RESEARCH ARTICLE

EFFECT OF TRANSPLANTING DATES, CULTIVARS AND ZINC ON NUTRIENT CONTENT AND UPTAKE STUDIESIN ONION (*ALLIUM CEPA* L.) IN SEMI-ARID CONDITIONS OF RAJASTHAN

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Abstract: The experiment was conducted during 2020-21 & 2021-22 in *Rabi* season. The treatment combinations, was laid out in split-plot design with two transplanting dates (10th December and 01st January) and three cultivars (RO-01, RO-59 and Bhima Shakti) were kept in main plots. Four zinc application methods (control, Soil application of zinc sulphate @ 25 kg/ha, dipping of seedling in zinc solubilizer before transplanting, foliar spray of zinc sulphate @ 0.5% at 30 & 45 DAT) were applied in sub plots. As per results transplanting on 01st January and Bhima Shakti with foliar spray of $ZnSo_4$ @ 0.5% at 30 & 45 DAT (Z_3) significantly increased the nutrient content and uptake of nutrients in both years as well as in pooled analysis. Thus, findings were in conclusion that 01st January transplanting and Bhima Shakti cultivar with Z_3have the potential effect to improve nutrient content and uptake of nutrients in onion.

Keywords: *Allium cepa*,Cultivar, Nutrients, Onion, Zinc

INTRODUCTION

Onion (*Allium cepa*L.) is one of the most important commercial crop not only in India but also in the world. It can be transported to a long distance without much transit injury losses. India ranks second in onion production contributing 13.31percent of total vegetable production of the India. Production of onion in India is 26.64 million tonnes in area of 1.62 million ha (Anonymous, 2020-21). Onion is rich in protein, calcium, phosphorus and carbohydrates (Bhattacharjee*et al.*, 2013). The yellowish colour outer skin is due to the presence of quercetin. India ranks second in onion production contributing 13.31 percent of total vegetable production of the India. Production of onion in India is 26.64 million tonnes in area of 1.62 million ha (Anonymous, 2020-21). Now a day, commercially prepared onion products include dehydrated flakes and powders usually made from white coloredcultivars with high dry-matter content and onion oil is produced by distillation (Currah and Proctor, 1990). Dehydrated bulbs and onion powder are in great demand that reduce transport cost and storage losses. Onion is very sensitive to temperature and photoperiod. Therefore, the transplanting date plays a vital role in uptake of nutrients. In North Indian conditions, sowing time of nursery is October to the middle of November and transplanting time of seedlings is from mid-December to January.

Onion varieties differ in size, colour of skin, pungency and maturation time of bulbs etc. Large sized bulbs are mild in pungency with sweet in taste as compared to small sized bulbs. Red coloured cultivars are more pungent than white skinned varieties and keep better in storage. Various cultivars of the same species grown even in the same environment give different yields as performance of a cultivar mainly depends on the interaction of genetic makeup and environment.

Therefore, cultivators are not able to get desired growth and yield of onion only by management practices. Hence, application of zinc through zinc solubilizer, soil application and foliar application stimulate plant growth that enhances the biological efficiency of crops. The present investigation was conducted to know the effect of transplanting dates, cultivars and zinc on nutrient content and uptake studies of Onion.

MATERIALS AND METHODS

The experiment was conducted during 2020-21 and 2021-22 in *rabi* season at Horticulture Farm, S.K.N. College of Agriculture, Jobner (Jaipur) by laying out in split block design (SPD) with three replications consisting of twenty-four treatment combinations.The treatment combinations, was laid out in split-plot design with two transplanting dates (10th December and 01stJanuary) and three cultivars (RO-01, RO-59 and Bhima Shakti) were kept in main plots. Four zinc applicationmethods (control, Soil application of zinc sulphate @ 25 kg/ha, dipping of seedling in zinc solubilizer before transplanting, foliar spray of zinc sulphate @ 0.5 per cent at 30 & 45 DAT) were applied in sub plots. The raised beds were prepared of 3 x 1 m size. The seed sowing was performed on 15th October and 05thNovember of 2020 and 2021, respectively followed by lightirrigationswith thehelpof watering can nutrients like nitrogen, phosphorus and potassium were applied through urea, single super phosphate and

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muriate of potash, respectively. Healthy, uniform size seedlings of different cultivars about 10 cm height were transplanted in the main field on 10th December of 2020 & 2021 and 01st January of 2021 and 2022. The spacing between row and plant was kept 20 x10 cm, respectively.

