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Effect of zinc on growth, yield and quality of Knol-khol [*Brassica oleracea* var. *gongylodes* (L.)]

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Abstract

A field experiment was conducted on Knol-khol to find out the effect of foliar application of zinc at different doses on various growth, yield and quality traits. The study revealed that the application of zinc showed an increase in all the 16 traits studied but highest increase was observed at 0.6% zinc per ha over the control. Maximum growth, yield and quality parameters are increases were observed in the plant height (27.90 cm), number of leaves per plant (11.16), leaf area (165.91 cm²), chlorophyll content (1.83 mg/g), knob diameter (7.85 cm), knob weight (186.52 g), knob yield per plot (4.47 kg), total yield (198.77 q/ha), TSS (10.22 bricks), protein content (3.94), nitrogen content in leaves (0.25%) and in knob (1.03%), phosphorus content in leaves (0.28%) and in knob (1.12%), zinc content in leaves (28.9 ppm) and in knob (55.0 ppm) followed by presence of net returns (3,06,502 Rs/ha) and benefit cost ratio (3.35) were find out. The profound effect of zinc fertilizer on growth and quality attributes are increases metabolic activities leads to increase knob diameter, weight and yield per hectare was exhibits these research programme.

Keywords: Plant height, chlorophyll content, knob diameter, knob weight, yield, TSS, protein content, zinc content and B:C ratio

Introduction

Knol-khol [*Brassica oleracea* var. *gongylodes* (L.)] is important vegetable cole crop after cabbage and cauliflower it belongs to family Brassicaceae or Cruciferae originated to mediterian region. Knol-khol is also called kholrabi (Khol-cabbage and rabi-turnip) and “Ghanth gobhi” in hindi. The edible part of knol-khol is ‘knob’, it is modified swollen stem and its formation of just above the surface of soil. The thickening of cotyledon leaves and long lanceolate thick leaves are presented on knob. It is cool season vegetable crop and tolerant to the frost injury. The optimum temperature for the cultivation is 15-25 °C. Knol-khol requires well drained fertile soils rich in organic matter and soil pH of 5.5 is ideal for its growth. In India, it is mostly grown in Northern parts of Kashmir valley region and also cultivated in selected parts of west Bengal, Utter Pradesh, Himachal Pradesh, Madhya Pradesh and some parts of Rajasthan.

Knol-khol is an important source of minerals, carbohydrates, proteins and fiber. As per 100 g knol-khol contains 92.7% moisture, 3.8 g carbohydrates, 1.1 g protein, 0.2 g fat, 0.05 mg thiamine, 0.09 mg riboflavin, 85 mg vitamin C, 21 mg calcium and 0.4 mg iron. The knol-khol knobs are used as cooked vegetable and also used for salad purpose. In Kashmir valley, the leaves are used as a potherb and this leaves are also used in soups. In India the most widely cultivated varieties are White Vienna, Early White Vienna, Early purple Vienna, Pusa virat and large green.

Materials and Methods

The field experiment was conducted at Horticulture farm, S.K.N college of Agriculture, Jobner (Jaipur) during Rabi season 2019-20. In Rajasthan, this region falls under agro-climatic Zone-III A (Semi-Arid Eastern Plains). This experiment was laid out in Factorial Randomized Block Design (FRBD) with the four levels of foliar application of zinc (control, zinc @ 0.2, 0.4 and 0.6 per cent) with the three replications of treatment combination. The variety White Vienna with spacing 30 x 20 cm and all the required cultural operations were followed to raise the good crop.

The observations of parameters like plant height (cm), number of leaves per plant, leaf area (cm²), chlorophyll content in leaves (mg), knob diameter (cm), knob weight (cm), knob yield per plot, total yield (q/ha), TSS content (° bricks) in knob, protein content in knob (%), nitrogen (%), phosphorus (%) and zinc (ppm) content in leaves and knob of knol-khol were collected manually. The data obtained from the trail were subjected to statistical analyses which are presented in tabular form.

Results and Discussion

Growth attributes

The pertaining data, the maximum plant height (cm), number of leaves per plant, leaf area (cm²) and chlorophyll content in leaves more over than control. The maximum growth attributes were recorded at 0.6 per cent foliar application of zinc but it was observed at par with 0.4 per cent zinc. Where foliar applied zinc was effectively influence to increase plant height, number of leaves per plant, leaf area and increase chlorophyll content in leaves ok knol-khol (Choudhary *et al.* 2018 in knol-khol) [1].

The foliar application of zinc was enhanced to provide plant height was affected by cell division and stomatal conductance significantly increases the number of leaves and leaf area. It was indicated to increase in absorption of nutrients from foliar spray which enhancement of carbohydrates assimilation and synthesis of new tissue directly on leaves and knob through ultimately increased vegetative growth of plant. Similarly, this result was finding to Singh and Singh (2004) [2] in cauliflower and Shah *et al.* (2010) [3] in knol-khol.

