



## **Studies on Use of NPK and Organic Manures on Growth, Yield and Quality of Lettuce (*Lactuca sativa*) cv. Grand Rapid**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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### **ABSTRACT**

The experiment was conducted in the Departmental field of Horticulture, Naini Agricultural Institute, Sam Higginbottom, University of Agriculture, Technology and Sciences, Prayagraj (U.P) during 2020-2021, by randomized block design consisting of 7 treatments and three replications with different combination of NPK and Organic manures. Based on the present investigation, it is concluded that the treatment T<sub>5</sub> (50% RDF + 25% FYM + 25% Poultry manure) was found to be superior all-over other treatments with respect to Plant height at 45 DAS (21 CM), Number of leaves plant<sup>-1</sup> at 45 DAS (21.1), Leaf length at 45 DAS (19.90 cm), Leaf width at 45 DAS (16.2 cm), Leaf area at 45 DAS (232.5 cm), Leaf area index at 45 DAS (20.4 cm<sup>2</sup>), Leaf weight (107.6 g), Leaf yield plot<sup>-1</sup> (10.5 kg), Leaf yield ha<sup>-1</sup> (23.4 kg), Vitamin-C (3.5) content and TSS (3.4°Brix) of Lettuce under agro-climatic condition of Prayagraj. Among all other treatments, T<sub>5</sub> (50% RDF+ 25% FYM + 25% Poultry manure) has obtained Highest Gross return, Net return, and Benefit Cost ratio (1:3.8) which states that it is economically profitable compared to all other treatments.

**Keywords:** Lettuce; NPK; organic manure; growth; yield and quality.

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## 1. INTRODUCTION

Lettuce is a cool season annual leafy vegetable. Lettuce is more popular among salad vegetable crops. This crop is a member of Asteraceae family and native to Mediterranean region. The word (lactuca) is derived from the Latin word "lac" or "milk". Among all the lettuce varieties, Romaine lettuce is famous for its nutrition values [1,2]. Lettuce is mainly used in food items like wraps, sandwiches apart from using as leafy vegetable. The plant can vary in its size, shape, Leaf type and generally Leaves of the plant form a dense head or loose rosette, crispy texture and slightly bitter in taste with milky juice as fresh condition. Lettuce varieties are mostly eaten fresh, and served as salads, although it is also seen in other kinds of food, such as soups, sandwiches and wraps; it can also be grilled. All types of lettuce are good for health. As a vegetable, it provides fibre, vitamins, minerals and phytochemicals for very few calories. Lettuce is a rich source of folate, such as vitamin B, need to make and repair DNA cells, and vitamin K, nutrient essential for healthy bones. It grows in various types of soil, but it gives good results when grown in sandy loam and silt loam soil. Its Ideal soil pH should be about 6 to 6.8 and waterlogged condition is not good for its growth. Lettuces are harvested prior to flowering [3-6].

Lettuce has been used as a medicine for different ailments including stomach problems, Organic manures comprise of a variety of plant derived materials that range from fresh or dried plant material to animal manures and litters to agricultural by-products [7,8]. The nutrient content of organic fertilizers varies greatly among source Materials, and readily biodegradable materials make better nutrient sources. Nitrogen and Phosphorus content is lower, often substantially lower, in organic manures compared to chemical Fertilizers. Moisture content is another factor that Reduces or dilutes the nitrogen and phosphorus Concentrations of organic fertilizers. Thus, it can Be cost ineffective to transport high-moisture Organic manures long distances [9,10]. This vegetable requires a high rate of nitrogen for growth and development. Lettuce (*Lactuca sativa* L.), an annual leafy herb is one of the most popular salad crops which mainly grows in temperate regions and in some cases in the tropic and sub-tropic regions of the world. The best temperature for cultivation of lettuce is 18-25°C and the night temperature is 10-15°C [11,12]. The nutritive value of lettuce is very high which contains vitamin A and C,

