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Enhancement of qualitative attributes of onion by application of mepiquat chloride

S.P. Singh, Suman Laddha and Sunil Kumar Pal*

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Abstract

An investigation was carried out at Agricultural Farm, Institute of Agricultural Sciences, Banaras Hindu University to evaluate the effect of mepiquat chloride quality characters of onion cv. Agrifound Light Red *viz.* moisture content, TSS, protein, sugar, nitrogen and acid content of bulb. The present investigation comprised eight treatments *viz.,* 50 g a.i./ha of mepiquat chloride at 35 DAT, 62.5 g a.i./ha of mepiquat chloride at 35 DAT, 125 g a.i./ha of mepiquat chloride at 35 DAT, 50 g a.i./ha of mepiquat chloride at 50 DAT, 62.5 g a.i./ha of mepiquat chloride at 50 DAT, 125 g a.i./ha of mepiquat chloride at 50 DAT, 50 g a.i./ha of mepiquat chloride at 35 and 50 DAT and control (water spray). The experiment was conducted in randomised block design (RBD) with three replications. The results of the present experiment showed that 125 g a.i./ha of mepiquat chloride produced noticeably superior results in terms of all the aforesaid characters in comparison to all the other treatments. Maximum bulb dry weight (8.96 g), protein (18.32 mg/g), sugar (8.61 %) nitrogen (0.64 %) and acid content (0.29 %) were recorded under treatment 125 g a.i./ha of mepiquat chloride at 35 DAT whereas maximum moisture content was recorded under control. However, treatment 62.5 g a.i./ha of mepiquat chloride at 35 DAT observed significantly in case of TSS content (13.67^0 Brix).

Keywords: Onion, Allium, Agrifound Light Red, Mepiquat chloride, Quality attributes.

Introduction

Onion (*Allium cepa* L.) is famous as "Queen of Kitchen" is an important vegetable consumed daily by human beings and potential foreign exchange earners among the vegetables in India. It is used by almost all the sections of the society in various ways for its characteristic pungency and wide range of medicinal properties. The aroma and pungency is due to sulphur constituted volatile oil known as "allyl propyl disulphide" (Fageria 2013). The onion bulb is a strongly contracted subterranean shoot with thickened, fleshy, scaly leaves as food organs. Most of onion cultivar having about 89 % moisture, 11.1 % sugar and 1.2 % proteins, vitamin 'B' and 'C' and traces of phosphorus, calcium and iron (Fageria 2013). As a food item, it is usually served cooked, as a vegetable or part of a prepared savoury dish, but can also be eaten raw or used to make pickles or chutneys. Extracts of onion are being used in the prevention of atherosclerosis and coronary heart disease as they can inhibit the aggregation of human blood platelets to form the clots which have the potential for arterial blocking. Mepiquat chloride, 1,1 dimethylpiperidinium chloride, is a water soluble organic molecule, which is absorbed by the green parts and redistributed throughout the plant. Mepiquat chloride inhibits gibberellic acid synthesis by stopping the conversion of geranlgeranyl diphosphate to entkaurene, consequently reducing cell enlargement and cell division rate (Srivastava, 2002). Pre-harvest foliar sprays of growth regulators (maleic hydrazide, ethrel and cycocel) have been widely applied without impairing the quality of onion. These compounds greatly facilitate the maintenance of quality in onion bulbs on storage but there is no information available pertaining to effect of mepiquat chloride on quality of onion. Therefore, the present investigation was undertaken to find out the effect of mepiquat chloride on quality attributes of onion.

Materials and Methods

The experiment was conducted during winter season on onion (*Allium cepa* L.) variety 'Agrifound Light Red' with the objective to effect of mepiquat chloride on quality of onion. The investigation was conducted at Agricultural Farm, Institute of Agricultural Science, Banaras Hindu University during the year 2015–2016. Geographically, the experimental site falls under sub–tropical zone

Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi-221005, UP
*Corresponding author, E-mail: sunil15apr1993@gmail.com

between 25^{0}32' north latitude and 82^{0}98' east longitude. The experiment was conducted in randomised block design (RBD) with three replications. The present investigation comprised eight treatments *viz.,* T_1 - 50 g a.i./ha of mepiquat chloride at 35 DAT (days after transplanting), T_2 - 62.5 g a.i./ha of mepiquat chloride at 35 DAT, T_3 - 125 g a.i./ha of mepiquat chloride at 35 DAT, T_4 - 50 g a.i./ha of mepiquat chloride at 50 DAT, T_5 - 62.5 g a.i./ha of mepiquat chloride at 50 DAT, T_6 - 125 g a.i./ha of mepiquat chloride at 50 DAT, T_7 - 50 g a.i./ha of mepiquat chloride at 35 and 50 DAT, and T_8 - control (water spray). Seed sowing was done in second week of October and one month old seedlings were transplanted at 15 cm row to row and 10 cm plant to plant distance. Plot size was kept 6.0 × 3.0 m to accommodate 1200 plants in each plot. Recommended dose of Urea, DAP and MOP were applied @ 60 kg N + 50 kg P_2O_5 + 50 kg K_2O ha^{-1} along with 25 t ha^{-1} compost as broadcast and incorporated into the soil by just before transplanting. Half dose of required nitrogen was applied at the time of transplanting as basal dose in the soil in urea form. Remaining half of the nitrogen was applied as top dressing at 35 days after transplanting through urea. All the recommended agronomic practices were adopted during the experimental period. The fresh weight and dry weight of bulb was determined with help of electronic top pan balance. The total soluble solids (TSS) of the sample were determined with the help of Abbe type Refractometer whereas, protein content in the sample was determined with the help of Bradford method of A.O.A.C. (1975). Sugars in all samples were estimated by Lane and Eynon's (1923) method reported by Ranganna (1995). The nitrogen content in bulb was determined by using Micro-kjeldahl method of A.O.A.C. (1975) and titrable acidity was estimated by adopting standard method of A.O.A.C. (1975). The statistical analysis was done as per the procedure described by Panse and Sukhatme (1985).

Results and Discussion

Significant results were recorded due to mepiquat chloride on bulb quality of onion (Table 1). The moisture content of bulb decreases gradually from 88.50 % to 86.51 % by increasing the concentration of mepiquat chloride because of it is capable of partitioning of dry matter in plants. The fresh weight of bulb was found to be highest (66.40 g) with treatment 125 g a.i./ha of mepiquat chloride at 35 DAT which was closely followed by treatment 125 g a.i./ha of mepiquat chloride at 50 DAT (64.05 g) and treatment 50 g a.i./ha of mepiquat chloride at 35 and 50 DAT (63.36 g) however, it was noted to be lowest (56.80 g) in control. Never the less, treatment 50 g a.i./ha of mepiquat chloride at 35 and 50 DAT was at par with treatment 125 g a.i./ha of mepiquat chloride at 50 DAT Regarding dry weight of bulb, it was discerned that maximum dry weight (8.96 g) was observed with treatment 125 g a.i./ha of mepiquat chloride at 35 DAT. It was closely followed by treatment 125 g a.i./ha of mepiquat chloride at 50 DAT (8.56 g) and treatment 50 g a.i./ha of mepiquat chloride at 35 and 50 DAT (8.26 g) whereas, the minimum dry weight (6.53 g) was recorded under control. The minimum moisture content (86.51%) was recorded in treatment 125 g a.i./ha of mepiquat chloride at 35 DAT followed by treatment 125 g a.i./ha of mepiquat chloride at 50 DAT (86.63 %) whereas, the maximum moisture content (88.50 %) was recorded under control. These results brought out the role of mepiquat chloride in increasing photosynthetic activity, translocation of photo-assimilates to bulbs and roots, better conversion of photo-assimilates from source to sink and ultimately lead to highest weight of whole plant. These results are in conformity with the findings of Singh *et al.* (2003) and Nichols *et al.* (2003).