Yield attributes

The revealed data that in table-2 was clearly showed the foliar application of zinc was greatly affected to increase knob diameter, knob weight, knob yield per plot and total yield of knol-khol. The highest yield attributes were recorded in 0.6 per cent foliar application of zinc but it was found non-significant

with 0.4 per cent zinc more over than control. The increased zinc levels were significantly increased yield parameters over than control. These results were closely related to Choudhary *et al.* (2018) [1] in knol-khol and Lashkari (2008) [4] in cauliflower.

Zinc was largely function to improve growth and subsequent plays an important role for synthesis of tryptophan, which increases formation of IAA in plant and affect of foliar applied Zn²⁺ ions was essentially induce of metallo-enzyme in plants though control the several functional metabolisms and ultimately influence of yield attributes (Bairwa *et al.* 2015 in knol-khol and Singh and Singh 2004 in cauliflower) [5, 2].

Quality attributes

The perusal data in table-3 exhibited that the effect of zinc on quality attributes of TSS and protein content in knob, nitrogen, phosphorus, zinc content in leaves and knob was significantly affected to increase with increasing zinc levels. The maximum quality attributed were reported at 0.6 per cent foliar application of zinc but it was found at par with 0.4 per cent zinc except to nitrogen content in knob and phosphorus content in leaves. While minimum quality attributes were noted in control. These results were closely related to previous researches of Choudhary *et al.* (2018) [1] in knol-khol, Shah *et al.* (2010) [3] in Knol-khol and Chippa (2005) [6] in cauliflower.

Zinc might have established fact that nutrients uptake by the plants levels primarily on zinc accumulation and recording nutrients concentration at cellular levels. The more photosynthesis utilizes and physiological utilize by more dry matter production and nutrients concentration in plant seem to major factor responsible for higher components of knob & leaves under the influence of foliar application of zinc. These experimental results are closely related to Chhipa *et al.* (2005) [6] in cauliflower, Yadav *et al.* (1999) [8] in tomato. Shah *et al.* Zhang *et al.* (2011) [3, 7] and Choudhary *et al.* (2018) [1] in Knol-khol.

Table 1: Effect of foliar application of zinc on plant height, number of leaves per plant, leaf area and chlorophyll content in leaves of Knol-khol.

Treatments	Plant height (cm)		Number of leaves per plant	Leaf area (cm ²)	Chlorophyll content in in leaves (mg)
	45 DAT	Harvest			
Zn ₁ - control	11.68	20.72	9.00	137.99	1.38
Zn ₂ - 0.2%	15.89	24.53	10.08	151.21	1.47
Zn ₃ - 0.4%	17.49	26.42	10.66	159.99	1.73
Zn ₄ - 0.6%	18.08	27.90	11.16	165.91	1.83
S.Em ₊	0.21	0.53	0.16	3.29	0.03
CD (p=0.05)	0.61	1.54	0.48	9.51	0.10

Table 2: Effect of foliar application of zinc on knob diameter, knob weight, knob yield per plot and yield of Knol-khol.

Treatments	Knob diameter (cm)	Knob weight (g)	Knob yield per plot (kg)	Yield (q/ha)
Zn ₁ - control	6.25	141.07	3.38	150.33
Zn ₂ - 0.2%	7.00	163.83	3.93	174.55
Zn ₃ - 0.4%	7.50	181.08	4.34	192.88
Zn ₄ - 0.6%	7.85	186.52	4.47	198.77
S.Em ₊	0.280	1.97	0.05	2.08
CD (p=0.05)	0.809	5.68	0.14	6.01

Table 3: Effect of foliar application of zinc on TSS and protein content of knob and nitrogen, phosphorus and zinc content in leaves and knob of Knol-khol.

Treatments	TSS (°brrix)	Protein (%)	Nitrogen (%)		Phosphorus (%)		Zinc (ppm)	
			Leaves	Knob	Leaves	knob	Leaves	knob
Zn ₁ - control	7.85	3.30	0.175	0.660	0.150	0.717	19.79	38.36
Zn ₂ - 0.2%	9.04	3.61	0.220	0.819	0.222	0.916	24.64	45.69
Zn ₃ - 0.4%	9.96	3.84	0.240	0.964	0.268	1.103	28.63	53.62
Zn ₄ - 0.6%	10.22	3.94	0.250	1.037	0.283	1.128	28.93	55.09
S.Em _±	0.19	0.07	0.002	0.007	0.002	0.008	0.24	0.35
CD(p=0.05)	0.55	0.22	0.005	0.020	0.006	0.024	0.70	1.01

