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Field performance and storage losses of onion (*Allium cepa* L.) under Coastal Saline Zone of West Bengal

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Abstract

In West Bengal (India), onions are mainly cultivated during the Rabi season. The Coastal Saline Zone of West Bengal is a non-traditional onion growing belt. An experiment was conducted to study the production and storage performance of onion cultivars in this region with the broader aim of understanding the suitability of this region for commercial onion cultivation. Sixteen short-day onion cultivars were grown and assessed for their yield and storage performance during the Rabi season. Variation among the onion cultivars was noted for observed field and storage traits. Onion cultivars Agrifound Light Red, Bhima Shakti, Sukhsagar, NHRDF Red-2, Pusa white Flat, NHRDF Red-3, Bhima Kiran, and N-53 out yielded others. Average physiological loss in weight, rotting, sprouting and total loss was registered 33.6, 24.8, 1.3 and 59.7%, respectively, after 180 days of storage. Onion cultivars recorded 20.0 to 99.6 % total losses after six months of storage. Cultivar Sukhsagar was found to be suitable for extended storage.

Key words: *Allium cepa,* cultivars, yield, PLW, storage, onion

Introduction

Onion (*Allium cepa* L.) is a bulbous vegetable crop belongs to family Alliaceae. Unlike other vegetables, it can be kept for a fairly long period. As compared to other vegetables, it can withstand the hazards of rough handling and long distance transport. In India, three main seasons, *Kharif* (monsoon), *Late Kharif* and *Rabi* (winter) contribute 20, 20 and 60 %, respectively, to the total onion production. India produced 23262.33 thousand metric tons of onion from 1284.99 thousand ha in 2017-18. During this period, the annual demand for onion was 20531 thousand metric tons. Besides meeting domestic need, a sizeable quantity of onion is being exported from India. India's recent export of onion during 2017-2018 was 1588985.71 MT which valued of 308882.23 lacs (Ministry of Agriculture & Farmers' Welfare, 2018). Among the total onion production in India, about 71 % is used for domestic consumption, 20 % goes as waste during storage and handling, 5 % is used for export, 3 % for processing and 1 % bulbs are used for seed production (Singh *et al.*, 2017). In India, Maharashtra contributes nearly 38.06 % of the total production of onion. On the other hand, West Bengal has only 2.72 % production share (633.60 thousand MT) and 2.74 % area share (35.20 thousand ha) among the Indian States (Ministry of Agriculture & Farmers' Welfare, 2018). West Bengal is onion deficient State. As West Bengal produce mostly *Rabi* crop, it extremely depends upon supply from other States during lean period *i.e.*, July to February. Deficit in supply during this period is responsible for the higher market prices. In Kolkata market, there is a trend of price rise from June onwards and it lowers during March-April every year (Dhar *et al.,* 2016). This situation leads to explore the scope of onion cultivation during *Kharif* season and storage of *Rabi* onion in West Bengal. *Rabi* onions have more ability to store and thus widely used for domestic, export and seed bulbs purposes. In West Bengal major produce comes during the month of March-April mostly as *Rabi* crop. Thus, creation of sufficient storage structures for *Rabi* crop may lead to increase the period of availability beyond June in West Bengal (Dhar *et al.,* 2016).

Murshidabad, Hooghly, Midnapur (West), Nadia and 24 Paraganas (North) are the major onion producing Districts of West Bengal (Ministry of Agriculture & Farmers' Welfare, 2018). Locally adopted *Rabi* cultivar Sukhsagar has the major area coverage under West Bengal. Recently many new onion varieties were developed by various public institutes and private seed companies in India. However, their production and storage performance has mostly not been assessed in West Bengal. The South 24 Parganas (Sundarbans) has complex-divers-risk prone Agro-ecosystem which comes under the Coastal Saline Zone of West Bengal. Here, Agriculture is the mainstay of livelihood for majority of the people. Non availability of area specific technology hinders the efficient utilization of natural resources in this region. This is a non-traditional onion growing area. However, farmers grow onion in small plots for their homestead uses during *rabi* season. Rice fallow non-saline /slightly saline soils are normally used for onion cultivation. Farmers' often complains for low productivity and high storage losses.

