

# EFFECT OF SOWING DATE AND NITROGEN ON QUALITY OF BEET LEAF (*Beta vulgaris* var. *bengalensis*)

## ABSTRACT

The experiment entitled “Effect of sowing date and nitrogen on quality of beet leaf (*Beta vulgaris* var. *bengalensis*)” was conducted during summer, 2020 at Vegetable Research Farm, RHRS, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat, India. The experiment was laid out in Split plot design with five replications. The experiment was arranged with three levels of sowing date (D<sub>1</sub>:1<sup>st</sup> Fortnight of January D<sub>2</sub>:2<sup>nd</sup> Fortnight of January and D<sub>3</sub>:1<sup>st</sup> Fortnight of February) and four doses of nitrogen (N<sub>1</sub>:0 kg N ha<sup>-1</sup>, N<sub>2</sub>:50 kg N ha<sup>-1</sup>, N<sub>3</sub>: 75 kg N ha<sup>-1</sup> and D<sub>4</sub>: 100 N kg ha<sup>-1</sup>). Total chlorophyll content (1.91 mg g<sup>-1</sup>), moisture content (88.51 %), ash content (7.37 %) and iron content (4.56 ppm) in plant from the 2<sup>nd</sup> cutting were recorded higher in 1<sup>st</sup> fortnight of January sowing (D<sub>1</sub>).

Among the nitrogen doses, ascorbic acid (71.07 mg 100 g<sup>-1</sup>), total chlorophyll content (2.18 mg g<sup>-1</sup>), moisture content (89.22 %) and ash content (8.65 %) were obtained higher with application of nitrogen @ 100 kg ha<sup>-1</sup> (N<sub>4</sub>). The iron, nitrogen and potassium content (4.71 ppm, 1.83% and 2.67 %, respectively) in plant and nitrogen (231.18 kg ha<sup>-1</sup>) in soil were higher under nitrogen at 100 kg ha<sup>-1</sup> (N<sub>4</sub>).

Beet leaf sown at 1<sup>st</sup> fortnight of January with 100 kg N ha<sup>-1</sup> (D<sub>1</sub>N<sub>4</sub>) had given the best performance in the quality parameter *i.e.* total chlorophyll content (2.30 mg g<sup>-1</sup>).

**Keywords:** Sowing date, nitrogen, beet leaf, total chlorophyll, fortnight.

## Introduction

Beet leaf (*Beta vulgaris* var. *bengalensis*) is one of the most important leafy vegetable crops, which are consumed all over the world. It is commonly known as palak. It belongs to the genus *Beta*, species *vulgaris* and family *Amaranthaceae*. It is believed that beet leaf originated from Indo-China region. Beet leaf has Chromosome number  $2n=2x=18$ . In India, major palak producing states are Andhra Pradesh, Telangana, Tamil Nadu, Kerala, Karnataka, U.P., West Bengal, Maharashtra and Gujarat. The edible part of beet leaf consists of leaves and stalk. It is cultivated for its fresh green leaves, which becomes ready for harvest (cutting) in about 30 to 35 days from sowing.

Which It is very popular due to its high nutritive value. It is rich in minerals and hence called as “Mines of Minerals” and cheap source of fat 0.8 g, fibre 0.7 g, protein 3.4 g, minerals 2.2 g, carbohydrates 6.6 g, phosphorus 30 mg, riboflavin 0.56 mg, calcium 380 mg, thiamine 0.26 mg, vitamin 'A' (5862 I.U.), vitamin 'C' 70 mg, vitamin 'K' 167 mg, magnesium 24 mg. Which are important components of cell and body fluids to control heart and blood pressure, antioxidant enzyme, superoxide dismutase, for production of red blood cell, sperm generation, digestion and nucleic acid synthesis, (Sumati Narayan *et al.* 2018). It is also known as Indian spinach, Spinach beet, Beet leaf.

Beet leaf is more valued among all leafy vegetables due to better returns in shortest span of life. Also grow throughout the year so; many cultivators are attracted towards palak

cultivation. Now a day's requirement of quality of leaf is rising. The growth, yield and quality of palak leaf in a particular area depend upon genetic constitution of cultivar.

