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National Academy of Agricultural Science (NAAS) Rating : 3.03

Studies on Different Sources of Nitrogen and Potassium on Shelf Life of Onion (*Allium cepa* L.) var. Arka Kalyan

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ABSTRACT: *The investigation was conducted at Main Agriculture Research Station, UAS, Dhawad during kharif season to study the effect of different sources of nitrogen and potassium on shelf life of onion (Allium cepa L.) var. Arka Kalyan. Sources of potassium and nitrogen significantly influenced the shelf life of onion during storage period. Potassium in the form of sulphate of potash was noticed significantly superior over muriate of potash with respect to total soluble solid (TSS). The highest storage losses were recorded when onion was supplied with urea as a source of single nutrient i.e., nitrogen. Quality parameter (TSS) was superior due to application of ammonium sulphate over other nitrogen sources. significantly lowest loss in PLW (physiological loss in weight), rotting, sprouting and total loss due to application of sheep manure followed by FYM.*

Keywords: *onion, shelf life, TSS, sheep manure, sprouting, ammonium sulphate, PLW and sulphate of potash.*

INTRODUCTION

Onion (*Allium cepa* L. 2n=16), is an important vegetable belonging to family Alliaceae. It is most widely grown and popular crop among the alliums. Onion is considered to be the second most important vegetable crop grown in the world. It is an indispensible item in every kitchen as vegetable and condiment used to flavour many of the food stuffs. Therefore, onion is popularly referred as "Queen of Kitchen." In addition, onion is used as salad and pickle. Recently onion is being used by processing industry to greater extent for preparing dehydrated forms like powder and flakes.

India is second largest producer of onion in the World, but the productivity is very low as compared to advanced countries. Presently about 40 per cent of onion is estimated to be lost during various stages of handling. Post harvest factors *viz.*, curing, grading, Long storage life of onion bulbs without having much loss in terms of weight and other quality parameters like rotting and sprouting are the most important aspect for obtaining remunerative price and exporting. It is so essential because onion is used throughout the year in various ways; storage of onion bulbs after harvesting poses a great problem. Besides method of culture, harvesting, curing and use of certain chemicals, the healthier source of nutrients facilitate the long storage life without deteriorating in its quality.

MATERIAL AND METHODS

The present investigation was carried out at Main Agriculture Research Station, University of Agricultural Sciences, Dharwad, during *kharif* 2009. The experiment was laid out in split-plot design with three replication and eight treatments having two main plots *i.e.* M1 was recommended dose of potassium as muriate of potash and M2 was recommended dose of potassium as sulphate of potash; and four sub-plots *viz.*, S1 was recommended dose of nitrogen as urea, S2 was recommended dose of nitrogen as ammonium sulphate, S3 was recommended dose of nitrogen as sheep manure and S4 was recommended dose of nitrogen as FYM. The spacing was maintained 10 x 15 cm for all the treatments. The plot size was 3 x 2 m. the nitrogen sources *i.e.* sheep manure and FYM were applied fifteen days before transplanting and urea and ammonium sulphate applied half dose during transplanting and remaining half dose top dressed at thirty five days after transplanting. The potassium sources and recommended dose of phosphorus were applied as basal dose. The observations on storage

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characters likes physiological loss of weight, rotting of bulbs, sprouting of bulbs, total loss and TSS *etc,* were recorded.

RESULT AND DISCUSSION

Impact of potassium and nitrogen sources on shelf life of onion

It is estimated that over 30 to 50 per cent of the onion produced in India valued at more 600 crores is lost annually during storage and transportation. The most appropriate cause for this heavy loss is improper pre and post harvest management practices. Among the pre harvest management aspects, nutrient (especially nitrogen) management could be major considerations along with other factors like suitable variety, method of culture, harvesting, curing and use of certain chemicals to improve shelf life.