It is known that onion is a relatively salt sensitive crop. Salts influence bulbing and the quality of the bulbs harvested. Under saline soils conditions the reduced water supply of crops is the most critical growth factor. The permeability of cell walls of onion plants to solutes and water is deferentially reduced by stresses such as salinity. It is postulated that short root hair of onion contribute to a lower salt tolerance, whereas long root hairs of other crop enhance water uptake from saline soils (Schleiff,

2008). Salts cause alterations in key physiological processes, due to the salt-induced osmotic stress and the specific ionic effect, which in turn result in water deficit, ionic toxicity and plant nutritional imbalances (García *et al.,* 2020). Cultivar variation in onion for salt concentration was reported by Correa *et al.* (2013) and Hussein and El-Faham (2018). Sudha & Riazunnisa (2015) identified Agrifound White as tolerant one and LINE - 28 as susceptible to salt stress. García *et al.* (2020) suggested that the lower sensitivity to salt in some onion genotypes could be related to a better performance of the antioxidant machinery under salinity conditions. They elaborated that as salt stress being first perceived by the root system, the root apoplastic antioxidant defenses were enhanced in the salt-resistant genotype compared to the salt-sensitive genotype. El-baky *et al.* (2003) compared the degree of lipid peroxidation, CAT, SOD and POX enzymes behaviour and glutathione content in leaves of three onion varieties under saline conditions and they found that the most tolerant cultivar showed an increased antioxidant capacity.

A reasonable scope lays for the increase IN area under onion cultivation and thereafter storing the crop in this region. A non-formal survey revealed that farmers mostly use non-descriptive varieties for cultivation. The onion productivity can be increased by selection of improved cultivar and good management practices. Varietal performance often governed by adaptation to a particular environmental condition. Therefore, selection of improved cultivars with reasonable productivity was felt necessary. Again, identification of onion cultivars able to maintain productivity at low or moderate levels of salt stress may provide a cost-effective solution to this region. Considering the above aspects the present experiment was carried out with the objective to study the field and storage performance of different onion cultivars under Coastal Saline Zone of West Bengal.

Materials and methods

This experiment was carried out in Seed Farm of Ramkrishna Ashram Krishi Vigyan Kendra, Nimpith, South 24 Parganas (West Bengal) during *Rabi* season of 2014-15. The experimental field was situated between 22^0 09' 30'' North latitude and 88^0 26' 22'' East longitude with an average altitude of 25 m above mean sea level. The area comes under the humid, coastal saline belt of Sundarban (West Bengal) which located in the south-eastern part of India. The soil of the experimental field was saline having medium drainage capacity and uniform in texture. The soil of the experimental site had pH 6.58, EC 1.74 dS m^{-1} and organic carbon content 0.66 %. The available nitrogen, phosphorus, potassium content was found to be 424.29 kg ha^{-1}, 56.52 kg ha^{-1} and 321.72 kg ha^{-1}.

Sixteen short day *Rabi* season cultivars (Arka Kalyan, Arka Niketan, Agrifound Light Red, NHRDF Red, NHRDF Red – 2, NHRDF Red – 3, Sukhsagar, N- 53, Bhima Shakti, Bhima Kiran, Early Grano, Pusa White Flat, Pusa Madhavi, Pusa White Round, Pusa Ridhi and Superior Light Red) were grown in Randomized Complete Block Design with three replications. Fifty days old healthy seedlings were transplanted in the field on 23.12.2014 in 3.0 m x 2.0 m plots with 15 cm x 10 cm spacing. FYM @ 10 t ha^{-1} and N: P: K @ 125:100:100 kg ha^{-1} were applied to grow the crop. Observations were taken for plant height, number of leaves, neck diameter, polar and equatorial diameter, average bulb weight and bulb yield. For storage experiment, harvested onions were field cured for two days followed by shade cured for seven days. Then top portions were removed and five kilogram bulbs of each genotype were stored separately in perforated high grade polyethylene baskets in traditional store at ambient condition. Storage observations like, physiological loss in weight, rotting and sprouting were taken at monthly interval up to six months. The percent weight loss, rotting loss and sprouting loss were calculated using the following equations:

PLW (%) = [{Initial weight (kg) – Final weight (kg)} / Initial weight (kg)] x 100

Rotting (%) = [Rotted onions weight (kg) / Total weight of sample (kg)] x 100

Sprouting (%) = [Sprouted onions weight (kg) / Total weight of sample (kg)] x 100

The total loss at storage of onion calculated on monthly basis up to 180 days of storage by calculating the cumulative losses using the following formula:

Total losses (%) = PLW (%) + Rotting (%) + Sprouting (%)

The total variation among genotypes for different characters was tested for significance by 'F' test using analysis of variance technique. The statistical analysis was performed by using computer software programme INDOSTAT 8.1 (developed by Indostat services, Hyderabad, India).

Results and discussion

Analysis of variance for plant height, neck diameter, polar and equatorial diameter, average bulb weight, bulb yield, PLW (%), rotting (%) and sprouting (%) and total loss in store (%) revealed that cultivars were significantly differing among themselves. However, onion cultivars were not differed for number of leaves per plant. Maximum plant height was noted in Pusa White Flat which was found statistically similar to Early Grano and NHRDF Red-2. Correlation studies indicated positive association between onion bulb yield and the plant height of onion (Chattoo *et al.,* 2015). Neck diameter varied from 10.2 to 13.2 mm. Bulb yield have positive and significant association with bulb neck thickness (Gurjar and Singhania, 2006). Maximum neck diameter was noted in NHRDF Red-2 which was found statistically similar to NHRDF Red-3, Pusa Madhavi, Agrifound Light Red, Early Grano, Bhima Kiran. On the other hand, neck diameter is an important parameter that determines the storage potential of onion. Thin necked cultivars of onion have more storability than thick neck cultivars (Mandal *et al.,* 2019). Minimum neck diameter was noted in Arka Kalyan which was found statistically similar to Pusa White Round and Pusa Ridhi. Bulb thickness and bulb weight are important yield attributes in onion.

Bulb yield expressed positive and significant association with bulb neck thickness, bulb weight, equatorial and polar bulb diameter (Gurjar and Singhania, 2006). Bulb equatorial and polar diameter varied from 34.6 to 49.7 mm and 39.4 to 51.6 mm respectively. Maximum equatorial diameter was noted in Agrifound Light Red which was found statistically similar to Sukhsagar, N-53 and Pusa Madhvi; while maximum polar diameter of bulb was noted in Sukhsagar. Sukhsagar also produced maximum average bulb weight among the studied cultivars. Bulb yield was differing from 54.2 to 129.1 q ha^{-1} with mean 101.1 q ha^{-1}. Maximum bulb yield was noted in Agrifound Light Red which was found statistically similar to Bhima Shakti, Sukhsagar, NHRDF Red-2, Pusa

