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EFFECT OF PRE HARVEST APPLICATION OF PLANT GROWTH REGULATORS ON STORAGE LIFE OF ONION CV. AKOLA SAFED

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ABSTRACT

The study aimed to investigate the effect of plant growth regulators on the storage life of onion cv. Akola Safed during the year 2021-2022 at Department of Vegetable Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The experiment involved thirteen pre-harvest application treatments, including CCC 500 ppm (T_1), CCC 1000 ppm (T_2), CCC 1500 ppm (T_3), MCC 500 ppm (T_4), MCC 1000 ppm (T_5), MCC 1500 (T_6), NAA 25 ppm (T_7), NAA 50 ppm (T_8), NAA 75 ppm (T_9), GA3 25 ppm (T_{10}), GA3 50 ppm (T_{11}), GA375 ppm (T_{12}), and Control (T_{13}) replicated thrice in RBD. The results showed that, pre-harvest application of CCC 1000 ppm (T_2) three weeks prior to harvest resulted in minimum PLW (19.42%), sprouting (0.57%) rotting loss (15.55%) and total loss (35.54%) after six months storage study. The spray of CCC 1000 ppm (T_2) three weeks prior to harvest was found to be superior among the treatments, minimizing storage losses up to 23.58 per cent over the control treatment and helping to maintain post-harvest quality.

Key words : *Allium cepa*, Onion, Akola Safed, Pre harvest application, PGR, PLW.

Introduction

At least 5000 years have passed since the origins of onions. The origins of onions were unknown to all of the monographers. It is most likely native to Asia, which includes Afghanistan, Baluchistan and North-West India. The city that ONIA constructed close to the Gulf of Swez in 1703 B.C. is most likely, where it got its name. As early as 3200 B.C., onions were shown as food in Egyptian tombs, the oldest known historical account. Egyptologists think they fed them to labourers so they would have the strength to build pyramids. The Bible and the Kuran both make mention of onions as food. The well-known ancient medical text Charaka Samhita (6 B.C.) mentions the cultivation of onions in India. The Romans and Greeks used onions as well. Soon after the onion was brought to Europe by the Romans, it gained popularity as a vegetable. The onion has progressively recovered acceptability despite centuries-long societal and religious taboos. Onions still play a significant role in our diets today. The onion is a significant crop that is farmed all over the world for both culinary and medicinal purposes (Mehta, 2017).

Numerous folk remedies involve the use of onions, and current research indicates that they may be particularly effective in preventing heart disease and other conditions (Augusti, 1976). Most of the medicinal effects of onion are preferable to a sulphur compound known as allicin (Schulz, 1998), which is influenced by both genetic and agronomical practices. Due to their seasonal surplus on the market, onions are typically preserved until the next season's crop is harvested, although they have a relatively poor storage capacity. During storage, onions suffer significant losses in both quantity and quality. Consequently, in tropical nations like India, the storage of onion bulbs has become a major issue. Garlic and onions both breathe minutely and are live commodities. Water is the energy that is lost by any respiring commodity during post-harvest storage, in addition to some metabolic changes. Both onions and garlic typically experience these kinds of losses (Lawande, 2018). Hence, the present investigation was undertaken tostudy the effects of PGR on storage life of onion.

Materials and Methods

The present study entitled, "Effect of Pre Harvest Application of Plant GrowthRegulators on Storage Life of Onion cv. Akola Safed'' was carried out at Department of Vegetable Science, Dr. P.D.K.V. Akola, during *Rabi* season of year 2021-2022. Akola is situated in sub-tropical region between 22.7006^0 N and 77.0371^0 E. The climate of Akola is semi-arid and characterised by three distinct seasons. Hot and dry *summer* from March to May, warm humid and rainy monsoon from July to November, and mild cold winter from November to February. Experiment was carried out with thirteen treatments and three replicationsin randomised block design with plot size of 3 × 1 m^2 and spacing of 10 × 15 cm. The physio-chemical observations were recorded at ambient storage on each successive interval (after 30, 60, 90, 120, 150, 180 days). The sample size of uniform bulb is 10 kg were taken for study. Bulb was stored for six month and observations wererecorded at monthly interval. The applications of pre harvest application of plant growth regulators were done three weeksprior to harvest. Analysis of variance was carried out as per the procedure given by Panse and Sukhatme (1967).

Table 1 : Treatment details for field experiment.