Physiological Loss of Weight

There was no significant difference with respect to PLW in onion during storage due to potassium sources such as sulphate of potash and muriate of potash. Potassium increases bulbs cellulose, controls plant turgidity, maintains integrity of the cell membranes and reduces water loss. Nitrogen sources differed significantly with respect to PLW at all the stages of storage. The highest cumulative physical loss of weight was due to urea as compared to sheep manure and FYM. The highest PLW due to application of urea might be due to higher moisture content of bulb. Whereas, sheep manure exhibited least PLW loss during storage. Similarly, Katung *et al.* (2005) reported lowest PLW in onion by the application of sheep manure.

Loss due to Rotting

The rotting loss was least with potassium sources. This was attributed to potential activity of potassium against the rotting of the bulbs. Potassium is as an essential elements and it plays vital role in plant nutrition and reduces water requirement (Wayse, 1967). The rotting loss was highest due to application of urea than organic sources like sheep manure and FYM. This may be attributed to higher moisture content of bulb by urea. Whereas, sheep manure exhibited significantly least rotting loss which might be due to presence of trace elements which helped to withstand rotting indicating the key role of nitrogen source to counteract the rotting losses during storage. The beneficial effect of sheep manure in reducing the post harvest rotting of horticultural crops have been reported by Patil (1995) in onion, Krishna (2002) in tomato and Suresh (1997) in garlic.

Loss due to Sprouting

There was no significant difference with respect to sprouting loss of onion during storage. However, onion fed with sulphate of potash resulted in lesser sprouting than muriate of potash. Potassium results less sprouting loss during storage due to its role in controlling plant turgidity, it maintains the integrity of the cell membranes and reduces water loss Faten *et al.* (2010). Urea exhibited highest sprouting loss followed by ammonium sulphate, this might be due to higher moisture content of bulb during storage. Whereas, onion grown with sheep manure resulted significantly less sprouting losses reflecting proper source of nutrients for better availability of nitrogen. Similar results have been reported by Patil (1995). The rate of sprouting increased with the storage period was in conformity with the results obtained by Kukanoor (2005).

Total Loss

Potassium sources did not show significant difference with respect to total loss of onion. However, the marginally loss was observed in the bulbs that were supplied with sulphate of potash than muriate of potash during storage. Similar results have been expressed by Faten *et al.* (2010) with respect total loss. Urea recorded highest total loss during storage followed by ammonium sulphate, normally it is perceived that the application of urea tends to develop soft tissue with higher moisture content which predisposes the bulbs to sprouting and rotting and hence causes higher storage loss in onion (Vishnu Shukla *et al.*, 1986 and Gopalkrishna and Srinivas, 1990). The sheep manure exhibited least total loss in onion during storage. Beneficial effect of sheep manure resulting in low sprouting, rotting and total storage losses was attributed to their composition of certain amount of essential micronutrients. Similar result was reported by Sankar *et al.* (2005) with the application of organic sources of nutrients.

Total Soluble Solid

The total soluble solids were highest due to application of sulphate of potash, which was due to the increased uptake of nutritional elements (N, P, K, S and other trace elements) with the addition of the potassium sulphate. Also, potassium has a major role in plant metabolism of carbohydrates. These results are in agreement with the findings of El-Bassiony

Table 1
Effect of nitrogen and potassium sources on physiological loss of weight (%) during storage

