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Effect of fertilizers on growth-rate analysis of *Hordeum vulgare* L. at Shahdol district (M.P.)

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Abstract

The understanding of the interactive Effect of fertilizers on growth-rate analysis of *Hordeum vulgare* L. at Shahdol district (M.P.). For this reason, study was conducted in six locations within Shahdol (M.P.) namely Burhar, Jaitpur, Shahdol, Gohparu, Jaisinghnagar and Beohari. The experiment it is clear that in experimental sets with 0.2% of urea, potassium sulphate and super phosphate the average height of plant species *Hordeum vulgare* increased as compared to their control sets but in another sets with 0.4% to 0.6% urea the average height of the plants was found to have decreased. Results indicated that total dry matter, leaf area index, crop growth ratio and net assimilation rate increased due to nitrogen fertilization but leaf area ratio, relative leaf growth rate, specific leaf area and leaf weight ratio declined throughout with the increasing time and plant weight.

Keywords: *Hordeum vulgare*, urea, potassium sulphate, super phosphate, soil, Shahdol

1. Introduction

Barley is one of the most important cereals of the world. It is cultivated in almost all parts of the world except the tropical regions. Barley is a major source of food for large number of people living in the cooler semi-arid areas of the world, where wheat and other cereals are less well adapted. It is a staple food of the people in the Tibet, Nepal and Bhutan. In European countries it is used only as breakfast food. The leading countries of its production are USSR, China, France, Canada, USA and Spain. Barley is an important cereal in India. Total area under barley in the country is about 0.7 million hectares. The chief barley growing regions in the country are higher Himalayas, central parts of eastern Uttar Pradesh, eastern parts of Rajasthan and north western parts of north Bihar. The most important uses of barley in India are as grain feed to livestock and poultry, as malt for manufacture of beer and other liquors like whisky, brandy etc.

Barley is the fourth most important cereal crop in the world after wheat, maize, and rice, and is among the top ten crop plants in the world (Akar, *et al.* 2004) ^[1]. Globally, over 136 million tonnes of barley is produced annually on about 56 million hectares. Originally, barley was mainly cultivated and used for human food, but it is now used primarily for animal feed and to produce malt, with smaller mounts used for seed and direct human consumption. Barley is also used to the production of starch, either for food or for the chemical industry (OECD 2004). In addition, barley has some useful by products, the most valuable being the straw which is used mainly for bedding in developed countries, but also for animal feed in developing and under developed countries (Akar *et al.*, 2004) ^[1].

It is a rabi crop, which is sown between September and November and is harvested between Feb. and April. It is cultivated as pure or mixed with wheat, barley, linseed or mustard. Mixed cropping helps to check the gram blight to some extent.

The importance of organic matter in plant-nutrition was brought out and revealed first by soil microbiologists and chemists who showed that the decay of the organic matter releases nitrogen and mineral nutrients in forms available to plants. Decomposition products of organic matter have a beneficial effect on soil aggregation, increase water-holding capacity and cation exchange capacity as well as the availability of nutrients, especially the phosphorous, carbon dioxide liberated by the decomposition of one organic matter when diffused into the atmosphere serves as source of carbon to the plant.

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2. Material and Methods

From the experiment it is clear that in experimental sets with 0.2% of urea, the average height of plant species *Hordeum vulgare* increased as compared to their control sets but in another sets with 0.4% to 0.6% urea the average height of the plants was found to have decreased.

In case of 0.2% of potassium sulphate the average height of the plants increased as compared to their control sets. At 0.4% and 0.6% of potassium sulphate sets, the average height was found to have decreased the correlation value was also found to be negative.

In case of the super-phosphate sets plants showed promoting character. The average height of the plants of all the species had registered an increase. under the treatment of 0.2% treatment. The % of super-phosphate increased from 0.4% to 0.6% the average height of the plants have decreased as compared to their control sets. The correlation values were found negative.

The analysis of 10 days old plant of *Hordeum vulgare* which were irrigated with 0.2% urea had revealed that the percentage of sugar, non-sugar, and protein had increased (i.e. as per 3.32 mg., 5.64 mg., and 4.50 mg.) when compared with that of the control sets of plants (i.e. as per 2.83mg., 4.5mg. and 4.40mg.) but with 0.6% of urea the percentage of sugar, non-sugar, and protein was found to have decreased. Likewise the values of Chl a and Chl b was observed lesser when compared with control. During the treatment of 0.2%, urea the fats conserved 0.99 mg which is similar to control if the concentration of urea soln. was increased the values of fats was observed 1.11 mg & 1.02 mg respectively. Azimi *et al.* (2013 a & 2013b) [2-3] has also reported previously.

In case of 0.2% and 0.4% of potassium sulphate of the ten - day old plants of *Hordeum vulgare*, the percentage of non-sugar and protein increased up to 5.61 mg, 4.45mg, but sugar remained the same when compared with that of the control sets which recorded 4.5 gm., 4.40mg. and 2.83 mg. whereas the above sets which were irrigated with 0.6% of potassium sulphate, showed decrease in sugar (2.67 mg.) the amount of non-sugar and protein remained the same in respect of their control sets. Likewise fat, Chl a and Chl b are shows lesser value when compared with control sets. Cao *et al.* (2007) [4] also reported such type results.

3. Results and Discussion

The 10-days old plants of *Hordeum vulgare* on treatment with 0.2% & 0.4% urea sets showed increase in sugar, non-

sugar and protein (i.e. as per 4.11 mg., 10.13 mg., and 4.01mg.) but with 0.6% of urea sets, sugar & protein were found to be the same i.e. 3.84 mg. and non-sugar decreased (i.e. down to 7.81 mg.) and fat shows 0.84 mg as compared to the control ones i.e. 99 mg. The value of Chl a and Chl b were found in lesser amount 436 mg and 146 mg as compared with control 466 mg and 168 mg respectively (Kumar and Yadav, 2007, Jat & Mehra, 2007, Pettigrew, 2008, Zaki, 2007 and Nargave, 2016) [5-9].

In case of super-phosphate sets 10-days old plants of *Hordeum vulgare* exhibited promoting effect with 0.2% to 0.6% of fertilizer, the percentage concentration of sugar, non-sugar and protein have increased as compared the control ones, but fat, Chl a and Chl b are found in decreasing way. During present investigations with a concentration of fertilizer from 0.2% to 0.6% of sugar, non-sugar & protein increased from 4.51 mg. to 4.58 mg., 10.13 mg. to 11.23 mg. and 3.89 mg. to 3.96 mg. respectively as compared to the control ones (i.e. as per 3.83 mg., 9.00 mg. and 3.80 mg./100 mg.). In the other hand fat, Chl a and Chl b shows negative results (Nargave, 2016 and Gangwal *et al.* 2011) [9-10] was previously reported such type of studies.

The 20 days old plants of *Hordeum vulgare* was analysed for 0.2% to 0.4% urea treatment the sugar, non-sugar, protein and fats increased in comparison to control one. The Chl a shows normal value 510 mg while Chl b decreased as compared with control. The potassium sulphate and super phosphate are not effective.

An analysis of 30-day old plants of the *Hordeum vulgare* which were treated with 0.2% and 0.4% of urea exhibited an increase in sugar, non-sugar, protein and fat (4.5 mg., 13.50 mg., 4.09 mg. and 0.99 mg.) as compared to the value of control sets (i.e., 4.3 mg. 13.50 mg., 3.92 mg and 0.99mg.). But with 0.6% of urea, the percentage of non-sugar and protein has decreased to 10.11 mg. and 3.78 mg. respectively whereas the percentage of sugar remained the same as compared to the above given values of the control sets. The chl a and chl b shows lesser values.

The 30-days old plants of *Hordeum vulgare* exhibited decrease in non-sugar and protein along with increase in the concentration of potassium sulphate from 0.2% to 0.6%, while the amount of sugar increased from 4.6 mg. to 4.7 mg. The protein, chl a and chl b shows lesser amount.

The 30-days old plants of *Hordeum vulgare* which treated with super-phosphate, when analysed exhibited an increase in sugar, non-sugar and protein while fat, chl a and chl b decreased as compared to the control ones.