Table 1: Effect of mepiquat chloride on fresh weight, dry weight and moisture content of bulb

Treatment	Fresh wt. (g)	Dry wt. (g)	Moisture Content (%)
T_1	62.53	7.52	87.98
T_2	59.30	7.49	87.37
T_3	66.40	8.96	86.51
T_4	59.59	7.01	88.23
T_5	62.01	7.65	87.66
T_6	64.05	8.56	86.63
T_7	63.36	8.26	86.96
T_8	56.80	6.53	88.50
CD 5%	2.53	0.38	0.39

Different levels of mepiquat chloride caused striking effect on TSS of onion bulbs. The maximum total soluble solids (13.67^0 Brix) were observed with treatment 62.5 g a.i./ha of mepiquat chloride at 35 DAT followed by treatment 125 g a.i./ha of mepiquat chloride at 35 DAT (13.47^0 Brix) and 62.5 g a.i./ha of mepiquat chloride at 50 DAT (13.33^0 Brix) whereas the minimum total soluble solids (11.90^0 Brix) were recorded under control (Table 2). The superior quality under growth retardant might be due to its property of promoting the accumulation of carbohydrate by suppressing the apical dominance. Accumulation of more carbohydrates might have resulted in more solids in bulbs. These results are in agreement resembled with the findings of Singh *et al.* (2003), Ganie and Solanki (2010). The maximum soluble protein (18.32 mg/g) was observed in treatment 125 g a.i./ha of mepiquat chloride at 35 DAT. It was closely followed by treatment 125 g a.i./ha of mepiquat chloride at 50 DAT (18.26 mg/g) and treatment 50 g a.i./ha of mepiquat chloride at 35 and 50 DAT (18.24 mg/g)

whereas the minimum soluble protein (17.63 mg/g) was recorded under control (Table 2). The protein content of the bulbs has been increased due to stimulatory effect of mepiquat chloride on the enzymatic system and metabolic activities of the plants related to the synthesis of this content. These results resembled the findings of Ganie and Solanki (2010) and Sivakumar *et al*. (2002). The soluble protein being a measure of RuBP carboxylase activity was considered as an index for photosynthetic efficiency. There were reports that RuBP-case enzyme forms nearly 50 per cent of the soluble proteins in leaves of many plants. In the present study it can be observe that nitrogen percentage in dry bulb increased by increasing concentrations of mepiquat chloride. The maximum nitrogen (0.64 %) was observed with treatment 125 g a.i./ha of mepiquat chloride at 35 DAT which was closely followed by treatment 50 g a.i./ha of mepiquat chloride at 50 DAT (0.63 %) and treatment 125 g a.i./ha of mepiquat chloride at 50 DAT (0.62 %) while the minimum nitrogen (0.59 %) was recorded in control. Although increase in nitrogen content due to mepiquat chloride is not fully understood. Among the treatments, the maximum acidity (0.29 %) was observed in treatment 125 g a.i./ha of mepiquat chloride at 35 DAT whereas the minimum acidity (0.27 %) was recorded under control (Table 2). These results corroborate the findings of Shepherd and Singh (1999).

The maximum reducing sugar (2.84 %) was observed in treatment 125 g a.i./ha of mepiquat chloride at 35 DAT. It was closely followed by treatment 125 g a.i./ha of mepiquat chloride at 50 DAT (2.77 %) and treatment 50 g a.i./ha of mepiquat chloride at 35 and 50 DAT (2.68 %) whereas the minimum reducing sugar (2.57 %) was recorded under control which was found at par with treatment 50 g a.i./ha of mepiquat chloride at 35 DAT and treatment 62.5 g a.i./ha of mepiquat chloride at 35 DAT. Regarding non reducing sugar, it was discerned that the maximum non reducing sugar (5.77 %) was observed with treatment 125 g a.i./ha of mepiquat chloride at 35 DAT which was closely followed by treatment 125 g a.i./ha of mepiquat chloride at 50 DAT (5.39 %) and treatment 50 g a.i./ha of mepiquat chloride at 35 and 50 DAT (5.25 %) while it was the minimum (4.65 %) under control (Table 3). The possible reason for increased sugar content in mepiquat chloride treatment might be due the increased translocation of photosynthetic metabolites from other parts of the plant towards to developing fruits. Similar result also reported by Arvin and Banakar (2002). Singh (2014) observed that higher concentration of cycocel (1500 ppm), potassium sulphate (2 %) and benlate (500 ppm) significantly increased fruit quality (reducing sugar and non reducing sugar). From the results of this study, it could be concluded that, application of mepiquat chloride at 125 g a.i./ha at 35 DAT is the recommended treatment for improving quality of onion.