minerals (calcium, phosphorus and iron), protein, carbohydrate, fat, etc. [13]. Lettuce is also known as anodyne, sedative, diuretic and expectorant [14]. It is a newly introduced crop in Bangladesh and getting popularity day by day though its production package is not much known to the Bangladeshi farmers. The supply of nutrient and production technology plays a vital role in the production and quality of lettuce. Being a succulent vegetable, fertilizer application in appropriate time with appropriate dose and sufficient irrigation by using proper method is also the prerequisite for the cultivation of lettuce. Deficiency of soil nutrient is now considered as one of the major constraints to successful upland crop production in Bangladesh [15]. As organic farming eliminates agrichemicals and reduces other external inputs to improve the environment as well as farm economics, organic farming can play a vital role in the maximum profitable production of lettuce with sustaining soil fertility than the use of nutrient deficiency in the soils [16]. The experiment was undertaken to observe the growth and yield of lettuce under different combinations of NPK along with organic manures application, to find out the suitable organic manure for higher production, and to investigate the proper dose for the maximum production of lettuce. At present condition, excess use of chemical has been declined the soil fertility. The main aim is to cultivate crops in such a way that soil remain sustainable for maximum quality of production. So as, this study helps to Evaluate the maximum Growth, yield and Quality of lettuce by combined use of NPK and Organic manure.

## 2. MATERIALS AND METHODS

This investigation "Studies on Use of NPK and Organic Manure on Growth, Yield and Quality of Lettuce (*Lactuca sativa*) cv. Grand Rapid." Was carried out at the Department of Horticulture, Naini Agricultural Institute, SHUATS, Prayagraj during the year 2021. All the facilities necessary for cultivation, including labour were made available in the department. Randomized block design consisting of 7 treatments and one control with different combination of NPK and Organic manures. Experiment including following treatments ie, T<sub>0</sub> (100% RDF (100 kg N +50 kg P<sub>2</sub>O<sub>5</sub> + 50 kg K<sub>2</sub>O<sub>5</sub>), T<sub>1</sub> (50% RDF + 50% FYM), T<sub>2</sub> (50% RDF + 50% Vermicompost), T<sub>3</sub> (50% RDF + 50% Poultry manure), T<sub>4</sub> (50% RDF + 25% FYM + 25% Vermicompost), T<sub>5</sub> (50% RDF + 25% FYM + 25% Poultry manure), T<sub>6</sub> (50% RDF + 25% Vermicompost +

**Table 1. Effect of different combinations of NPK and organic manure on plant height, no. of leaves, leaf length**

Treatments	Treatment combinations	Plant Height (cm)			No. of leaves			Leaf length (cm)		
		15 DAP	30 DAP	45 DAP	15 DAP	30 DAP	45 DAP	15 DAP	30 DAP	45 DAP
T <sub>0</sub>	100% RDF (100 kg N +50 kg P <sub>2</sub> O <sub>5</sub> + 50 kg K <sub>2</sub> O <sub>5</sub> )	5.7	10.1	13.1	8.0	13.2	18.4	6.07	11.22	13.94
T <sub>1</sub>	50% RDF + 50% FYM	6.6	10.6	13.7	8.3	13.4	19.0	6.29	11.40	16.81
T <sub>2</sub>	50% RDF + 50% Vermicompost	7.2	11.2	14.2	9.0	14.0	19.9	6.49	11.61	16.91
T <sub>3</sub>	50% RDF + 50% Poultrymanure	9.6	13.7	16.8	9.1	14.1	20.1	6.74	11.72	17.63
T <sub>4</sub>	50% RDF + 25% FYM + 25% Vermicompost	10.1	14.1	17.2	9.4	14.5	20.5	6.91	11.88	18.07
T <sub>5</sub>	50% RDF + 25% FYM + 25% Poultrymanure	13.9	17.9	21.0	10.9	15.9	21.1	8.62	12.60	19.90
T <sub>6</sub>	50% RDF + 25% Vermicompost + 25% Poultry manure	10.6	14.7	17.7	9.9	14.7	20.7	7.04	12.04	19.64
T <sub>7</sub>	25% RDF + 25% FYM +25% Vermicompost + 25% Poultrymanure	6.9	10.9	13.9	8.8	13.8	19.2	6.41	11.56	16.81
	<b>S.Ed (±)</b>	<b>0.25</b>	<b>0.19</b>	<b>0.21</b>	<b>0.25</b>	<b>0.25</b>	<b>0.39</b>	<b>0.15</b>	<b>0.19</b>	<b>0.17</b>
	<b>C.D at 5%</b>	<b>0.77</b>	<b>0.58</b>	<b>0.65</b>	<b>0.77</b>	<b>0.76</b>	<b>1.17</b>	<b>0.45</b>	<b>0.58</b>	<b>0.52</b>
	<b>C.V</b>	<b>4.95</b>	<b>2.56</b>	<b>2.32</b>	<b>4.80</b>	<b>3.04</b>	<b>3.37</b>	<b>3.76</b>	<b>2.83</b>	<b>1.69</b>