Table 1: Analysis of 10 day old plants of *Hordeum vulgare* (per 100 gm.)

Name % percentage of the fertilizer	Sugar	Non-sugar	Protein	Fat	Chl-a (mg)	Chl-b (mg)	
Urea	0.2	4.11	10.13	4.01	0.84	442	155
	0.4	4.12	10.13	4.02	0.86	440	150
	0.6	3.84	7.81	3.84	0.88	436	146
	r	-0.84	-0.86	-0.84	1.00	-0.33	-0.99
	SD	±0.16	±1.34	±0.10	0.02	±9.17	±4.51
Potassium sulphate	0.2	3.82	9.01	3.86	0.99	470	160
	0.4	3.79	9.01	3.85	0.98	466	158
	0.6	3.59	7.78	3.81	1.03	454	154
	r	-0.91	-0.86	-0.94	0.75	-0.66	-0.43
	SD	±0.13	±0.71	±0.03	±0.03	±6.11	±7.02
Super phosphate	0.2	4.51	10.13	3.85	1.09	460	166
	0.4	4.54	10.14	3.89	1.00	458	165
	0.6	4.58	11.23	3.96	0.98	446	162
	r	0.99	0.86	0.98	-0.94	0.29	1.00
	SD	±0.04	±0.63	±0.06	±0.06	±8.74	±3.00
Control		3.83	9.00	3.80	0.99	466	168

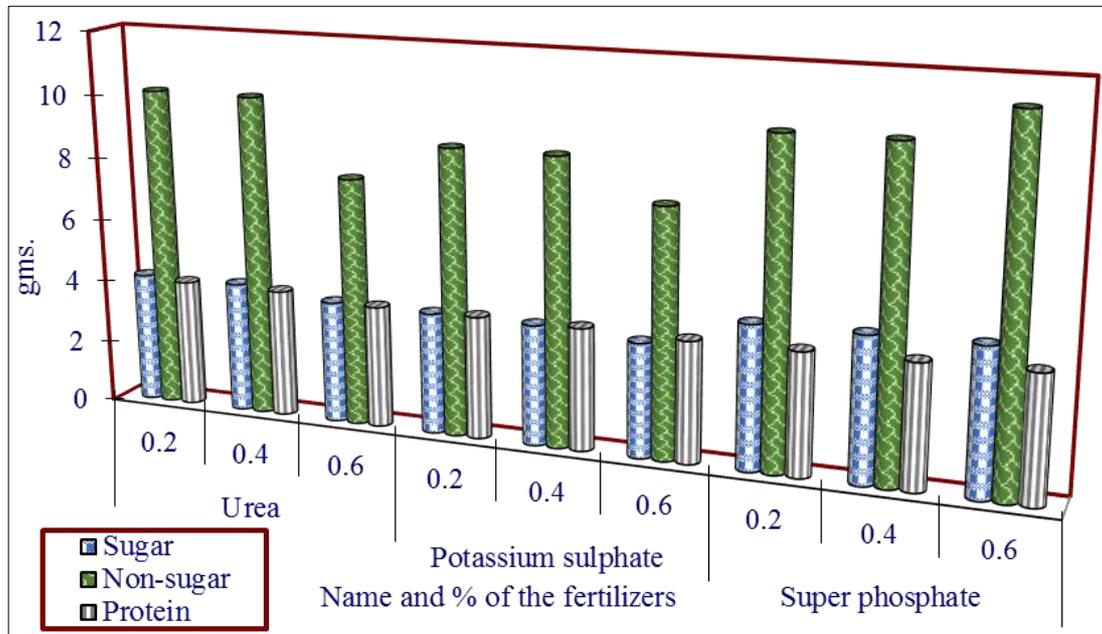


Fig 1: Analysis of 10 day old plants of *Hordeum vulgare* (per 100 gm.)

Table 2: Analysis of 20 day old plants of *Hordeum vulgare* (per 100 gm.)