Nitrogen supply of such a leafy vegetable crop, takes the superiority as a result of the relatively higher demand from this element; since, it plays an essential role in overall metabolism of plant enzymes activity, building up protoplasm, amino acids and proteins, which induce cell division and initiate meristematic activity. Therefore, to meet the nitrogen demand of beet leaf plants using large quantities of nitrogen fertilizer in mineral form still being practiced by growers.

### Materials and Methods

A field experiment entitled "Effect of sowing date and nitrogen on quality of beet leaf (*Beta vulgaris* var. *bengalensis*)" was conducted at Vegetable Research Farm, Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, India during **Summer kharif**, 2020 on var. Pusa Harit to assess the effect of sowing date, nitrogen and their interaction on quality. The experiment was conducted in Split Plot Design (SPD) with five replications. The experiment was arranged with twelve treatment combinations comprising of 3 levels of sowing date (D<sub>1</sub>: 1<sup>st</sup> Fort night of January, D<sub>2</sub>: 2<sup>nd</sup> Fortnight of January, and D<sub>3</sub>: 1<sup>st</sup> Fortnight of February) and four nitrogen doses (N<sub>1</sub>: 0 kg N ha<sup>-1</sup>, N<sub>2</sub>: 50 kg N ha<sup>-1</sup>, N<sub>3</sub>: 75 kg N ha<sup>-1</sup> and D<sub>4</sub>: 100 kg N ha<sup>-1</sup>).

Five plants of beet leaf from each net plot area were selected randomly in the beginning and tagged with the labels for recording different field observations. Some of the observations for various traits were recorded during the growth period of crop while, and some were recorded after harvesting the crop.

## Results And Discussion

### QUALITY PARAMETERS FROM 2<sup>nd</sup> SECOND CUTTINGS

#### Ascorbic Acid (mg 100 g<sup>-1</sup>)

Higher ascorbic acid (71.07 mg 100 g<sup>-1</sup>) was recorded (Table 1) in the treatment N<sub>4</sub> (100 kg N ha<sup>-1</sup>). This might be due to high nitrogen and nitrogen is constituent of fat, proteins, amino acid, enzymes and chlorophyll II and main stimulative agent for enzymatic activity. It increased enzymatic activity which resulted might have increased ascorbic acid. Similar findings as were also reported by Bhore (2000) and Singh *et al.* (2015) in beet leaf.

#### Total Chlorophyll Content (mg g<sup>-1</sup>)

Total chlorophyll content (1.91 mg g<sup>-1</sup>) was recorded (Table 1) significantly higher in 1<sup>st</sup> Fortnight of January (D<sub>1</sub>) sowing than the other sowing dates. The obtained data obtained might be ascribed to the seasonal atmosphere conditions during growing season. These results are in harmony conformity with Abed and Shebl (2016) in beet leaf.

Maximum total chlorophyll content (2.18 mg g<sup>-1</sup>) was recorded (Table 1) significantly with application of nitrogen @ 100 kg ha<sup>-1</sup> (N<sub>4</sub>) as compare to other sowing date. This might be due to increased nitrogen supply which would retard leaf senescence and improve photosynthesis. Similar results were noticed by Anupama *et al.* (2017) in Fenugreek.

The interaction effect of sowing date and nitrogen was significant on total chlorophyll content (%). Higher total chlorophyll content (2.30 mg g<sup>-1</sup>) was recorded (Table 1) in the treatment D<sub>1</sub>N<sub>4</sub> (1<sup>st</sup> Fortnight of January and 100 kg N ha<sup>-1</sup>). This might be due suitable climatic

condition, short day length and less light intensity during shoot growth and due to increased nitrogen supply which would retard leaf senescence and improve photosynthesis.

#### **Moisture Content (%)**

Higher moisture content (88.51 %) was noted (Table 1) with treatment D<sub>1</sub> (1<sup>st</sup> Fortnight of January). Maximum moisture content in early dates may be probable due to suitable climatic condition, short day length, low intensity of light which favored for developing succulence and tenderness in earlier sowing dates. Similar result was also found by Bhore (2000) in beet leaf and Goswami (2018) in vegetable amaranthus.

In related to Regarding the dose of nitrogen, More more moisture content (89.22 %) was recorded (Table 1) with treatment N<sub>4</sub> (100 kg N ha<sup>-1</sup>) as compare to other nitrogen doses. Moisture percentage was increased probably due active participation in nitrogen in protoplasmic activity which has developed succulence and tenderness in leaves of beet leaf. Similar result was found by Singh *et al.* (2015) in beet leaf.