T_1	Chlormequat chloride 500 ppm	Spray- three week before harvest.
T_2	Chlormequat chloride 1000 ppm	Spray- three week before harvest.
T_3	Chlormequat chloride 1500 ppm	Spray- three week before harvest.
T_4	Mepiquat chloride 500 ppm	Spray- three week before harvest.
T_5	Mepiquat chloride 1000 ppm	Spray- three week before harvest.
T_6	Mepiquat chloride 1500 ppm	Spray- three week before harvest.
T_7	NAA 25 ppm	Spray- three week before harvest
T_8	NAA 50 ppm	Spray- three week before harvest
T_9	NAA 75 ppm	Spray- three week before harvest.
T_{10}	GA_3 25 ppm	Spray- three week before harvest
T_{11}	GA_3 50 ppm	Spray- three week before harvest.
T_{12}	GA_3 75 ppm	Spray- three week before harvest.
T_{13}	Control (No spray)	Spray- three week before harvest.

Physiological loss in weight

From each treatment 10 bulbs were selected randomly. The weight of bulbs was recorded on 30, 60, 90, 120, 150 and 180 days after storage using electronic balance. The cumulative loss in weight of bulbs was calculated and expressed as per cent physiological loss in weight using the formula given below:

$$\text{PLW \%} = \frac{P_0\text{-}P_1 \text{ or } P_2 \text{ or } P_3 \text{ or } P_4 \text{ or } P_5 \text{ or } P_6}{P_0} \times 100$$

Where, P_o = Initial weight

P_1 = weight after 30 days

P_2 = weight after 60 days

P_3 = weight after 90 days

P_4 = weight after 120 days

P_5 = weight after 150 days

P_6 = weight after 180 days

Sprouting loss

For determining the sprouting percentage on respective days (30, 60, 90, 120, 150 and 180 days) after storage, the bulbs showing a sprout were separated from the lot of every treatment. The same were weighed on an electronic balance. The percentage of sprouting was calculated by using following formula;

$$\text{Sprouting losses (\%)} = \frac{\text{Weight of the sprouted bulbs}}{\text{Initial weight of bulbs}} \times 100$$

Rotting loss

At each periodical observation, the rotted bulbs in storage were separated from each treatment and weighted on an electronic balance. Percentage loss due to rotting was calculated by using following formula.

$$\text{Rotting percentage} = \frac{\text{Weight of the rotted bulbs}}{\text{Initial weight of the bulbs}} \times 100$$

Total loss

The total losses are calculated on respective days after storage, with sample addition ofthe all-weight losses calculated earlier during the storage period. The percentage of total losses was calculated by using following formula:

$$\text{Total losses (\%)} = \frac{\text{Weight of the PLW + rotten + sprouted bulb}}{\text{Initial weight of bulbs}} \times 100$$

Results and Discussion

Physiological loss in weight

The highest physiological loss in weight was noticed in the treatment T_{13} (control) with the values of 6.97%, 10.74%, 15.17%, 19.59%, 22.49% and 29.56% at 30, 60, 90, 120, 150 and 180 DAS, respectively. The lowest physiological loss in weight was recorded in the pre harvest spraying treatment of cycocel @ 1000 ppm (T_2) with the values of 3.45%, 5.46%, 7.63%, 10.61%, 14.22% and 19.42% at 30, 60, 90, 120,150 and 180 DAS respectively, followed by MC 500 ppm (T_4) treatment (Table 2). The minimum loss in weight of bulb during storage is considered to be one of the desirable factors to increase storage life. In the present experiment, the bulbs showed a gradual increase in the physiological loss in weight (%) with the storage period in all the treatments. The reason might be due to action of cycocel as inhibiting substance and reducing the respiration of bulbs, which in turn reduces the loss of moisture from the bulbs (Anbukkarasi *et al.*, 2013). Similar findings were reported by Kukanoor *et al.* (2005) and Gopalkrishnarao (1998) in onion, Akhilesh *et al.* (2010) and Kumara and Patil (2015) in garlic. Sidhu and Chadha (1986) and Vijayakumar *et al.* (1989) observed reduction in moisture loss in onion with pre harvest spraying of growth regulators due to reduction of cell division after harvest and retention of cell structural integrity in the epical region. These results are in agreement with Vethamoni and Gomathi (2018).

Sprouting loss

As days passed the rate of sprouting loss increased. At 30 and 60 DAS, sprouting was not seen (Table 2). One hundred eighty days after the storage period, treatment T_2 (Cycocel @ 1000 ppm) showed the least amount of sprouting (0.57%), followed by treatment T_4 (Mepiquat chloride @ 500 ppm-1.24%), with the highest sprouting in the control treatment (T_{13}) at 4.11 percent. This is consistent with research by Biswas *et al.* (2010), who found that after 90 days of storage, onion bulbs begin to sprout. Growth promoters, which facilitate onion bulb sprouting after prolonged storage, rise as the amount of endogenous ABA, which is recognised as a component of the growth inhibit complex present in the onion bulbs, decreases with the length ofstorage (Chope *et al.*, 2012).

Rotting loss

No rotting was observed at 30 DAS. Rotting loss increased as period of storage increased from 60 to 180 days (Table 3). The least rotting was noticed in the treatment cycocel @ 1000 ppm (T_3) *i.e.* 0.00%, 1.63%, 5.75%, 8.23%, 12.14%, 15.55% at 30, 60, 90, 120, 150, 180 days after storage followed by MC 500 ppm treatment (T_4). The highest rotting was observed in treatment control (T_{13}) showed 0.00%, 7.56%, 12.54%, 18.27%, 22.68% and 25.45%. These results are in agreement with Vethamoni and Gomathi (2018).

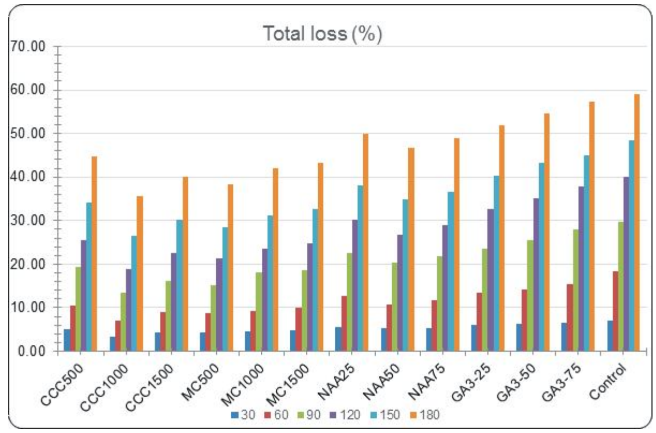

Fig. 1 : Effect of pre-harvest treatment of plant growth regulators on total loss (%) of onion bulbs during storage.

Total loss

The total amount of onion bulbs lost during storage rose as the duration of storage increased (Table 3) (Fig. 1). The highest total loss was noticed in the treatment T_{13} (control) at 6.97, 18.30, 29.59, 40.00, 48.32 and 59.12 percent at 30, 60, 90, 120, 150 and 180 DAS. The lowest total loss was recorded in the treatment Cycocel at 1000 ppm (T_2) with values of 3.45, 7.09, 13.38, 18.84, 26.54 and 35.54 percent at 30, 60, 90, 120, 150 and 180 DAS, followed by the treatment T_4 (Mepiquat chloride at 500 ppm). The increase in percentage of total loss of bulbs in the control treatment might be due to rotting, sprouting, moisture loss, and physiological weight loss during storage. Higher weight loss as a result of rotting, sprouting, moisture loss, and physiological weight was also reported by Biswas *et al.* (2010) in onions. But total loss was less in the pre-harvest spraying treatments with growth retardants like cycocel and mepiquat chloride than in the control. This might be due to the anti-gibberellin action of growth retardants, which might have facilitated the maintenance of the quality of bulbs on storage with respect to inhibition of sprouting, leading to a reduction in moisture and a physiological loss in weight (Rahman and Isenberg, 1974).

From the above study, it is concluded that,pre-harvest application of CCC 1000 ppm (T_2) three weeks prior to harvest resulted in minimum PLW, sprouting, rotting and total loss and found to be superior among the treatments, minimizing storage losses over the control treatment after six months storage study.

Table 2 : Effect of pre-harvest treatment of plant growth regulators on Physiological loss in weight loss (%) and Sprouting (%) of onion bulbs during storage.