Zinc was applied by different methods *viz.* soil application of zinc sulphate, treating of onion seedling with zinc solubilizer and foliar spray of zinc sulphate. As per treatment combination, 25 kg zinc sulphate per ha was mixed in soil just before transplanting. Two foliar spray of zinc sulphate @ 0.5 percent after 30 and 45 days of transplanting. Suspension of 5 ml zinc solubilizer in 1 litre of water was prepared for treatment of seedlings and then dipped the roots of onion seedling in the solution for 10 minutes before transplanting. Five plants were tagged in every plot to record observations. The sulphur and zinc content were measured with the turbidometric method (Tabatabi and Bremner, 1970) and Atomic Absorption Spectrophotometer (Lindsay and Norvell, 1978), respectively. The zinc uptake by plant was calculated by using formula as given below:

Zinc uptake (kg/ha)

$$= \frac{\text{Zinc content in plant (ppm)} \times \text{Bulb yield (kg/ha)}}{100}$$

RESULTS AND DISCUSSION

The effect of two transplanting dates (10th December and 01st January) and three cultivars (RO-01, RO-59 and Bhima Shakti) with application methods of zinc (control, soil application of zinc sulphate(25 kg/ha), dipping of seedling in zinc solubilizer before transplanting and foliar spray of zinc sulphate (0.5%) was studied to recognize the nutrient content and uptake studies of onion. The results obtained are presented in Table 1 & 2

Effect of transplanting date sonnutrient content and uptake of nutrients by onion plant

The result data of present study (Table 1 and 2) clearly indicated that sulphur and zinc content in onion bulb and uptake of zinc by plant of onion in both the years as well as in pooled mean analysis increased significantly with delayed transplanting. The transplanting on 01st January significantly increased the sulphur & zinc content in bulb and zinc uptake by plant as compared to transplanting on 10th December in pooled mean analysis (Table 1 & 2). The transplanting on 01st January significantly increased sulphur content (0.694 %), zinc content in bulb (37.19 ppm) and zinc uptake (0.95 kg/ha) by plant as compared to transplanting on 10th December. This might be due to nutritional quality was influenced by photoperiod and temperature. Better availability of air, water, photoperiodic and optimum utilization of nutrients at low temperature enhanced nutrient content in onion.

The finding of the current study confirms the previous finding of Neenu*et al*. (2017) in chickpea.

Effect of cultivars on nutrient content and uptake of nutrients by onion plant

The results (Table 1 and Table 2) showed that significantly increased sulphur (0.661 %) and zinc content (35.45 ppm) in onion bulb and uptake of zinc (0.92 kg/ha) by plant of onionin Bhimashakti as compared to RO-01 cultivar. However, it is found statistically at par to RO-59 cultivar in case of these nutritional parameters in 2020-21 and 2021-22 as well as in pooled mean analysis. It might be due to characteristics of this variety that slightly increased trend of zinc uptake resulting in significantly higher accumulation of zinc and sulphur content in bulb. The efficient varieties will absorb nutrients continuously even in the adverse environmental conditions and perform better than the inefficient varieties (Neenu*et al*., 2017).

These results are also in conformity with the findings of Anwar *et al.*,2001) in onion.

Effect of zinc on nutrient content and uptake of nutrients by onion plant

The result (Table 1 and 2) of present investigation revealed that sulphur content, zinc content in bulb and uptake of zinc significantly increased with foliar spray of zinc over control and dipping of seedling in zinc solubilizer before transplanting.Foliar application of $ZnSO_4$ @ 0.5% followed by soil application of zinc sulphate 25 kg recorded maximum sulphur content in bulb (0.680 %), zinc content in bulb (37.22 ppm) and uptake of zinc (0.96 kg per ha) by plant. However, available zinc (0.56 ppm) in soil after harvest is maximum in soil application of zinc sulphate (25 kg/ha) as compare to rest of treatments in pooled data during experimentation. It might be due to adequate nutrient availability in the feeding zone which eventually increased the uptake of nutrients, photosynthetic rate and finally thebetter growth of plant by enhancing the nutrient content in bulb.

The increase in available content of zinc may also be due to direct addition of these nutrients in the plant. Synergism between sulphur and zinc made zinc responsible for increase in available content of these nutrients. The beneficial role of zinc in increasing the cation exchange capacity of roots, chlorophyll formation, regulating auxin concentration and its stimulatory effect on most of the physiological and metabolic processes of plant, might have helped to plants in absorption of greater amount of nutrients from soil.