Name % percentage of the fertilizer	Sugar	Non-sugar	Protein	Fat	Chl-a (mg)	Chl-b (mg)	
Urea	0.2	4.32	11.26	4.03	1.03	510	185
	0.4	4.32	11.25	4.07	1.00	496	182
	0.6	4.01	9.03	3.85	0.99	482	180
	r	-0.86	-0.86	-0.76	-0.19	-1.00	0.72
	SD	±0.18	±1.28	±0.12	±0.10	±14.00	±6.24
Potassium sulphate	0.2	4.03	10.11	3.87	1.00	508	191
	0.4	3.99	10.10	3.86	0.98	503	186
	0.6	3.77	9.03	3.80	0.87	500	180
	r	-0.92	-0.87	0.50	-0.93	0.50	-0.19
	SD	±0.14	±0.62	±0.01	±0.07	±5.00	±2.65
Super phosphate	0.2	4.79	11.27	3.93	0.96	465	169
	0.4	4.81	11.27	3.90	0.89	464	163
	0.6	5.03	12.34	3.87	0.88	451	160
	r	0.90	0.86	0.75	-0.53	-0.80	0.24
	SD	±0.13	±0.62	±0.03	±0.08	±8.72	±2.08
Control		4.10	11.25	3.52	0.99	510	194

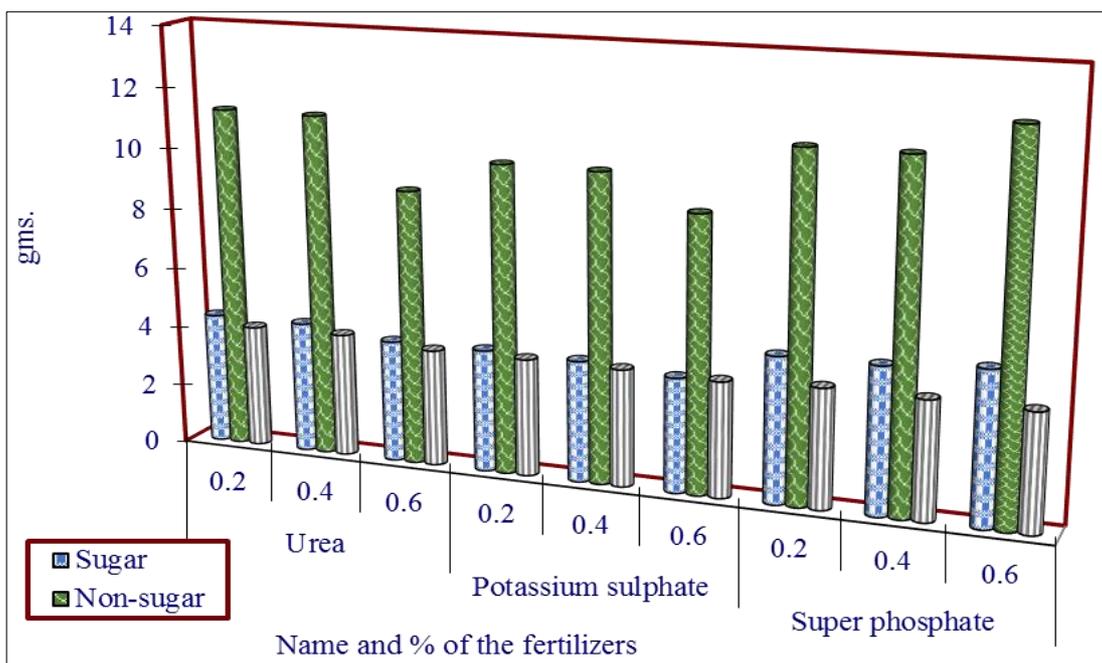


Fig 2: Analysis of 20 day old plants of *Hordeum vulgare* (per 100 gm.)

Table 3: Analysis of 30 day old plants of *Hordeum vulgare* (per 100 gm.)

Name % percentage of the fertilizer	Sugar	Non-sugar	Protein	Fat	Chl-a (mg)	Chl-b (mg)	
Urea	0.2	4.5	13.50	4.09	0.99	375	128
	0.4	4.5	13.42	4.09	0.80	390	122
	0.6	4.6	10.11	3.78	0.75	418	120
	r	0.5	-0.86	-0.83	0.23	0.99	0.24
	SD	±0.10	±1.96	±0.17	±0.13	±21.83	±4.16
Potassium sulphate	0.2	4.6	11.26	3.93	0.88	446	140
	0.4	4.6	11.20	3.89	0.98	446	140
	0.6	4.7	9.01	3.86	1.08	440	136
	r	0.5	-0.86	-0.99	0.97	0.87	-0.87
	SD	±0.10	±1.30	±0.04	±0.10	±2.31	±2.31
Super phosphate	0.2	5.01	13.49	3.97	0.98	390	128
	0.4	5.02	13.45	4.00	0.95	390	120
	0.6	5.00	13.38	4.00	0.87	392	120
	r	-0.5	0.86	0.5	-0.5	0.50	-0.87
	SD	±0.01	±0.86	±0.03	±0.11	±2.00	±4.62
Control		4.3	13.50	3.92	0.99	446	140

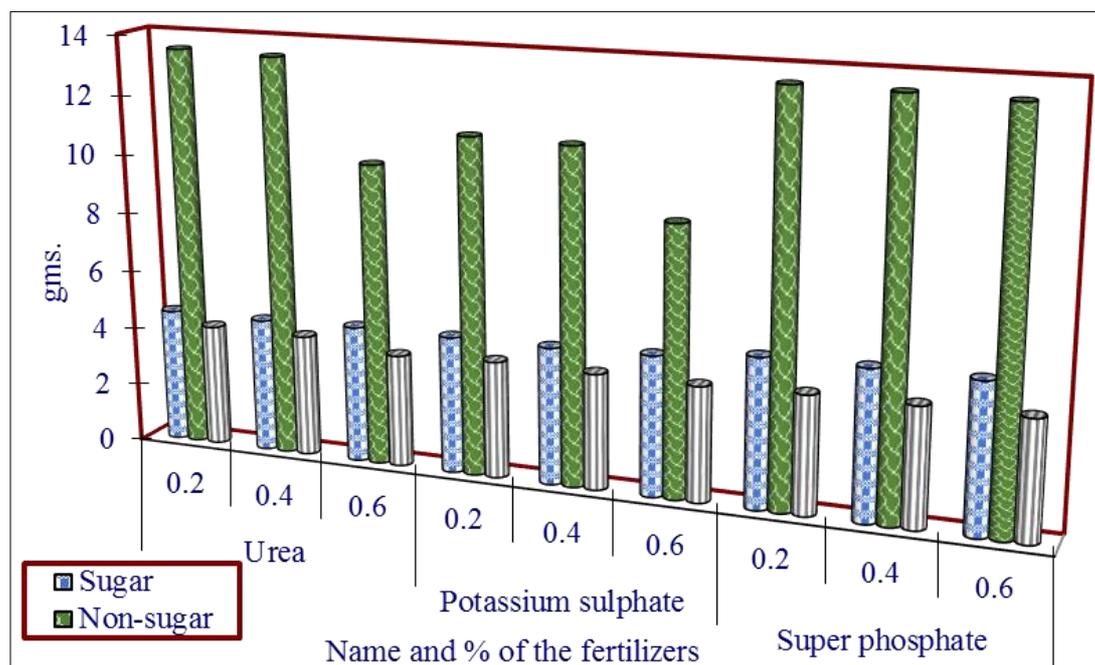


Fig 3: Analysis of 30 day old plants of *Hordeum vulgare* (per 100gm.)

4. Conclusion

Plant water stress is likely to reduce also the photo-synthetic surface and production of food material. Phosphorous also stimulated the root-growth potassium increased the size of the leaves in the early part of the growing season. Calcium appears to be essential for the growth of meristems and particularly for the proper growth and functioning of root tips. Phosphorous also stimulated the root-growth potassium increased the size of the leaves in the early part of the growing season. Apart from stimulatory compounds, substances inhibitory to the growth of roots and the production of root-hairier secretes by some organisms and these may cause a considerable reduction in nutrient uptake.

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