NSources (S)	*Potassium sources (M)*																	
	15 DAS			*30 DAS*			*45 DAS*			*60 DAS*			*75 DAS*			*90 DAS*		
	M1	*M2*	*Mean*	*M1*	*M2*	*Mean*	*M1*	*M2*	*Mean*	*M1*	*M2*	*Mean*	*M1*	*M2*	*Mean*	*M1*	*M2*	*Mean*
S1	7.14	6.98	**7.06**	13.07	11.43	**12.25**	14.86	14.34	**14.60**	22.95	22.03	**22.49**	26.00	25.83	**25.92**	26.01	25.87	**25.94**
S2	6.30	5.77	**6.03**	12.00	10.25	**11.13**	14.07	13.88	**13.98**	22.04	21.40	**21.72**	25.56	24.33	**24.95**	24.87	24.44	**24.65**
S3	3.76	3.33	**3.55**	8.35	6.90	**7.63**	11.62	11.40	**11.51**	15.41	15.53	**15.47**	18.63	18.52	**18.57**	20.67	20.33	**20.50**
S4	5.09	4.28	**4.69**	10.22	8.28	**9.25**	13.67	12.47	**13.07**	16.74	16.89	**16.82**	19.67	20.31	**19.99**	21.33	21.08	**21.21**
Mean	5.57	5.09	5.53	10.91	9.22	10.06	13.55	13.02	13.29	19.28	18.97	19.12	22.46	22.25	22.25	23.22	22.93	23.07
	SE±	CD (0.01)		SE±	CD (0.01)		SE±	CD (0.01)		SE±	CD (0.01)		SE±	CD (0.01)		SE±	CD (0.01)	
M	0.12	NS		0.27	NS		0.26	NS		0.17	NS		0.11	NS		0.18	NS	
S	0.17	0.67		0.38	1.32		0.24	0.97		0.22	0.80		0.24	0.78		0.21	0.76	
M × S of sub-plots at the same level of main plot	0.25	NS		0.53	NS		0.34	NS		0.32	NS		0.34	NS		0.29	NS	
M × S of main plots at the same level of sub-plots	0.30	NS		0.53	NS		0.34	NS		0.32	NS		0.32	NS		0.31	NS	

NS: Non-significant
DAS : Days after storage
M1: Muriate of potash
M2: Sulphate of potash
S1: Urea
S2: Ammonium sulphate
S3: Sheep manure
S4: FYM

Table 2
Effect of nitrogen and potassium sources on rotting of bulbs (%) during storage

NSources (S)	*Potassium sources (M)*																	
	15 DAS			*30 DAS*			*45 DAS*			*60 DAS*			*75 DAS*			*90 DAS*		
	M1	*M2*	*Mean*	*M1*	*M2*	*Mean*	*M1*	*M2*	*Mean*	*M1*	*M2*	*Mean*	*M1*	*M2*	*Mean*	*M1*	*M2*	*Mean*
S1	2.41	1.74	**2.08**	3.85	3.82	**3.84**	7.72	7.53	**7.62**	13.33	12.79	**13.06**	18.21	18.50	**18.35**	18.80	18.28	**18.54**
S2	2.16	1.91	**2.03**	3.44	3.28	**3.36**	7.42	7.22	**7.32**	12.60	12.04	**12.32**	17.82	17.24	**17.53**	17.80	16.87	**17.34**
S3	0.92	0.91	**0.92**	2.00	1.96	**1.98**	5.42	4.60	**5.01**	8.63	8.08	**8.36**	11.58	10.75	**11.17**	16.57	15.34	**15.96**
S4	0.97	0.93	**0.95**	2.03	2.11	**2.07**	5.63	5.42	**5.53**	9.83	9.70	**9.77**	13.52	12.84	**13.18**	18.01	16.60	**17.30**
Mean	1.62	1.37	1.49	2.83	2.79	2.81	6.55	6.19	6.37	11.10	10.65	10.88	15.28	14.83	15.06	17.80	16.77	17.28
	SE±	CD (0.01)		SE±	CD (0.01)		SE±	CD (0.01)		SE±	CD (0.01)		SE±	CD (0.01)		SE±	CD (0.01)	
M	0.08	NS		0.020	NS		0.08	NS		0.07	NS		0.04	NS		0.21	NS	
S	0.16	0.52		0.075	0.32		0.21	0.66		0.45	1.37		0.27	0.83		0. 26	0.87	
M × S of sub-plots at the same level of main plot	0.23	NS		0.106	NS		0.30	NS		0.64	NS		0.39	NS		0.37	NS	
M × S of main plots at the same level of sub-plots	0.21	NS		0.094	NS		0.27	NS		0.54	NS		0.33	NS		0.31	NS	

NS: Non-significant
DAS : Days after storage
M1: Muriate of potash
M2: Sulphate of potash
S1: Urea
S3: Sheep manure
S2: Ammonium sulphate
S4: FYM

Table 3
Effect of nitrogen and potassium sources on sprouting of bulbs (%) during storage

NSources (S)	*Potassium sources (M)*																	
	15 DAS			*30 DAS*			*45 DAS*			*60 DAS*			*75 DAS*			*90 DAS*		
	M1	*M2*	*Mean*	*M1*	*M2*	*Mean*	*M1*	*M2*	*Mean*	*M1*	*M2*	*Mean*	*M1*	*M2*	*Mean*	*M1*	*M2*	*Mean*
S1	2.07	2.17	**2.12**	3.22	3.15	**3.19**	6.20	5.83	**6.02**	6.42	6.30	**6.36**	9.03	8.95	**8.99**	9.34	9.40	**9.37**
S2	2.00	2.00	**2.00**	3.11	2.84	**2.98**	5.93	5.92	**5.93**	6.20	6.17	**6.18**	8.63	8.75	**8.69**	8.95	8.92	**8.93**
S3	1.28	1.22	**1.25**	2.46	2.28	**2.37**	3.37	3.33	**3.35**	3.93	3.97	**3.95**	6.40	5.54	**5.97**	7.33	5.67	**6.50**
S4	1.57	1.47	**1.52**	2.50	2.33	**2.42**	3.77	3.70	**3.74**	5.73	5.38	**5.56**	6.00	6.30	**6.15**	7.33	8.00	**7.67**
Mean	1.73	1.71	1.72	2.82	2.65	2.74	4.82	4.70	4.76	5.57	5.45	5.51	7.52	7.38	7.45	8.24	8.00	8.12
	SE±	CD (0.01)		SE±	CD (0.01)		SE±	CD (0.01)		SE±	CD (0.01)		SE±	CD (0.01)		SE±	CD (0.01)	
M	0.03	NS		0.06	NS		0.08	NS		0.21	NS		0.07	NS		0.12	NS	
S	0.12	0.37		0.07	0.26		0.08	0.34		0.24	0.88		0.18	0.59		0.26	0.78	
M × S of sub-plots at the same level of main plot	0.17	NS		0.10	NS		0.15	NS		0.34	NS		0.26	NS		0.37	NS	
M × S of main plots at the same level of sub-plots	0.15	NS		0.11	NS		0.16	NS		0.36	NS		0.24	NS		0.34	NS	

NS: Non-significant; M1: Muriate of potash; S1: Urea; S2: Ammonium sulphate
DAS : Days after storage; M2: Sulphate of potash; S3: Sheep manure; S4: FYM

Table 4
Effect of nitrogen and potassium sources on total loss of bulbs (%) during storage

Treatments	*15 DAS*	*30 DAS*	*45 DAS*	*60 DAS*	*75 DAS*	*90 DAS*
Main plot						
Muriate of potash	8.90	16.52	24.92	35.38	45.26	49.25
Sulphate of potash	8.20	14.47	23.91	35.60	44.53	47.83
SE±	0.15	0.20	0.17	0.32	0.15	0.33
CD (0.05)	NS	NS	NS	NS	NS	NS
Sub-plot						
Urea	11.26	19.27	28.24	41.91	53.26	53.85
Ammonium sulphate	10.07	17.46	27.22	40.22	51.17	50.92
Sheep manure	5.71	11.45	19.87	27.72	35.85	43.22
FYM	7.15	13.80	22.33	32.10	39.32	46.18
SE±	0.25	0.42	0.41	0.32	0.48	0.45
CD (0.05)	0.84	1.92	1.31	1.26	1.51	1.59
Interaction						
Muriate of potash × Urea	11.63	20.14	28.78	42.70	53.24	54.15
Muriate of potash × Ammonium sulphate	10.46	18.55	27.42	40.84	52.01	51.61
Muriate of potash × Sheep manure	5.92	12.57	20.40	26.56	36.61	44.57
Muriate of potash × FYM	7.58	14.84	23.07	31.44	39.18	46.67
Sulphate of potash × Urea	10.89	18.40	27.70	41.12	53.28	53.54
Sulphate of potash × Ammonium sulphate	9.67	16.37	27.02	39.61	50.32	50.23
Sulphate of potash × Sheep manure	5.50	10.33	19.34	28.89	35.08	41.86
Sulphate of potash × FYM	6.72	12.75	21.59	32.77	39.45	45.68
SE±	0.35	0.59	0.58	0.45	0.68	0.63
CD (0.05)	NS	NS	NS	NS	NS	NS