Treatments	Physiological loss in weight (%)						Sprouting (%)					
	30 DAS	60 DAS	90 DAS	120 DAS	150 DAS	180 DAS	30 DAS	60 DAS	90 DAS	120 DAS	150 DAS	180 DAS
T_1: CCC 500 ppm	5.16	6.99	10.74	13.16	16.09	22.17	0.00	0.00	0.88	0.93	1.09	2.54
T_2: CCC1000 ppm	3.45	5.46	7.63	10.61	14.22	19.42	0.00	0.00	0.00	0.00	0.18	0.57
T_3: CCC1500 ppm	4.44	6.45	9.18	12.41	15.21	20.53	0.00	0.00	0.53	0.62	0.74	1.95
T_4: MC 500 ppm	4.32	6.32	8.89	11.95	14.80	20.19	0.00	0.00	0.00	0.22	0.46	1.24
T_5: MC 1000 ppm	4.54	6.47	10.49	12.56	15.40	21.21	0.00	0.00	0.65	0.74	0.83	2.18
T_6: MC 1500 ppm	4.95	6.84	10.58	12.98	15.96	21.83	0.00	0.00	0.74	0.83	0.99	2.36
T_7: NAA 25 ppm	5.64	8.27	12.12	14.63	17.18	25.02	0.00	0.00	1.27	1.34	1.56	2.93
T_8: NAA 50 ppm	5.28	7.15	11.30	13.42	16.32	23.47	0.00	0.00	0.97	1.06	1.26	2.65
T_9: NAA 75 ppm	5.41	7.72	11.79	13.96	16.78	24.94	0.00	0.00	1.12	1.22	1.35	2.80
T_{10}: GA_3 25 ppm	6.03	8.68	12.32	15.59	18.40	26.34	0.00	0.00	1.34	1.47	1.69	3.13
T_{11}: GA_3 50 ppm	6.30	8.88	13.51	17.27	19.57	27.87	0.00	0.00	1.56	1.59	1.99	3.46
T_{12}: GA_3 75 ppm	6.66	9.34	14.95	18.46	20.09	28.98	0.00	0.00	1.70	1.77	2.59	3.65
T_{13}: Control	6.97	10.74	15.17	19.59	22.49	29.56	0.00	0.00	1.87	2.14	3.15	4.11
SE (m) ±	0.13	0.17	0.11	0.15	0.11	0.16	0.00	0.00	0.09	0.07	0.08	0.09
CD at 5 %	0.38	0.49	0.33	0.45	0.33	0.48	NS	NS	0.27	0.21	0.23	0.27

Table 3 : Effect of pre-harvest treatment of plant growth regulators on rotting loss (%) and total loss (%) of onion bulbs during storage.

Treatments	Rotting loss (%)						Total loss (%)					
	30 DAS	60 DAS	90 DAS	120 DAS	150 DAS	180 DAS	30 DAS	60 DAS	90 DAS	120 DAS	150 DAS	180 DAS
T_1: CCC 500ppm	0.00	3.44	7.63	11.53	16.95	19.96	5.16	10.43	19.26	25.62	34.13	44.68
T_2: CCC 1000ppm	0.00	1.63	5.75	8.23	12.14	15.55	3.45	7.09	13.38	18.84	26..54	35.54
T_3: CCC 1500ppm	0.00	2.48	6.57	9.56	14.35	17.67	4.44	8.93	16.28	22.60	30.30	40.15
T_4: MC 500ppm	0.00	2.33	6.21	9.14	13.24	17.02	4.32	8.66	15.10	21.31	28.51	38.45
T_5: MC 1000ppm	0.00	2.82	6.88	10.19	14.97	18.56	4.54	9.30	18.01	23.50	31.20	41.95
T_6: MC 1500ppm	0.00	3.12	7.30	10.88	15.73	19.19	4.95	9.96	18.62	24.69	32.68	43.38
T_7: NAA 25ppm	0.00	4.31	9.16	14.13	19.26	22.00	5.64	12.59	22.56	30.10	38.00	49.95
T_8: NAA 50ppm	0.00	3.67	8.14	12.34	17.29	20.56	5.28	10.82	20.41	26.82	34.87	46.68
T_9: NAA 75ppm	0.00	3..95	8.84	13.68	18.52	21.15	5.41	11.67	21.76	26.86	36.66	48.88
T_{10}: GA_3 25ppm	0.00	4.72	9.96	15.60	20.22	22.49	6.03	13.40	23.62	32.65	40.31	51.96
T_{11}: GA_3 50ppm	0.00	5.38	10.38	16.74	21.71	23.33	6.30	14.26	25.45	35.23	43.27	54.66
T_{12}: GA_3 75ppm	0.00	6.16	11.28	17.68	22.34	24.74	6.66	15.50	27.93	37.91	45.03	57.37
T_{13}: Control	0.00	7.56	12.54	18.27	22.68	25.45	6.97	18.30	29.59	40.00	48.32	59.12
SE (m) ±	0.00	0.14	0.13	0.13	0.13	0.15	0.13	0.23	0.19	0.22	0.23	0.25
CD at 5 %	NS	0.41	0.38	0.39	0.37	0.45	0.38	0.68	0.56	0.63	0.68	0.73

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