Table 1. Growth and yield attributes on onion cultivars

Genotype	Plant height (cm)	Leaf number	Neck diameter (mm)	Equatorial diameter (mm)	Polar diameter (mm)	Average bulb weight (g)	Yield (q ha^{-1})
Arka Kalyan	57.4^{efg}	6.9	10.2^{f}	43.2^{cdef}	43.7^{cd}	51.4^{c}	104.1^{bcd}
Arka Niketan	59.2^{bcde}	7.0	11.5^{cde}	43.8^{cde}	46.7^{b}	40.7^{gh}	104.3^{bcd}
Agrifound Light Red	58.8^{cdef}	6.4	12.7^{ab}	49.7^{a}	46.6^{b}	43.3^{fg}	129.1^{a}
NHRDF Red	59.1^{bcde}	7.1	11.9^{bcd}	42.6^{def}	44.1^{bcd}	46.9^{de}	83.3^{de}
NHRDF Red-2	60.6^{abc}	6.6	13.2^{a}	43.6^{cdef}	44.5^{bc}	40.6^{gh}	114.1^{abc}
NHRDF Red-3	58.7^{cdef}	6.7	13.1^{a}	46.2^{bc}	44.2^{bc}	58.1^{b}	109.6^{abc}
Sukhsagar	59.6^{bcd}	6.3	11.8^{bcd}	48.4^{ab}	51.6^{a}	76.8^{a}	119.1^{abc}
N-53	58.6^{def}	6.8	11.9^{bcd}	46.6^{abc}	44.9^{bc}	50.3^{cd}	105.2^{abcd}
Bhima Shakti	59.2^{bcde}	6.4	11.4^{cde}	44.5^{cde}	46.6^{b}	39.6^{h}	125.1^{ab}
Bhima Kiran	59.8^{bcd}	6.6	12.3^{abc}	45.7^{bcd}	46.8^{b}	38.8^{h}	105.8^{abcd}
Early Grano	61.0^{ab}	6.5	12.6^{ab}	40.3^{f}	41.3^{d}	52.5^{c}	71.9^{e}
Pusa White Flat	62.0^{a}	6.9	11.7^{bcd}	41.4^{ef}	45.8^{bc}	51.9^{c}	111.2^{abc}
Pusa Madhabi	59.2^{bcde}	6.6	13.1^{a}	46.3^{abc}	45.5^{bc}	39.4^{h}	102.4^{bcd}
Pusa White Round	57.4^{efg}	6.7	10.9^{def}	35.3^{g}	43.3^{cd}	39.1^{h}	54.2^{f}
Pusa Ridhi	56.9^{fg}	6.6	10.6^{ef}	34.6^{g}	39.4^{e}	41.8^{fgh}	82.6^{de}
Superior Light Red	56.4^{g}	6.8	11.7^{bcd}	41.8^{ef}	43.2^{cd}	44.2^{ef}	95.8^{cde}
Mean	59.0	6.7	11.9	43.4	44.9	47.2	101.1
CD (P=0.05)	1.9	NS	1.0	3.4	2.8	3.4	24.2

Note: Similar alphabets in a column denote that they are statistically at par.

Table 2. Physiological loss in weight (%) of onion cultivars during storage

Genotype	30 days	60 days	90 days	120 days	150 days	180 days
Arka Kalyan	6.2^{c}	12.6^{cde}	14.9^{bc}	17.6^{b}	21.7^{b}	31.6^{ef}
Arka Niketan	2.9^{a}	9.8^{bc}	14.9^{bc}	21.5^{c}	21.7^{b}	28.8^{cd}
Agrifound Light Red	1.5^{a}	6.3^{b}	14.1^{b}	18.2^{b}	24.6^{c}	29.4^{cde}
NHRDF Red	14.9^{g}	19.3^{h}	21.4^{fg}	23.3^{cde}	23.3^{bc}	34.5^{gh}
NHRDF Red-2	9.6^{de}	19.1^{h}	26.3^{h}	32.2^{h}	34.1^{g}	36.3^{h}
NHRDF Red-3	12.0^{f}	15.6^{fg}	19.7^{ef}	23.0^{cd}	25.2^{c}	28.2^{c}
Sukhsagar	1.5^{a}	2.8^{a}	7.4^{a}	12.7^{a}	15.6^{a}	20.0^{b}
N-53	11.0^{ef}	17.7^{gh}	18.9^{de}	25.4^{def}	30.1^{de}	47.0^{k}
Bhima Shakti	10.2^{de}	15.2^{ef}	21.6^{fg}	23.9^{cde}	28.0^{d}	39.3^{j}
Bhima Kiran	10.6^{ef}	13.7^{def}	16.9^{cd}	22.8^{cd}	23.4^{bc}	32.3^{fg}
Early Grano	3.8^{b}	11.3^{cd}	14.1^{b}	27.5^{fg}	30.7^{e}	35.9^{h}
Pusa White Flat	9.6^{de}	11.6^{cd}	13.0^{b}	14.9^{a}	16.4^{a}	18.6^{b}
Pusa Madhavi	8.8^{d}	22.7^{i}	28.2^{h}	29.4^{g}	31.2^{e}	53.6^{l}
Pusa White Round	13.9^{g}	17.1^{gh}	21.4^{fg}	27.7^{fg}	30.7^{e}	30.9^{def}
Pusa Ridhi	14.8^{g}	18.5^{h}	20.6^{efg}	26.9^{f}	31.8^{ef}	32.1^{fg}
Superior Light Red	10.5^{e}	18.3^{gh}	22.4^{g}	25.8^{ef}	33.4^{fg}	38.9^{ij}
Mean	8.9	14.5	18.5	23.3	26.4	33.6
CD (P=0.05)	1.4	2.7	2.0	2.6	2.1	2.5