DAS**:** Days after storage
NS: Non-significant

(2006), Singh and Singh (2000) and Varadhi and patel (1993). Nitrogen sources *viz.,* ammonium sulpahte, urea, sheep manure and FYM increase the total soluble solids. Highest total soluble solids were recorded due to application of ammonium sulphate. This is due to both nitrogen and sulphur content in ammonium sulphate which increases the uptake of major and trace elements, which results in high soluble solids. The increase in the total soluble solid due to application of sulphur was reported by Kumar and Singh (1992).

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Table 5
Effect of potassium and nitrogen sources on TSS level (^{0}brix) during storage

NSources (S)	*Potassium sources (M)DAS (Days after storage)*																	
	15 DAS			*30 DAS*			*45 DAS*			*60 DAS*			*75 DAS*			*90 DAS*		
	M1	*M2*	*Mean*	*M1*	*M2*	*Mean*	*M1*	*M2*	*Mean*	*M1*	*M2*	*Mean*	*M1*	*M2*	*Mean*	*M1*	*M2*	*Mean*
S1	13.83	14.67	**14.25**	13.93	14.76	**14.35**	13.63	14.12	**13.88**	12.75	13.62	**13.18**	12.47	13.35	**12.91**	12.20	13.05	**12.63**
S2	15.58	16.55	**16.07**	15.81	16.72	**16.26**	15.23	16.12	**15.55**	14.63	15.62	**15.13**	14.42	15.38	**14.90**	14.12	15.02	**14.57**
S3	15.00	15.78	**15.39**	15.18	15.94	**15.56**	14.68	15.41	**15.05**	13.97	14.73	**14.35**	13.70	14.50	**14.10**	13.40	14.20	**13.80**
S4	14.45	15.28	**14.87**	14.58	15.39	**14.99**	14.87	15.31	**15.09**	14.05	14.55	**14.30**	13.63	14.27	**13.95**	13.30	13.93	**13.62**
Mean	14.72	15.57	15.14	14.88	15.70	15.29	14.54	15.24	14.89	13.85	14.63	14.24	13.55	14.38	13.96	13.25	14.05	13.65
	SE±	CD (0.01)		SE±	CD (0.01)		SE±	CD (0.01)		SE±	CD (0.01)		SE±	CD (0.01)		SE±	CD (0.01)	
M	0.04	0.53		0.04	0.53		0.03	0.48		0.13	NS		0.11	NS		0.11	NS	
S	0.06	0.25		0.06	0.27		0.22	1.17		0.25	1.41		0.21	0.70		0.20	0.57	
M × S of sub-plots at the same level of main plot	0.08	NS		0.09	NS		0.31	NS		0.35	NS		0.30	NS		0.29	NS	
M × S of main plots at the same level of sub-plots	0.08	NS		0.09	NS		0.27	NS		0.33	NS		0.28	NS		0.27	NS	

NS: Non-significant M1: Muriate of potash S1: Urea S2: Ammonium sulphate
M2: Sulphate of potash S3: Sheep manure S4: FYM

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