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Varietal Screening of Short Day Onions (*Allium cepa* L.) under Coastal Saline Area

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ABSTRACT

Background: Onion is an economically important bulbous vegetable crop widely cultivated in India. Onion produced in West Bengal can only partially meet up its domestic need and thus extremely depends upon supply from other Indian States during lean period. Bringing more area under cultivation with improved varieties can boost the production and productivity of onion in West Bengal. The present situation leads to explore the scope of onion cultivation in non-traditional area. The objective of the study was to know the production and storage performance of onion varieties under Coastal Saline Zone of West Bengal, with the greater aim to explore this non-traditional onion growing area in future.

Methods: Sixteen short day onion varieties were evaluated in *Rabi* 2014-15 and 2015-16 in Ramkrishna Ashram KVK, Nimpith following Randomized Block Design with three replications. Eight field parameters, three laboratory parameters and four storage parameters were studied.

Result: Enough variation was noticed for different growth, yield, quality and storage attributes among the onion cultivars. The bulb yield, bulb weight, bulb equatorial and polar diameter was ranged from 62.8 to 124.5q/ha, 38.9 to 78.5 g, 32.5 to 47.6 cm and 34.7 to 47.3 cm respectively. The average TSS and pyruvic acid content was noted 12.7 ºBrix and 11.2 µmol/g respectively. After six month of storage in ambient condition, average PLW, rotting, sprouting and total losses was found 33.6%, 24.8%, 1.3% and 59.7% respectively. Among the varieties, Sukhsagar followed by Arka Niketan registered minimum storage losses of 20% and 35.1% at the end of storage period. Onion variety, Sukhsagar, Agrifound Light Red, Bhima Shakti, NHRDF Red-2, Pusa white Flat and NHRDF Red-3 were identified as top performers.

Key words: *Allium cepa*, Growth, Loss, PLW, Quality, Storage, Variety, Yield.

INTRODUCTION

Onion (*Allium cepa* L.) is an important bulbous vegetable grown all over the world. Onion is used to enhance flavour of different recipes. Its green leaves, immature and mature bulbs andimmature inflorescence are used as vegetable. Processed products onion like, flakes, powder, paste, crush and pickles reduces transport cost and storage losses. Onions are diuretic, applied on bruises, boils and wounds. It relieves heat sensation. Onion is useful for prevention and treatment of blood and heart diseases (Augusti, 1990). India is next to china in area and production of onion. In India, Maharashtra rank first in area and production of onion and it contributes nearly 38.06% of the total production of onion. On the other hand, West Bengal ranks eighth in area (35.20 thousand ha; 2.74% area share) and production (633.60 thousand MT; 2.72% production share) among the Indian States (Ministry of Agriculture and Farmers' Welfare, 2018). West Bengal is not self sufficient in onion production and it extremely depends upon supply from other Indian States during lean period. This situation leads to explore the scope of onion cultivation in non-traditional area. Again, in West Bengal, the productivity of onion is 18.0 MT/ha, which is *at par* with national average (18.01 tons/ha) but much lower than other major onion producing states (Ministry of Agriculture and Farmers' Welfare, 2018). The productivity can be increased by varietal replacement and good management practices. West Bengal produces mostly *rabi* onion. Thus, standardization of varieties for *rabi* season in West Bengal has immense utility. In this state the major produce comes from Murshidabad, Hooghly, Midnapur (West), Nadia and 24 Paraganas (North) (Ministry of Agriculture and Farmers' Welfare, 2018). Sukhsagar is an heirloom onion cultivar that exclusively cultivated in entire West Bengal. In recent past, however, many new onion varieties were developed by various public institutes in India. Similarly, private seed companies also introduce some onion cultivars. