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Effect of nitrogen and phosphorus on growth, yield and quality of lettuce (*Lactuca sativa* L.)

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Abstract
The present investigation entitled studies on the effect of nitrogen and phosphorus on growth, yield and quality of lettuce (*Lactuca sativa* L.) was carried out in *Rabi* season 2020-2021 at Department of Horticulture, College of Agriculture, Latur. The treatments were four levels of nitrogen (0, 75, 100, 125 kg/ha) and three levels of phosphorus (0, 75, 100 kg/ha). The experiment was laid out in FRBD with three replications. Nitrogen and phosphorus levels significantly influenced the growth, yield and quality parameters at all growth stages. The maximum plant height, number of leaves per plant, leaf area, fresh weight of leaves per plant, yield per plant, yield per plot, gross yield, marketable yield, dry matter content, fibre content and chlorophyll content were obtained with the application of 100 kg N/ha and 100 kg P/ha in lettuce.

Keywords: Lettuce, nitrogen, phosphorus, chlorophyll, fibre

Introduction
Lettuce (*Lactuca sativa* L.), annual leaf vegetable of the composite family. Lettuce is king of green salad, it's universal use in kind of foods, such as soaps, burger and sandwiches. Demand for quality lettuce in metro-politian cities and retail super markets has picked in the recent years. In 2017, world production of lettuce (report combined with chicory) was 27 millio tones or 56% of the world total. India include 1.1 million of tones. (ANON, 2018).
Lettuce is most important salad crop generally cultivated for it's tender crisp leaves and head. It is an excellent source of essential nutrients and antioxidants. It is rich source of vitamins K and A, thyroid stimulating substances, anticancer compounds, some healing properties in case of high blood pressure and heart diseases. It is known to be sedative, diuretic and expectorant stem (Kallo, 1986) [8]. A cigarette containing no nicotine is made from lettuce.
Nitrogen requires for better growth and proper development of lettuce. Nitrogen positively affects fresh and dry weight of plant, diameter of plant and the total number of leaves. Phosphorus is useful nutrient that contribute most to the physiological mechanism of plants and is related to energy metabolism, membrane formation and cell wall. Lettuce is newly introduced crop in our country and getting popularity day by day. Nitrogen, phosphorus and potassium progressively increase the marketable yield but an adequate supply is essential for vegetative growth and desirable yield. In Maharashtra state very less work was done on this aspect.

Materials and Methods
The experiment was conducted during *Rabi* season of 2020-2021 at Department of Horticulture, College of Agriculture, Latur. The experiment was laid out in a Factorial Randomized Block Design having two factors i.e., nitrogen and phosphorus with three replications. The treatments include four levels of nitrogen and three levels of phosphorus. Total numbers of treatments combinations were 12. The treatment details were as 1) Levels of nitrogen (N)-N_0:0 kg/ha; N_1:75 kg/ha; N_2: 100 kg/ha; N_3: 125 kg/ha. 2) Levels of phosphorus (P)-P_0: 0 kg/ha; P_1: 75 kg/ha; P_2: 100 kg/ha.
One month old seedlings of lettuce were transplanted in plots 1.8x1.5m. Half dose of nitrogen and full dose of phosphorus and potash were given as basal dose. Remaining nitrogen was given in one split doses. Five plants from each plot were selected for taking observations on growth, yield and quality parameters. The data were analyzed statistically.

Quality parameters

Dry matter content (%)

One hundred gram of leaf sample previously cut into thin pieces were sundried, after that samples were placed in an envelop and placed in oven maintained at 70^0C for 72 hours. The sample then was taken. The dry matter content were computed by simple calculation from the weight by the following formulae.

$$\text{Dry matter (\%)} = \frac{\text{Dry weight x 100}}{\text{Fresh Weight of leaves}}$$

Fibre content (%)

One hundred gram of fresh leaf was randomly collected from each plot. Then the leaves were cut into small pieces and boiled for 25 minute. The boiled leaves sample were meshed and sieved. After sieving, found fibre was dried at room temperature and weighed. The fibre contents were computed by the following formula.

$$\text{Fibre content (\%)} = \frac{\text{Fibre weight x 100}}{\text{Fresh Weight of leaves}}$$

Chlorophyll content (mg/100 g)