#### **Ash Content (%)**

Ash content (7.37 %) was recorded (Table 1) higher in 1<sup>st</sup> Fortnight of January (D<sub>1</sub>) sowing.

Higher ash content (8.65 %) was observed (Table 1) in the treatment N<sub>4</sub> (100 kg N ha<sup>-1</sup>). This might be due to increased nitrogen supply which would retard leaf senescence and improve photosynthesis.

### **NUTRIENT CONTENT IN PLANT**

#### **Iron Content (ppm)**

Iron content (4.56 ppm) was noted (Table 2) with 1<sup>st</sup> Fortnight of January (D<sub>1</sub>) sowing. The obtained data of quality might be ascribed that reasonable seasonal environmental conditions during growing period such as temperature, relative humidity, day length and light intensity are favorable conditions available during the growing period when sown earlier than the later sowing. Similar result was also found by Goswami (2018) in vegetable amaranthus.

An application of N at 100 kg ha<sup>-1</sup> had noted (Table 2) higher iron content (4.71 ppm) than other nitrogen levels. The obtained data of quality might be ascribed that higher dose of nitrogen increased availability of nitrogen further nitrogen being an essential constituent of protein. These results corroborated the findings of Goswami (2019) in vegetable amaranthus.

#### **Nitrogen Content (%)**

Nitrogen content (1.83 %) in plant was noted (Table 2) higher with application of nitrogen @ 100 kg ha<sup>-1</sup>. This might be due to the application of nitrogen fertilizer converted this deficiency reflected which was increase in nitrogen uptake by plant which resulted in higher nitrogen content in plant and also better development of crop. The present findings are on the lines of the findings of Sajirani *et al.* (2012) in spinach, Sakr and Husein (2012) and Goswami (2019) in vegetable Amaranthus.

#### **Phosphorus Content (%)**

More phosphorus content (0.35 %) in plant was noted (Table 2) with treatment N<sub>3</sub> (75 kg N ha<sup>-1</sup>). Whereas, the less phosphorus content (0.26 %) in plant was recorded with treatment N<sub>1</sub> (0 kg N ha<sup>-1</sup>).

#### **Potassium Content (%)**

Higher potassium content (2.67%) in plant was noted (Table 2) with treatment N<sub>4</sub> (100 kg N ha<sup>-1</sup>). Whereas, lower potassium content (1.90 %) was recorded with no nitrogen application.

**Table 1: Effect of sowing date and nitrogen on quality of beet leaf**

<b>Treatment</b>	<b>Ascorbic Acid (mg 100 g<sup>-1</sup>)</b>	<b>Total Chlorophyll Content (mg g<sup>-1</sup>)</b>	<b>Moisture Content (%)</b>	<b>Ash Content (%)</b>
<b>Sowing date</b>				
1 <sup>st</sup> Fortnight of January (D <sub>1</sub> )	69.89	1.91	88.51	7.37
2 <sup>nd</sup> Fortnight of January (D <sub>2</sub> )	69.59	1.83	87.58	6.99
1 <sup>st</sup> Fortnight of February (D <sub>3</sub> )	69.20	1.76	86.47	6.63
S.Em.±	0.78	0.02	0.48	0.06
C.D. at 5 %	NS	0.06	1.57	0.20
<b>Dose of nitrogen (kg ha<sup>-1</sup>)</b>				
0 kg ha <sup>-1</sup> (N <sub>1</sub> )	68.09	1.50	85.89	5.42
50 kg ha <sup>-1</sup> (N <sub>2</sub> )	69.13	1.73	87.01	6.52
75 kg ha <sup>-1</sup> (N <sub>3</sub> )	69.94	1.92	87.95	7.40
100 kg ha <sup>-1</sup> (N <sub>4</sub> )	71.07	2.18	89.22	8.65
S.Em.±	0.68	0.01	0.67	0.06
C.D. at 5 %	1.96	0.04	1.94	0.18
<b>D x N</b>				
S.Em.±	1.18	0.03	1.17	0.11
C.D. at 5 %	NS	0.07	NS	NS
<b>Mean of D x N</b>				
<b>D<sub>1</sub>N<sub>1</sub></b>	68.33	1.56	86.76	5.70
D <sub>1</sub> N <sub>2</sub>	69.47	1.80	87.95	6.85
D <sub>1</sub> N <sub>3</sub>	70.15	1.97	88.92	7.74
D <sub>1</sub> N <sub>4</sub>	71.60	2.30	90.39	9.20
<b>D<sub>2</sub>N<sub>1</sub></b>	68.22	1.53	86.05	5.54
D <sub>2</sub> N <sub>2</sub>	69.13	1.72	87.08	6.50
D <sub>2</sub> N <sub>3</sub>	69.95	1.90	88.06	7.36
D <sub>2</sub> N <sub>4</sub>	71.06	2.18	89.14	8.56
<b>D<sub>3</sub>N<sub>1</sub></b>	67.72	1.41	84.86	5.00
D <sub>3</sub> N <sub>2</sub>	68.78	1.67	85.10	6.21
D <sub>3</sub> N <sub>3</sub>	69.73	1.88	86.90	7.10
D <sub>3</sub> N <sub>4</sub>	70.55	2.05	88.13	8.19
S.Em.± (D x N)	1.18	0.03	1.17	0.11
C.D. at 5 % (D x N)	NS	0.07	NS	NS
C.V. %	-	3.13	-	-

<b>Table 2: Effect of sowing date and nitrogen on quality of beet leaf</b>					
<b>Treatment</b>	<b>Iron Content (ppm)</b>	<b>Nitrogen Content (%)</b>	<b>Phosphorus Content (%)</b>	<b>Potassium Content (%)</b>	<b>Soil analysis (After experiment)</b>
<b>Sowing date</b>					<b>Nitrogen (kg ha<sup>-1</sup>)</b>
1 <sup>st</sup> Fortnight of January (D <sub>1</sub> )	4.56	1.72	0.32	2.37	220.33
2 <sup>nd</sup> Fortnight of January (D <sub>2</sub> )	4.48	1.73	0.29	2.32	217.90
1 <sup>st</sup> Fortnight of February (D <sub>3</sub> )	4.40	1.61	0.31	2.31	214.45
<b>S.Em.±</b>	0.04	0.03	0.01	0.04	5.69
<b>C.D. at 5 %</b>	0.13	NS	NS	NS	NS
<b>Dose of nitrogen (kg ha<sup>-1</sup>)</b>					
0 kg ha <sup>-1</sup> (N <sub>1</sub> )	4.27	1.46	0.26	1.90	204.65
50 kg ha <sup>-1</sup> (N <sub>2</sub> )	4.41	1.69	0.28	2.19	213.39
75 kg ha <sup>-1</sup> (N <sub>3</sub> )	4.54	1.77	0.35	2.57	221.03
100 kg ha <sup>-1</sup> (N <sub>4</sub> )	4.71	1.83	0.34	2.67	231.18
<b>S.Em.±</b>	0.04	0.03	0.02	0.04	4.55
<b>C.D. at 5 %</b>	0.12	0.09	0.04	0.11	13.07
<b>D x N</b>					
<b>S.Em.±</b>	0.07	0.06	0.03	0.07	7.89
<b>C.D. at 5 %</b>	NS	NS	NS	NS	NS
<b>Mean of D x N</b>					
<b>D<sub>1</sub>N<sub>1</sub></b>	4.33	1.45	0.25	1.92	207.09
<b>D<sub>1</sub>N<sub>2</sub></b>	4.49	1.74	0.30	2.21	216.12
<b>D<sub>1</sub>N<sub>3</sub></b>	4.61	1.74	0.37	2.58	222.73
<b>D<sub>1</sub>N<sub>4</sub></b>	4.82	1.95	0.34	2.74	235.40
<b>D<sub>2</sub>N<sub>1</sub></b>	4.28	1.50	0.24	1.87	205.47
<b>D<sub>2</sub>N<sub>2</sub></b>	4.41	1.70	0.26	2.23	213.50
<b>D<sub>2</sub>N<sub>3</sub></b>	4.54	1.81	0.36	2.64	221.90
<b>D<sub>2</sub>N<sub>4</sub></b>	4.71	1.90	0.30	2.52	230.75
<b>D<sub>3</sub>N<sub>1</sub></b>	4.18	1.43	0.28	1.89	201.40
<b>D<sub>3</sub>N<sub>2</sub></b>	4.33	1.63	0.26	2.13	210.55
<b>D<sub>3</sub>N<sub>3</sub></b>	4.46	1.75	0.32	2.50	218.46
<b>D<sub>3</sub>N<sub>4</sub></b>	4.61	1.63	0.38	2.73	227.39
<b>S.Em.± (D x N)</b>	0.07	0.06	0.03	0.07	7.89
<b>C.D. at 5 % (D x N)</b>	NS	NS	NS	NS	NS

## SOIL ANALYSIS (After experiment)

### Nitrogen (kg ha<sup>-1</sup>)

Higher nitrogen (231.18 kg ha<sup>-1</sup>) was noted (Table 2) with treatment N<sub>4</sub> (100 kg N ha<sup>-1</sup>) which was statistically at par with N<sub>3</sub> (75 kg N ha<sup>-1</sup>). Whereas, lower nitrogen (204.65 kg ha<sup>-1</sup>) was recorded with no nitrogen application.

## CONCLUSION

From the result of investigation, it could be concluded that sowing of beet leaf at 1<sup>st</sup> fortnight of January was superior on quality over rest of sowing date. Application of nitrogen at 100 kg ha<sup>-1</sup> was superior in terms of quality and nutrient content in plant. Sowing of beet leaf at 1<sup>st</sup> fortnight of January with application of nitrogen at 100 kg ha<sup>-1</sup> had given best results on quality parameter like total chlorophyll content.

## REFERENCES

- Abed, M. Y. and Shebl, E. F. (2016). Effect of sowing dates on growth, yield and quality of spinach (*Spinacia oleracea* L.). *J. Plant Prod. Mansoura Uni.*, **7**(12): 1437 -1442.
- Ali, H.; Ayub, G.; Shahab, G. E. M.; Ahmed, S. and Ahmed, N. (2015). Response of coriander (*Coriandrum sativum* L.) to different nitrogen levels and sowing dates. *Asian J. Agric. Biol.*, **3**(4): 140-144.
- Ali, S.; Zeb, B. and Khan, T. H. (2016). Impact of different levels of nitrogen on the yield of spinach. *Int. J. Adv. Res. And Rev.* **1**(12): 80-87.
- Anonymous (2020). 2<sup>nd</sup> advance estimate at 2019-20 Area and Production of Various horticulture crops, Press Information Bureau, Government of India, ministry of Agriculture and Farmers Welfare, New Delhi., 1P.
- Anupama, G.; Hegde, L. N.; Hegde, N. K.; Devappa, V.; Mastiholi, A. B. and Sandhyarani Nishani (2017). Effect of nitrogen and spacing levels on physiological and yield parameters of *Kasuri Methi* (*Trigonella corniculata* L.) var. Pusa Kasuri. *Int. J. Curr. Microbiol. App. Sci.*, **6**(9): 723-733.
- Bhore, M. R. (2000). Studies on effect of sowing dates and nitrogen levels on leaf yield in palak (*Beta vulgaris* L.). *Thesis, M.Sc. (Horti), Submitted to Marathwada Agricultural University, Parbhani, 1-139 PP.*
- Darani, F. H.; Zeinali, H.; Rad, A. H. S.; Khourgami, A. and Nasrollahi, H. (2013). Effect of planting date and nitrogen fertilizer on two varieties (inner and outer) of spinach. *Ann. Bio. Res.*, **4**(2): 56-59.
- Desai, R. G. and Patel, M. D. (1970). Report on Soil Survey Navsari Taluka. Dept. of Agri., Gujarat Bulletin No. **41**(4).
- Goswami, M. (2019). Integrated nutrient management in vegetable amaranthus (*amaranthus tricolor* L.) under south Gujarat condition. *Thesis, M.Sc.(Horti.)*. Submitted to Navsari Agricultural University, Navsari, Gujarat, 61-69 **PP.**
- Goswami, R. (2018). Evaluation of sowing dates and varieties of vegetable Amaranthus (*Amaranthus spp.*). *Thesis, M.Sc. (Horti.)*, Submitted to Navsari Agricultural University, Navsari, Gujarat, 57-66 **PP.**
- Ibrahim, E. A.; El-Gendy, S. E. and Ramadan, A. Y. (2010). Effect of sowing date and some soil amendments on yield and quality of spinach (*Spinacia oleracea* L.). In *Sixth International Conference of Sustainable Agriculture and Development*, Faculty of Agriculture Fayoum University, 191-200.

- Jackson, M. L. (1973). Soil Chemical Analysis, Prentice-Hall of India Pvt. Ltd., New Delhi, 39-451 **PP**.
- Meyo, C. A. (2004). The effect of nitrogen and phosphorous application on growth, yield and nutritional quality of vegetable amaranths (*Amaranthus hybridus*). *M.Sc. (Horti.) Thesis*, University of Nairobi, 1-89 **PP**.
- Mirdad, Z. M. (2009). Spinach (*Spinacea oleracea* L.) growth and yield responses to mineral nitrogen sources and levels application. *J. Agri. Env. Sci. Alex. Univ.*, **8**(1): 43-48.
- Mondal, R.; Thapa, U.; Subba, S. K. and Gurung, D. (2017). Optimisation of nitrogen level for growth and yield of *Ipomoea reptans*. *Int. J. Agri. Env. Biotec.*, **10**(1): 25-29.
- Naik, D. M.; Patil, S. B.; Jature, S. D. and Shinde, S. J. (2009). Effect of sowing dates on growth and yield of palak (*Beta vulgaris* L.). *Asian J. Hort.*, **4**(2): 377-379.
- Pallavi D.; Mishra, D. K.; Dhakad, R. and Kumar, A. (2019). Studies on different levels of nitrogen application on growth and yield of amaranthus (*Amaranthus tricolor* L.). *Int. J. Cur. Microbio. Appli. Sci.*, **8**(4): 1423-1427.
- Panse, V. G. and Sukhatme, P. V. (1985). *Statistical Methods for Agricultural Workers*. Indian Council of Agricultural Research, New Delhi, India, 381 **PP**.
- Sajirani, E. B.; Shakouri, M. J. and Mafakheri, S. (2012). Response of spinach (*Spinaciao leracea*) yield and nutrient uptake to urea and manure. *Indian J. Sci. Tech.*, **5**(1): 64-68.
- Sakr, W. R. and Husein, M. E. (2012). Response of *Amaranthus tricolor* L. plants to bio and chemical nitrogenous nutrition and their role in remediating some polluted soils with lead and cobalt. *American Eurasian J. Agri. Env. Sci.*, **12**(10):1377-1394.
- Sharma, A.; Naruka, I. S. and Shaktawat, R. P. S. (2016). Effect of row spacing and nitrogen on growth and yield of coriander (*Coriandrum sativum* L.). *J. Krishi Vigyan*, **5**(1): 49-53.
- Singh, G. P.; Meena, M. L. and Prakash, J. (2015). Effect of different levels of nitrogen and cuttings on growth, leaf yield and quality of spinach beet (*Beta vulgaris* var. *bengalensis*) cv. All Green. *European J. Biotech. & Biosci.*, **3**(6): 38-42.
- Singh, R.; Geeta Bassi and Singh, D. (2013). Influence of sowing time and leaf cuttings on the seed yield and quality components of palak (*Beta vulgaris* var. *bengalensis*). *Indian J. Agric. Sci.*, **83**(4): 410-414.
- Sumati Narayan.; Malik, A.; Makhdoomi, M. I.; Nabi, A.; Hussain, K. and Khan, F. A. (2018). Influence of date of sowing and number of cuttings on leaf yield and quality of seed in palak. *American J. Exp. Agric.*, **24**(3): 1-4.
- Vaghela, G. M.; Chauhan, N.P.; Dabhi, M.S. and Patel, H.K. (2018). Effect of date of sowing on growth, yield and quality of amaranthus (*Amaranthus hypochondriacus* L.). *Int. J. Agril. Sci.*, **10**(10): 6044-6046.
- Wahocho, N. A.; Memon, N.; Kandhro, M. N.; Miano, T. F. and Tal, K. H. (2015). Response of nitrogen levels on growth of spinach (*Spinacea oleracea* L.). *Sindh Univ. Res. J.*, **48**(2): 305-308.

**\*Note : Red colour for deletion ; Blue colour for addition ; Purple colour is not in reference**