Note: Similar alphabets in a column denote that they are statistically at par.

Table 3. Rotting (%) and sprouting (%) of onion cultivars during storage

Genotype	Rotting (%)				Sprouting (%)
	30 days	60 days	90 days	120 days	30 days
Arka Kalyan	0.0^{a}	19.7^{fgh}	28.2^{i}	30.2^{i}	11.7^{b}
Arka Niketan	0.0^{a}	2.3^{b}	4.4^{b}	6.3^{b}	0.0^{a}
Agrifound Light Red	2.5^{b}	12.1^{d}	14.3^{c}	16.4^{cd}	0.0^{a}
NHRDF Red	4.3^{bc}	18.4^{f}	26.2^{ghi}	33.8^{j}	0.0^{a}
NHRDF Red-2	6.8^{c}	18.9^{fgh}	24.4^{fg}	26.1^{g}	0.0^{a}
NHRDF Red-3	11.0^{f}	21.5^{gh}	25.6^{gh}	29.4^{hi}	0.0^{a}
Sukhsagar	0.0^{a}	0.0^{a}	0.0^{a}	0.0^{a}	0.0^{a}
N-53	6.7^{de}	8.7^{c}	14.8^{cd}	16.7^{de}	0.0^{a}
Bhima Shakti	13.5^{g}	15.6^{e}	17.6^{de}	19.5^{f}	0.0^{a}
Bhima Kiran	4.5^{bcd}	15.3^{e}	19.4^{e}	19.4^{f}	0.0^{a}
Early Grano	50.5^{j}	59.4^{j}	63.7^{k}	63.7^{l}	0.0^{a}
Pusa White Flat	27.1^{i}	33.8^{i}	40.3^{j}	44.5^{k}	0.0^{a}
Pusa Madhavi	18.2^{h}	22.1^{h}	27.5^{hi}	36.3^{j}	0.0^{a}
Pusa White Round	6.5^{cde}	21.0^{fgh}	22.9^{f}	26.5^{g}	0.0^{a}
Pusa Ridhi	10.6^{f}	20.8^{fgh}	24.8^{fg}	24.8^{g}	0.0^{a}
Superior Light Red	0.0^{a}	2.0^{b}	4.0^{b}	4.0^{b}	9.0^{a}
Mean	10.1	18.2	22.4	24.8	1.3
CD (P=0.05)	2.2	2.6	2.2	2.7	1.1

Note: Similar alphabets in a column denote that they are statistically at par.