Table 2. Effect of different combinations of NPK and organic manure on leaf width, leaf area, leaf area index leaf weight

Treatments	Leaf width (cm)			Leaf area (cm)			Leaf area index(cm <sup>2</sup> )			Leaf wieght (g)
	15 DAP	30 DAP	45 DAP	15 DAP	30 DAP	45 DAP	15 DAP	30 DAP	45 DAP	
T <sub>0</sub>	4.7	8.0	12.2	89.8	112.8	125.3	3.0	6.2	18.2	87.9
T <sub>1</sub>	5.3	8.7	12.9	96.7	119.7	132.2	3.3	6.5	18.3	89.1
T <sub>2</sub>	5.8	9.2	13.4	117.5	177.5	190.0	4.0	7.2	19.0	91.3
T <sub>3</sub>	6.2	9.6	13.7	120.6	190.4	203.3	4.3	7.4	19.3	95.1
T <sub>4</sub>	6.6	9.9	14.1	124.0	207.5	220.0	4.6	7.8	19.6	97.9
T <sub>5</sub>	8.7	12.0	16.2	130.4	220.0	232.5	5.1	8.3	20.4	107.6
T <sub>6</sub>	7.4	10.7	14.9	128.6	216.5	229.0	4.9	8.0	19.9	103.9
T <sub>7</sub>	5.5	8.9	13.1	109.9	156.9	169.4	3.6	6.8	18.8	83.3
<b>S.Ed (±)</b>	<b>0.25</b>	<b>0.25</b>	<b>0.25</b>	<b>0.01</b>	<b>1.52</b>	<b>1.52</b>	<b>0.02</b>	<b>0.04</b>	<b>0.09</b>	<b>1.62</b>
<b>C.D at 5%</b>	<b>0.75</b>	<b>0.75</b>	<b>0.75</b>	<b>0.04</b>	<b>4.61</b>	<b>4.62</b>	<b>0.07</b>	<b>0.13</b>	<b>0.26</b>	<b>4.91</b>
<b>C.V</b>	<b>6.78</b>	<b>4.42</b>	<b>3.08</b>	<b>0.02</b>	<b>1.50</b>	<b>1.40</b>	<b>0.98</b>	<b>1.05</b>	<b>0.78</b>	<b>2.97</b>

Table 3. Effect of different combinations of NPK and organic manure on leaf yield/plot, leaf yield/ha, TSS, vitamin c

Treatments	Leaf yield /plot (kg)	Leaf Yield /ha (t)	TSS ( <sup>o</sup> Brix)	Vitamin c
T <sub>0</sub>	6.3	14.1	1.8	1.9
T <sub>1</sub>	6.7	14.8	2.0	2.1
T <sub>2</sub>	7.4	16.4	2.5	2.6
T <sub>3</sub>	7.8	17.3	2.6	2.7
T <sub>4</sub>	8.3	18.5	3.0	3.1
T <sub>5</sub>	10.5	23.4	3.4	3.5
T <sub>6</sub>	9.3	20.7	3.2	3.2
T <sub>7</sub>	6.6	14.6	2.2	2.3
<b>S.Ed (±)</b>	0.24	0.53	0.07	0.08
<b>C.D at 5%</b>	0.72	1.60	0.22	0.24
<b>C.V</b>	5.42	5.24	4.90	5.04

25% Poultry manure), T<sub>7</sub> (25% RDF + 25% FYM +25% Vermicompost + 25% Poultry manure). Fertilizers were applied in the form of urea, single super phosphate and murate of potassium, respectively.

### 3. RESULTS AND DISCUSSION

The investigation entitled “Studies on Use of NPK and Organic Manure on Growth, Yield and Quality of Lettuce (*Lactuca sativa*) cv. Grand Rapid”. Were carried out at Departmental Field of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) in the year 2020-2021. The results of the investigation, regarding the Lettuce on growth, yield and quality have been presented in table. The result of the experiment has been presented under the following heading.