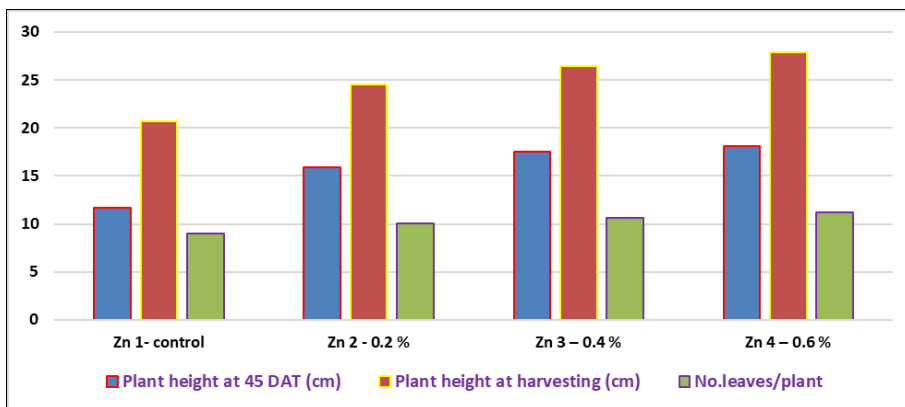


Fig 1: Zinc effect on growth parameters of Knol-khol

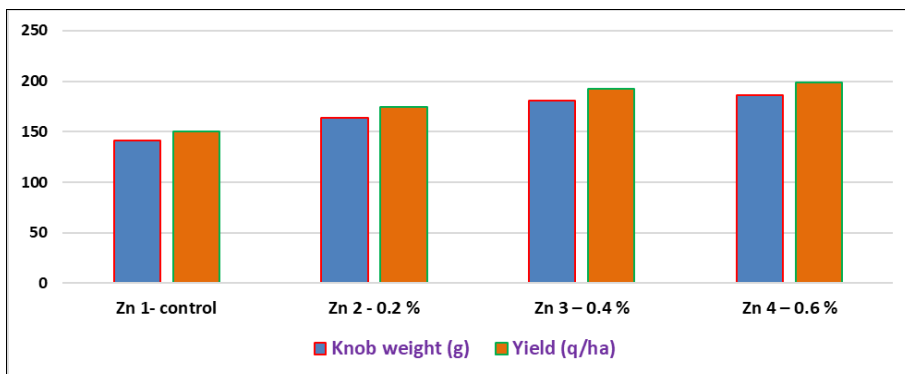


Fig 2: Zinc effect on yield parameters of Knol-khol

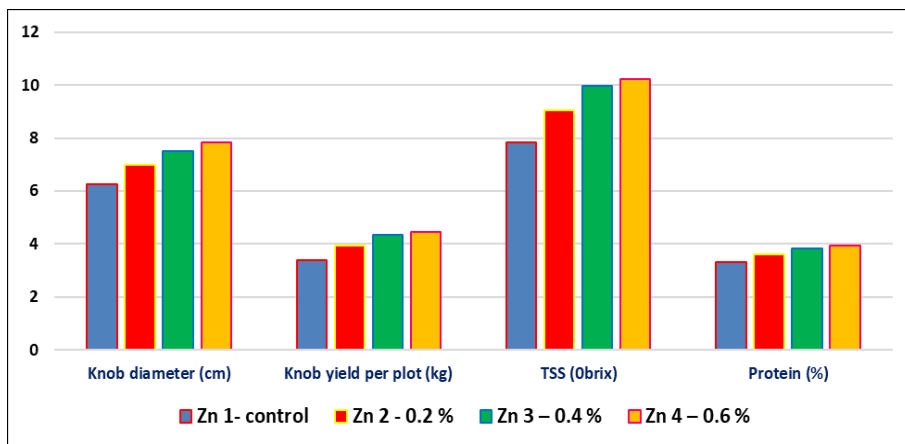


Fig 3: Zinc effect on yield and quality parameters of Knol-khol

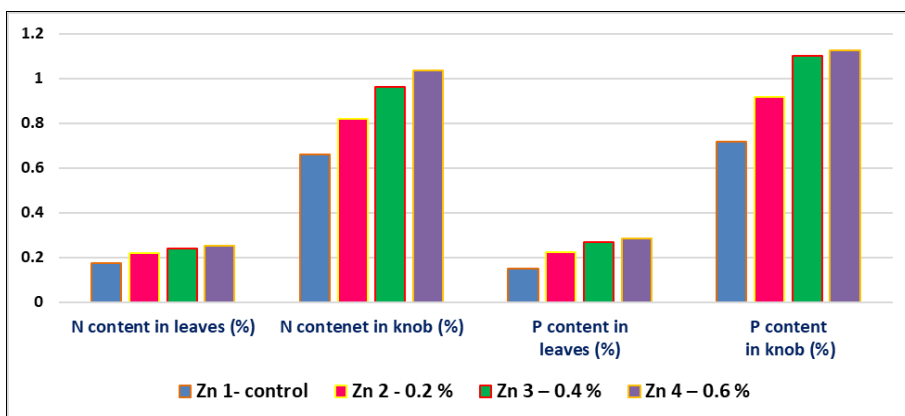


Fig 4: Zinc effect on nitrogen and phosphorus parameters of Knol-khol



Field view of Knol-Khol

Conclusion

On the one-year field experimental results basis it was concluded the effect of foliar application of zinc was clearly indicating the affected to increase the growth, yield and quality on knol-khol. The maximum growth, yield and quality attributes were recorded at 0.6 per cent foliar application of zinc but it was found at par with 0.4 per cent zinc, except nitrogen content in knob and phosphorus content in leaves. While the minimum growth, yield and quality attributes were noticed under in control.

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