white Flat, NHRDF Red-3, Bhima Kiran and N-53. In West Bengal condition, performance variation among cultivars was reported by several researchers (Haldar *et al.*, 2009; Mohanta and Mandal 2014; Behera *et al.,* 2017; Mohanta *et al.,* 2017; Dhar *et al.*, 2019; Mandal *et al,.* 2019). Haldar *et al.* (2009) suggested Baswant 780, Agrifound Dark Red, Arka Pragati and Phule Safed suitable under early rabi condition in the Gangetic plain of West Bengal. Behera *et al.* (2017) identified Sukhsagar, Bhima Shakti and Bhima Shweta, while Mandal *et al.* (2019) suggested Sukhsagar, N-53 and Bhima Shakti for *Rabi* season under Red and Laterite Zone of West Bengal. Relatively less yield response (overall mean 10.1 MT ha^{-1}) was noted in this experiment as compared to onion productivity of West Bengal (18.0 MT ha^{-1}) and India (18.1 MT ha^{-1}) (Ministry of Agriculture & Farmers' Welfare, 2018). Lower yield of onion may be due to salinity of the experimental field (EC 1.74 dS m^{-1}). Wannamaker and Pike (1987) noted significant reduction in growth and yield in onions at 1.4 dS m^{-1}. Similarly, Sta-Baba *et al.* (2010) observed 25 and 50 % yield reduction in onion at 2.0 and 2.9 dS m^{-1} of salinity, respectively. Separate in-depth research is needed to know the effect of soil salinity on onions in this region.

Uninterrupted supply of quality onion bulbs to meet year-round market demand is dependent on maintaining dormancy and bulb quality during storage. Harvested onion bulbs undergoes several physio-chemical changes like increase in respiration, physiological loss in weight (PLW), rotting and sprouting, and chemical changes in stored of onions include dry matter content, pungency, abscisic acid and fructans concentration (Shiva Kumar and Chandrasekhar, 2014). Water loss, sprout loss and disease loss were the major storage loss variables responsible for onion losses during storage. The data on physiological loss in weight (%), rotting (%) and sprouting (%) and total losses (%) has been presented in Table 2, 3 and 4 respectively. The PLW (%) varied from 1.5 to 14.9 %, 2.8 to 22.7 %, 7.4 to 28.2 %, 12.7 to 32.2 %, 15.6 to 34.1 % and 18.6 to 53.6 % at 30, 60, 90, 120, 150 and 180 days after storage (DAS), respectively. At 30 DAS, minimum PLW (%) was recorded in Sukhsagar and Agrifound Light Red;

Table 4. Total loss in weight (%) of onion cultivars during storage

Genotype	30 days	60 days	90 days	120 days	150 days	180 days
Arka Kalyan	17.9^{cde}	44.0^{g}	54.8^{jk}	59.5^{f}	63.6^{h}	73.5^{h}
Arka Niketan	2.9^{a}	12.1^{b}	19.3^{b}	27.8^{a}	27.9^{b}	35.1^{a}
Agrifound Light Red	4.1^{a}	18.4^{c}	28.4^{c}	34.6^{b}	41.0^{c}	45.8^{c}
NHRDF Red	19.2^{cde}	37.7^{f}	47.6^{gh}	57.1^{e}	57.1^{ef}	68.2^{g}
NHRDF Red-2	16.5^{bc}	38.0^{f}	50.7^{hi}	58.2^{ef}	60.1^{fg}	62.4^{f}
NHRDF Red-3	23.0^{eg}	37.2^{f}	45.3^{fg}	52.4^{d}	54.6^{e}	57.6^{e}
Sukhsagar	1.5^{a}	2.8^{a}	7.4^{a}	12.7^{a}	15.6^{a}	20.0^{a}
N-53	17.6^{bcd}	26.4^{d}	33.7^{d}	42.1^{c}	46.8^{d}	63.7^{f}
Bhima Shakti	23.7^{g}	30.8^{e}	39.3^{e}	43.4^{c}	47.5^{d}	58.8^{e}
Bhima Kiran	15.1^{b}	29.1^{de}	36.3^{de}	42.2^{c}	42.8^{c}	51.7^{d}
Early Grano	54.2^{j}	70.7^{h}	77.8^{l}	91.1^{g}	94.3^{j}	99.6^{j}
Pusa White Flat	36.6^{i}	45.4^{g}	53.3^{ij}	59.5^{f}	60.9^{gh}	63.2^{f}
Pusa Madhavi	27.0^{h}	44.8^{g}	57.0^{k}	65.7^{g}	67.5^{i}	89.9^{i}
Pusa White Round	20.5^{ef}	38.1^{f}	44.3^{f}	54.2^{de}	57.1^{ef}	57.3^{e}
Pusa Ridhi	25.4^{gh}	39.3^{f}	45.4^{fg}	51.7^{d}	56.6^{e}	56.9^{e}
Superior Light Red	19.5^{de}	29.3^{de}	35.4^{d}	38.8^{c}	46.4^{d}	51.9^{d}
Mean	20.3	34.0	42.3	49.4	52.5	59.7
CD (P=0.05)	2.7	4.2	3.2	3.6	3.1	2.8