The chlorophyll is extracted by treating fresh plant tissues with dimethyl sulphoxide (DMSO). The absorbance of DMSO extract is measured at 645 and 663 nm wave length from the absorbance values at these wave lengths, the total chlorophyll content is calculated.

$$\text{Total chlorophyll (mg/100 g)} = \frac{\text{Z x Vol. of extract x 100}}{\text{1000 x wt. of plant sample (g)}}$$

Results and Discussion

Effect of nitrogen

The level of nitrogen 100 kg/ha had significantly increased the growth, yield and quality characters. Significantly maximum plant height (12.50 cm), number of leaves per plant (16.64), leaf area (163.09 cm^2) and fresh weight of leaves per plant (241.56 g) were recorded at 100 kg N /ha., yield per plant (475.88 g), yield per plot (9.63 kg), gross yield (374.07 q/ha) and marketable yield (357.93 q/ha) were found maximum at 100 kg N/ha. Maximum dry matter content (3.30%), fibre content (2.03%) and chlorophyll content (2.91 mg/g) were recorded at 100 kg N/ha.

Nitrogen plays important role in growth and development of lettuce. The better effect of nitrogen levels might be attributed due to rapid expansion of dark green foliage, which could intercept and utilize more incidence of light energy in the production of food material through the process of photosynthesis. Similar findings given by Tittonell *et al.* (2003) [15] in lettuce, Prasad *et al.* (2009) [15] in Chinese cabbage, Yeshiwas *et al.* (2018) [16] in lettuce, Darshan *et al.* (2019) [5] in spinach, Islam *et al.* (2019) [7] in lettuce, Gashaw and Haile (2020) [6] in lettuce and Kavalgi *et al.* (2020) [10] in red cabbage.

Effect of phosphorus

Application of phosphorus showed significantly effect on growth, yield and quality character of lettuce. The level of phosphorus 100 kg/ha had significantly increased maximum plant height (12.99 cm), number of leaves per plant (16.55), leaf area (163.09 cm^2) and fresh weight of leaves per plant (231.75 g) were recorded at 100 kg P/ha., yield per plant (504.66 g), yield per plot (10.06 kg), gross yield (392.78 q/ha) and marketable yield (377.81 q/ha) were found maximum at 100 kg P/ha. Maximum dry matter content (3.33%), fibre content (2.16%) and chlorophyll content (3.43 mg/g) were recorded at 100 kg P/ha.

Phosphorus fertilizer ensured favourable condition for cell division and helps in the elongation of lettuce plants with optimum vegetative growth. Plants need phosphorus for growth, utilization of starch and sugar, photosynthesis, nucleus formation and cell division. Similar findings given by Katiyar *et al.* (2012) [9] in broccoli, Alahi *et al.* (2014) [2], Chowdhury *et al.* (2014), Ahmed *et al.* (2019), Isalam *et al.* (2019) [7], Mharib *et al.* (2019) [11] in lettuce.

Interaction effect of nitrogen and phosphorus

The combined effect of nitrogen and phosphorus was found significant for most of the characters of lettuce. Combined application of 100 kg nitrogen and 100 kg phosphorus per hector (N_2P_2) recorded maximum number of leaves (17.93), leaf area (228.13 cm^2) and fresh weight of leaves per plant (318.00 g). The yield characters were found significant for yield per plant (599.58 g), yield per plot (12.16 kg), gross yield (453.47 q/ha) and marketable yield (429.38 q/ha) with the combined application of nitrogen and phosphorus 100 kg/ha. Quality attributes were found significant for dry matter content (4.27%), fibre content (2.66%) and chlorophyll content (4.60 mg/g) with the combined application of nitrogen 100 kg/ha and phosphorus 100 kg/ha.

Combined use of nitrogen and phosphorus significantly increased the growth, yield and quality characters in lettuce. Similar findings given by Prasad *et al.* (2009) [13] in Chinese cabbage, Solangi *et al.* (2015) [14] in spinach, Nemadozi *et al.* (2017) [12] in baby spinach, Zaman *et al.* (2018) [17] in spinach, Islam *et al.* (2019) [7] in lettuce.

Table 1: Response of nitrogen and phosphorus levels on growth, yield and quality of lettuce

Treatments	Plant height (cm)	No. of leaves per plant	Leaf area (cm^2)	Fresh weight of leaves per plant(g)	Yield per plant (g)	Yield per plot (kg)	Gross yield (q/ha)	Marketable yield (q/ha)	Dry matter content (%)	Fibre content (%)	Chlorophyll content (mg/g)
Nitrogen (N)											
N_0 = 0 kg/ha	12.07	12.41	106.29	132.11	438.02	8.70	326.12	307.63	2.97	1.91	2.52
N_1= 75 kg/ha	12.20	16.59	161.59	225.56	450.24	9.12	355.93	344.10	3.17	1.98	2.63
N_2= 100 kg/ha	12.50	16.64	163.17	241.56	475.88	9.63	374.07	357.93	3.30	2.03	2.91
N_3= 125 kg/ha	12.09	13.53	123.54	154.34	448.10	9.02	350.88	332.15	3.13	1.94	2.55
SE(m)±	0.32	0.25	1.09	5.010	5.25	0.10	5.39	7.33	0.07	0.08	0.08
CD at 5%	0.93	0.74	3.20	14.692	15.40	0.28	15.80	21.49	0.22	0.24	0.23
Phosphorus (P)											
P_0= 0 kg/ha	11.38	13.10	94.22	118.51	358.12	7.45	282.83	273.82	2.86	1.80	2.19
P_1= 75 kg/ha	12.28	14.73	158.62	214.91	496.40	9.85	379.65	354.73	3.24	1.93	2.34

P_2= 100 kg/ha	12.99	16.55	163.09	231.75	504.66	10.06	392.78	377.81	3.33	2.16	3.43
SE(m)±	0.27	0.22	0.94	4.34	4.55	0.08	4.67	6.35	0.06	0.07	0.07
CD at 5%	0.80	0.64	2.77	12.72	13.34	0.25	13.68	18.61	0.19	0.21	0.20

Table 2: Interaction effect of nitrogen and phosphorus on growth, yield and quality of lettuce

Treatment combinations	No. of leaves per plant	Leaf area (cm^2)	Fresh weight of leaves per plant (g)	Yield per plant (g)	Yield per plot (kg)	Gross yield (q/ha)	Marketable yield (q/ha)	Dry matter content (%)	Fibre content (%)	Chlorophyll content (mg/g)
N_0P_0	11.00	72.50	75.00	283.53	5.94	236.90	222.33	2.13	1.10	1.34
N_0P_1	16.60	150.48	200.00	364.02	7.78	294.93	284.53	2.77	2.07	2.67
N_0P_2	16.53	139.57	196.00	442.42	9.01	333.67	320.43	3.47	1.91	2.33
N_1P_0	16.66	128.13	196.66	342.53	7.05	265.80	267.98	3.07	2.13	2.42
N_1P_1	16.46	171.03	269.33	430.94	7.99	288.00	271.17	2.50	1.98	1.72
N_1P_2	16.76	197.77	260.00	493.08	9.74	381.43	370.70	3.47	1.89	1.85
N_2P_0	16.60	195.23	295.00	499.62	10.42	421.23	385.70	3.40	1.99	3.20
N_2P_1	17.30	223.27	302.00	561.41	11.24	427.93	391.33	3.60	1.85	2.59
N_2P_2	17.93	228.13	318.00	599.58	12.16	453.47	429.38	4.27	2.66	4.60
N_3P_0	16.40	136.53	216.66	493.08	9.85	391.43	377.06	3.27	1.97	3.37
N_3P_1	16.80	154.70	233.66	485.60	9.45	367.30	367.67	3.04	2.20	3.20
N_3P_2	15.06	133.00	158.33	440.37	8.78	358.90	337.14	2.73	1.83	2.66
SE(m)±	0.44	1.89	8.68	9.10	0.17	9.33	12.69	0.13	0.14	0.14
CD at 5%	1.28	5.54	25.45	26.67	0.49	27.36	37.22	0.37	0.42	0.40

Conclusion

From Present investigation it is concluded that, for increasing growth, yield and quality parameters of lettuce, application of nitrogen and phosphorus is essential. The application of 100 kg N ha^{-1} and 100 kg P ha^{-1} was observed beneficial for producing better growth, yield and quality of lettuce.

Therefore, application of 100 kg N and 100 kg P_2O_5 per hectare can be recommended for lettuce in Marathwada conditions.

References

1. Ahmed SS, Khan MA, Sani IA, Sharif M, Shahwani MN, Afridi S *et al.* Impact of phosphorus levels on vegetative growth and seed yield of lettuce (*Lactuca sativa* L.) cultivars. COMU Journal of Agriculture Faculty 2013;1(1):95-100.
2. Alahi A, Hossain MI, Kabir K, Shahjahan M, Arefin MA, Hosain MT. Effect of phosphorus and plant spacing on the growth and yield of lettuce. Advance in Agriculture and Biology 2014;2(1):1-7.
3. Anonymous (UN Food and agriculture organization, statistics division) 2018.
4. Chowdhury SZ, Sobahan MA, Shamim AH, Akter N, Hossain MM. Interaction effect of phosphorus and boron on yield and quality of lettuce. Azarian Journal of Agriculture 2015;2(6):147-154.
5. Darshan SN, Vijaykumar NM, Gouraj V, Vinay GC, Murthy CM. Effect of varying levels of nitrogen on growth and yield of spinach (*Spinacia oleracea*). Journal of Emerging Technologies and Innovative Research 2019, 6(6).
6. Gashaw B, Haile S. Effect of different rates of N and intrarow spacing on growth performance of lettuce (Lactuca sativa L.) in Gurage zone Ethiopia. Advances in Agriculture 2020. https://doi.org/10.1155/2020/7364578.
7. Islam S, Islam H, Rouf A, Sultana P, Haque S. Effect of nitrogen and phosphorus fertilizer on yield and yield attributes of lettuce (*Lactuca sativa* L.). Journal of Bioscience and Agriculture Research 2019;23(1):1872-1884.
8. Kallo. Lettuce In: Base and som (eds.) vegetables crops in India, Naya Prokash, Calcutta, India 1986, 692-708.
9. Katiyar D, Tripathi SM, Dwivedi AK, Pandey V. Effect of nitrogen and phosphorus on crop growth, head yield and quality of broccoli. (*Brassica oleracea* L. *italic*). Hortflora Research Spectrum 2012;1(2):172-174.
10. Kavalgi AR, Rajyalakshmi K, Jyothi U, Krishna KU. Studies on the effect of nitrogen levels on growth, yield components and quality of red cabbage (Brassica oleracea *var. capitata* f. *rubra*). International Journal of Current Microbiology and Applied Sciences 2020;9(1):367-374.
11. Mharib MZK, Attalah AM, Ali AB. Effect of adding humic acid and phosphate fertilizer levels on growth and yield of lettuce. IOSR Journal of Agriculture and Veterinary Science 2019;12(4):12-15.
12. Nemadodzi LE, Araya H, Nkomo M, Ngezimana W, Mudau NF. Nitrogen, phosphorus and potassium effects on the physiology and biomass yield of baby spinach (*Spinacia oleracea* L.). Journal of Plant Nutrition 2017. http://dx.doi.org./ 10.1080/01904167.2017.1346121.
13. Prasad PH, Bhunia P, Naik A, Thapa U. Response of nitrogen and phosphorus levels on the growth and yield of Chinese cabbage (Brassica Campestris L. var. pekinensis) in the gangetic plains of west Bengal. Journal of crop and weed 2009;5(2):75-77.
14. Solangi M, Suthar V, Wagan B, Siyal AG, Sarki A, Soothar RK. Evaluate the effect of nitrogen and phosphorus fertilizer doses on growth and yield of spinach (*Spinacia oleracea* L.) Science International (Lahore) 2015;28(1):379-383.
15. Tittonell PA, Grazia JD, Chiesa A. Nitrate and dry matter conservation in a leafy lettuce cultivar as affected by N fertilization population. Agricultural Tropical Subtropical 2003;36:82-87.
16. Yeshiwas Y, Yikeber B, Zewedie B, Chekol A, Walle A. Effect of nitrogen and farm yard manure on growth and yield of lettuce (*Lactuca sativa* L.). International Journal of Agriculture Research 2018;13(2):74-79.
17. Zaman QR, Hamid FS, Islam S, Naveed FA. Impact of various levels of nitrogen and phosphorus on growth and yield of spinach (*Spinacea oleracea* L.) under conditions of Mansehra (Pakistan). Open Acadamic Journal of Advanced Science and Technology 2018;2(1):5-8.