Similar results were also reported by Rathod*et al*., (2020) and Begum *et al*. (2015) in bulb crops.

Table1. Effect of transplanting dates, cultivars and zinc on sulphur and zinc content in onion bulb

Treatments	**Sulphur content (%)**			**Zinc content (ppm)**		
	2020-21	**2020-21**	**Pooled**	**2020-21**	**2021-22**	**Pooled**
Transplanting dates						
T_1- 10th December	0.607	0.537	0.572	32.35	31.32	31.44
T_2- 01st January	0.735	0.653	0.694	37.91	36.47	37.19
SEm±	**0.007**	**0.006**	**0.005**	**0.42**	**0.45**	**0.31**
CD (P=0.05)	**0.021**	**0.020**	**0.013**	**1.33**	**1.42**	**0.91**
Cultivars						
C_1- RO-1	0.613	0.545	0.564	33.40	32.64	33.02
C_2- RO-59	0.701	0.608	0.654	35.67	34.46	35.07
C_3-Bhima Shakti	0.700	0.631	0.661	36.31	34.59	35.45
SEm±	**0.008**	**0.008**	**0.006**	**0.52**	**0.55**	**0.38**
CD (P=0.05)	**0.025**	**0.025**	**0.017**	**1.63**	**1.74**	**1.12**
Zinc application						
Z_0 – Control	0.604	0.519	0.562	30.44	29.80	30.12
Z_1 – Soil application of zinc sulphate (25 kg/ha)	0.710	0.633	0.672	36.98	35.42	36.20
Z_2 – Dipping of seedling in zinc solublizer before transplanting	0.655	0.583	0.619	35.28	33.75	34.52
Z_3 – Foliar spray of zinc sulphate @ 0.5% at 30 & 45 DAT	0.715	0.644	0.680	37.82	36.62	37.22
SEm±	**0.004**	**0.005**	**0.003**	**0.47**	**0.56**	**0.37**
CD (P=0.05)	**0.013**	**0.015**	**0.010**	**1.36**	**1.61**	**1.03**

Table 2. Effect of transplanting dates, cultivars and zinc on zinc uptake and available zinc in soil after harvest

Treatments	**Zinc uptake (kg/ha)**			**Available zinc (ppm)**		
	2020-21	**2020-21**	**Pooled**	**2020-21**	**2021-22**	**Pooled**
Transplanting dates						
T_1- 10th December	0.78	0.76	0.77	0.46	0.44	0.45
T_2- 01st January	0.96	0.94	0.95	0.43	0.42	0.43
SEm±	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
CD (P=0.05)	**0.04**	**0.04**	**0.03**	**NS**	**NS**	**NS**
Cultivars						
C_1- RO-1	0.78	0.75	0.77	0.43	0.41	0.42
C_2- RO-59	0.90	0.89	0.90	0.46	0.44	0.45
C_3-Bhima Shakti	0.94	0.90	0.92	0.45	0.43	0.44
SEm±	**0.02**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
CD (P=0.05)	**0.05**	**0.04**	**0.03**	**NS**	**NS**	**NS**
Zinc application						
Z_0 – Control	0.74	0.70	0.72	0.40	0.38	0.39
Z_1 – Soil application of zinc sulphate (25 kg/ha)	0.96	0.94	0.95	0.56	0.55	0.56
Z_2 – Dipping of seedling in zinc solublizer before transplanting	0.82	0.81	0.82	0.42	0.40	0.41
Z_3 – Foliar spray of zinc sulphate @ 0.5% at 30 & 45 DAT	0.97	0.95	0.96	0.41	0.39	0.40
SEm±	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
CD (P=0.05)	**0.04**	**0.03**	**0.02**	**0.03**	**0.02**	**0.02**

CONCLUSION

The results of two years of experimentation and pooled analysis relieved that transplanting date 01st January and Bhima Shakti significantly superior in sulphur and zinc content in bulb as well as uptake of zinc by plant. Similarly, foliar application of zinc sulphate (0.5 %) recorded maximum sulphur and zinc content in bulb, uptake of zinc by plant and available zinc in soil after harvest but the significantly maximum available in zinc in soil after harvest recorded in soil application of zinc sulphate (25 kg/ha) as compare to rest of treatments.

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