Note: Similar alphabets in a column denote that they are statistically at par

while maximum PLW (%) was recorded in NHRDF Red, Pusa Ridhi and Pusa White Round. After six month of storage, minimum PLW (%) was recorded in Pusa White flat and Sukhsagar and maximum PLW (%) was recorded in Pusa Madhvi. It was clear from the data that PLW (%) increased as storage duration extended. The average PLW was found 8.9 % after one month of storage which increased to 33.6 % at the end of storage period. Over the time, onion cultivars Pusa White Flat and Sukhsagar recorded minimum PLW of about 20 % after six months of storage.

Rotting losses varied from 0.0 to 50.5 % at 30 DAS, 0.0 to 59.4 % at 60 DAS and 0.0 to 63.7 % at 90, 120, 150 and 180 DAS, respectively. Average rotting losses increased from 9.7 at 30 DAS to 24.8 % for 120 DAS. The data revealed that not a single bulb of the onion variety Sukhsagar rotted throughout the storage period of six months. This may be due to the inherent capability of this variety. Superior Light Red and Arka Niketan also performed well for this trait with a rotting percent of 4.0 and 6.3 after six months of storage, respectively. On the other hand, Early Grano recorded maximum rotting (%) throughout the storage period. The data also revealed that average percent rotting of bulb increased as the length of storage period increased from 30 to 120 DAS. After that no further rotting was observed up to the end of storage period *i.e.* 180 DAS. Sprouting was a problem in storage only for two onion varieties *viz.*, Arka Niketan and Superior Light Red. These two varieties showed sprouting loss after a month of storage. However, after that, no further sprouting loss was observed in these two varieties up to six months of storage. Other onion varieties were sprout free throughout the storing period.

Total storage losses were varied from 1.5 to 54.2 %, 2.8 to 70.7 %, 7.4 to 77.8 %, 12.7 to 91.1 %, 15.6 to 94.3 % and 20.0 to 99.6 % at 30, 60, 90, 120, 150 and 180 DAS, respectively. The average total storage loss varied from 20.3 to 59.7 % at 30 and 180 DAS, respectively. Thus total storage losses increased as storage duration increased. Nabi *et al.* (2013) found that the weight loss, sprouting and rotting percentage increased with increasing storage duration in onion. Ilic *et al.* (2009) noted that prolonged storage in ambient conditions caused a significant decrease in marketable bulbs, up to 40-60 %, and an increase of the amount of sprouted bulbs, up to 30-50 %. The present study revealed that onion variety Sukhsagar performed outstandingly well throughout the storage period. It recorded a storage loss of 20 % after six month of storage in ambient condition. Arka Niketan was the next best performer which registered 35.1 % total losses after the end of storage period. On the other hand, Early Grano, which recorded almost total loss (99.6 %) after six months of storage, was not at all suitable for storing.

Thus, it is concluded that onion cv. Sukhsagar can be suggested for this region due to its production performance as well as long term storage ability under Coastal Saline Zone of West Bengal. Other cultivars like Agrifound Light Red, Bhima Shakti, NHRDF Red-2, Pusa White Flat, NHRDF Red-3, Bhima Kiran and N-53 can also be tried in this region. However, Pusa White Flat, NHRDF Red-2 and NHRDF Red-3 should be marketed within a month of their harvesting. Agrifound Light Red, Bhima Shakti, Bhima Kiran and N-53 should be marketed within two months of their harvesting. Storing of bulbs after the designated time period may incur high storage losses for these cultivars.

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