ryu (2017).effects of organic and inorganic fertilizers on lettuce (lactuca sativa l.) And soil properties.saarc j. Agri., 15(2): 93-102

Michael T.M., M.Bekhumusa, K. P. Mbokazi and O. O.Tajudeen.2012. Effects of Kraal Manure, chicken manure and inorganic fertilizer on growth and yield of lettuce (Lactuca sativa L. var Commander) in a semi-arid environment Horticulture Department,University of Swaziland, P.O. Luyengo, M205, Swaziland: 58-62.

Montemurro, F., and M. Maiorana. 2008. Organic fertilization as resource for a sustainable agriculture.Chapter 6. In: Fertilizers: Properties, Application, and Effects, eds. L. R. Elsworth, and W. O. Paley, pp.123–146. Hauppauge, NY: Nova Science Publishers, Inc.

Oliveira, M. K. T. et al. Agronomic performance of carrots fertilized with jitirana before sowing. Revista Agronomic Science, Fortaleza, v. 42, n. 2, p. 364-372, 2011.

Pant, H. K., M. B. Adjei, J. M. S. Scholberg, C. J. Chambliss, and J. E. Rechcigl. 2004. Forage production and phosphorus phytoremediation in manure-impacted soils. Agronomy Journal 96: 1780–1786.

Prota.2010.Plant Resources of Tropical Africa.PROTA4U Record Display

Raviv, M., J. H. Lieth, A. Bar-Tal, an Silber. 2008. Growing plants in soilless culture: operational conclusions. In: Soilless Culture: Theory and Practice, eds M. Raviv, and J. Lieth, pp. 545–566. London: Elsevier.

S. M. Z. Haidar, M. H. Rahman and M. M. Hossain (2012). "Effect of Organic Manures on the Seed Production of Carrot" Bangladesh J. Crop Sci. 2012, 22-23: 111-115. tomato in derived Savannah transition zone of southwestNigeria.Nature Sci.,8(2): 50-54.

Uddin, J., A. H. M. Solaiman and M. Hasanuzzaman.2009. Plant characters and yield of kohlrabi (Brassica oleraceae var. gongylodes) asaffected by different organic manures. J. of Hort. Sciand Ornamental Plants., 1(1): 1-4.

Villas Boas, R.L., Passos, J.C., Fernandes, D.M., Bull, L.T., Cezar, V.R.S., and Goto, R. (2004). Doses effects and organic compounds types in lettuce crop in two soils under protect environment. HorticulturaBrasileira, 22, 28-34.