Table 3: Effect of mepiquat chloride on sugar content of bulb

Treatment	Sugar Content		
	Reducing Sugar (%)	Non Reducing Sugar (%)	Total Sugar (%)
T_1	2.61	4.98	7.59
T_2	2.62	5.16	7.77
T_3	2.84	5.77	8.62
T_4	2.59	4.93	7.52
T_5	2.62	5.06	7.68
T_6	2.77	5.39	8.16
T_7	2.68	5.25	7.93
T_8	2.57	4.65	7.22
CD 5%	0.06	0.12	0.13

Table 2: Effect of mepiquat chloride on TSS, Protein, Nitrogen and Acid content of bulb

Treatment	TSS (^{0}Brix)	Protein content (mg/g)	Nitrogen content (%)	Acid content (%)
T_1	12.53	18.05	0.60	0.28
T_2	13.67	18.17	0.61	0.28
T_3	13.47	18.32	0.64	0.29
T_4	12.23	17.97	0.60	0.28
T_5	13.33	18.24	0.60	0.28
T_6	13.20	18.26	0.62	0.28
T_7	12.83	18.24	0.63	0.28
T_8	11.90	17.63	0.59	0.27
CD 5%	0.22	0.39	0.02	0.00

सारांश

मेपीकॉट क्लोराइड का प्याज की प्रजाति 'एग्रीफाउण्ड लाइट रेड' का उपयोग कर गुणात्मक गुणों जैसे–नमी की मात्रा, कुल घुलनशील विलेय, प्रोटीन, शर्करा, नत्रजन और अम्ल की मात्रा पर प्रभाव को ज्ञात करने हेतु कृषि विज्ञान संस्थान, काशी हिन्दू विश्वविद्यालय के कृषि प्रक्षेत्र पर वर्ष 2015–16 में एक शोध किया गया। इस शोध में मेपीकॉट क्लोराइड के आठ उपचारक जैसे– 50, 62.5 तथा 125 ग्राम सक्रिय तत्व/हे. का छिड़काव पौध रोपण के क्रमशः 35 एवं मेपीकॉट क्लोराइड का 50 दिनों के अन्तराल पर एवं 50 ग्राम सक्रिय तत्व/हे. प्रथम छिड़काव रोपण के 35 दिनों के बाद तथा दूसरा छिड़काव प्रथम छिड़काव के 15 दिनों के बाद नियंत्रित उपचारक के रूप में शुद्ध जल के साथ छिड़काव किया गया, शोध यादक्षिक आकार विधि से तीन बार प्रतिकृति करके किया गया। प्राप्त परिणामों से यह स्पष्ट होता है कि 125 ग्राम सक्रिय तत्व/हे. मेपीकॉट क्लोराइड का छिड़काव पौध रोपण के 35 दिनों बाद करने से अन्य सभी उपचरों की तुलना में सभी गुणों हेतु अत्याधिक उत्तम एवं लाभप्रद परिणाम प्राप्त हुए। प्याज के कंद का सर्वाधिक शुष्क भार (8.96 ग्राम), प्रोटीन (18.32 मिग्रा./ग्राम), शर्करा (8.61 प्रतिशत), नत्रजन (0.64 प्रतिशत) एवं अम्ल की मात्रा (0.29 प्रतिशात) मेपीकॉट क्लोराइड 125 ग्राम सक्रिय तत्व/हे. का छिड़काव पौध रोपण के 35 दिन बाद करने से प्राप्त हुई, वहीं प्याज के कंदों में सर्वाधिक नमी (87.98 प्रतिशत) नियंत्रित उपचारक (शुद्ध जल का छिड़काव) के प्रयोग से प्राप्त हुई। यद्यपि 62.5 ग्राम सक्रिय तत्व/हे. मेपीकॉट

क्लोराइड का छिड़काव पौध रोपण के 35 दिनों के बाद करने से प्याज के कंद में अत्याधिक कुल घुलनशील ठोस (13.67 डिग्री ब्रिक्स) प्राप्त हुआ।

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