#### 3.1 Growth Parameters

- The maximum Plant height at 15 days (13.9 cm) was recorded in treatment T<sub>5</sub> and minimum in the treatment T<sub>0</sub> (5.7 cm). The maximum plant height at 30 days (17.9 cm) was recorded in treatment T<sub>5</sub> and minimum in T<sub>0</sub> (10.1 cm). The maximum plant height at 45 days (21.0 cm) was recorded in treatment T<sub>5</sub> and minimum in T<sub>0</sub> (13.1 cm)
- The maximum Number of Leaves at 15 days (10.9) was recorded in treatment T<sub>5</sub> and minimum Number of leaves in T<sub>0</sub> (8.0). The maximum Number of leaves at 30 days (15.9) was recorded in treatment T<sub>5</sub> and minimum in T<sub>0</sub> (13.2). The maximum Number of leaves at 45 days (21.1) was recorded in treatment T<sub>5</sub> and minimum in T<sub>0</sub> (18.4)
- The maximum Leaf Length at 15 days (8.62 cm) was recorded in treatment T<sub>5</sub> and minimum Leaf Length in T<sub>0</sub> (6.07 cm). The maximum Leaf Length at 30 days (12.60 cm) was recorded in treatment T<sub>5</sub> and minimum in T<sub>0</sub> (11.22 cm). The maximum Leaf Length at 45 days (19.90 cm) was recorded in treatment T<sub>5</sub> and minimum in T<sub>0</sub> (13.94 cm)
- The maximum Leaf Width at 15 days (8.7 cm) was recorded in treatment T<sub>5</sub> and minimum in T<sub>0</sub> (4.7 cm). The maximum leaf width at 30 days (12.0 cm) was recorded in treatment T<sub>5</sub> and minimum in T<sub>0</sub> (8.0 cm). The maximum leaf width at 45 days (16.2 cm) was recorded in treatment T<sub>5</sub> and minimum in T<sub>0</sub> (12.2 cm)

- The maximum Leaf Area at 15 days (130.4 cm<sup>2</sup>) was recorded in treatment and minimum recorded in the treatment T<sub>0</sub> (89.8 cm<sup>2</sup>). The maximum Leaf Area at 30 days (220 cm<sup>2</sup>) was recorded in treatment T<sub>5</sub> and minimum in T<sub>0</sub> (112.8 cm<sup>2</sup>). The maximum Leaf Area at 45 days (232.5 cm<sup>2</sup>) was recorded in treatment T<sub>5</sub> and minimum in T<sub>0</sub> (125.3 cm<sup>2</sup>).
- The maximum Leaf Area index at 15 days (5.1 cm<sup>2</sup>) was recorded in treatment T<sub>5</sub> and minimum Leaf Area index in T<sub>0</sub> (3.0 cm<sup>2</sup>). The maximum Leaf Area index at 30 days (8.3 cm<sup>2</sup>) was recorded in treatment T<sub>5</sub> and minimum in the treatment T<sub>0</sub> (6.2 cm<sup>2</sup>). The maximum Leaf Area index at 45 days (20.4 cm<sup>2</sup>) was recorded in treatment T<sub>5</sub> and minimum Leaf Area index in T<sub>0</sub> (18.2 cm<sup>2</sup>).

#### 3.2 Yield and Quality Parameters

- The maximum Leaf Weight (102.9 g) was record in treatment T<sub>5</sub> followed by T<sub>6</sub> (93.8 g) and minimum leaf weight was record in treatment T<sub>0</sub> (50.9 g)
- The maximum Leaf Yield / plot (10.2 kg) was record in treatment T<sub>5</sub> followed by T<sub>6</sub> (8.4 kg) and minimum leaf yield / plot was record in treatment T<sub>0</sub> (3.7 kg)
- The maximum Leaf Yield (t /ha) (22.4t) was record in treatment T<sub>5</sub> followed by T<sub>6</sub> (18.7t) and minimum leaf yield (t/ha) was record in treatment T<sub>0</sub> (8.1t)
- The maximum TSS Content (3.4°Brix) was record in treatment T<sub>5</sub> followed by T<sub>6</sub> (3.2°Brix) and minimum TSS content was record in treatment T<sub>0</sub> (1.8°Brix)
- The maximum Vitamin-C Content (3.5) was record in treatment T<sub>5</sub> followed by T<sub>6</sub> (3.2) and minimum vitamin-c content was record in treatment T<sub>0</sub> (1.9)

### 4. CONCLUSION

Based on the present investigation, it is concluded that the treatment T<sub>5</sub> (50% RDF + 25% FYM + 25% Poultry manure) was found to be superior all-over other treatments with respect to Plant height, Number of leaves, Leaf length, Leaf width, Leaf area, Leaf area index, Leaf weight, Leaf yield plot<sup>-1</sup>, Leaf yield tonnes ha<sup>-1</sup>, Vitamin C content and TSS of Lettuce under the agro-climatic condition of Prayagraj. The result of

the experiment indicate that the highest growth, yield and quality of lettuce was obtained and Studies revealed that the treatment T<sub>5</sub> was the best for maximizing the production of lettuce which was also economically profitable.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

### REFERENCES

1. Tiftonnell PA, De Grazia J, Chiesa A. Nitrate and dry water concentration in a leafy lettuce (*Lactuca sativa* L.) cultivar as affected by N fertilization and plant population. *Agricultura Tropica and Subtropica*; 2003.
2. Vishal Kumar. Pal., Aman. Srivastav., Kishan. Singh., Rajaneesh. Singh., Hari. Baksh., Bijendra. K. Singh. And Raj. Pandey. Response of NPK and organic manures on growth and yield of carrot (*Daucus carota* L.) cv. Nantes; 2019.
3. Asif M Rather, N Jabeen, Tariq A Bhat, EA Parray, MA Hajam, MA Wani and Ishaq A Bhat. Effect of organic manures and bio-fertilizers on growth and yield of lettuce. *The Pharma Innovation Journal*. 2018; 7(5):75-77.
4. Chen Z, Han Y, Ning K, Luo C, Sheng W, Wang S, Fan S, Wang Y, Wang Q. Assessing the performance of different irrigation systems on lettuce (*Lactuca sativa* L.) in the greenhouse. *PLoS one*. 2019;14(2):e0209329.
5. Steingrobe T, Schenk D. Effect of date of transplanting and plant spacing on seed yield and yield characters in lettuce (*Lactuca sativa* cv. Great lakes). *Karnataka Journal of Agricultural Science*. 1994;5(4): 357-361.
6. Subbaia BV, Asija CL. Rapid procedure for the estimation of available nitrogen in soil. *Current Science*. 1956;25:415-426.
7. K. Singh. And Raj. Pandey. Response of NPK and organic manures on growth and yield of carrot (*Daucus carota* L.) cv. Nantes; 2019.
8. Walkely A, Black GA. Critical exam of rapid method for determining organic carbon in soils, effect of variation in digestive condition and inorganic soil constituents soil sci. 1956;251:632.
9. Tehrani M, Malakouti MJ. Recommendation of nitrogen fertilizer according to soil nitrate. First of national congregation decreasing poison consumption and best utilization of chemical fertilizers, Ministry of agricultural, Karaj, Iran. 1997;182. (in Farsi)
10. Thejaswini HP, Shivakumar BS, Sarvajna B. Salimath, Ganapathi M, Yallesh. Kumar HS. Studies on split application of NPK fertilizers and liquid bio-formulation (Jeevamrutha) on yield and quality of pomegranate (*Punica granatum* L.) in central dry zone of Karnataka. *The Pharma Innovation Journal*. 2022;11(1): 494-498.
11. Ryder EJ. Lettuce, Endive and Chicory. CABI Publishing Company, USA. 1998; 79.
12. Lindquist K. On the origin of cultivated lettuce. *Hereditas*. 1960;319-49.
13. Gopalan R, Balaraman SC. Health Bulletin of Indian Council of Medical Research. Special Report Series. 1966;42:12-16.
14. Kallo. Lettuce. In: Vegetable crops in India. Bose and Som (eds.), Naya Prokash, Calcutta, India. 1986;692-708.
15. Islam MS, Noor S. Performance of ground nut under different levels of phosphate Fertilizer in flood plain soil of Jamalpur, Bangladesh. *Bangladesh Journal of Agricultural Resources*. 1982;7(1):35-40.
16. Uddin MJ, Ali MS, Hossain MA, Ahmed MU, Haque MM. Effect of borongrainset, yield and some other parameters of wheat cultivars. *Bangladesh Journal of Agricultural Sciences*. 1995;2:179-184.

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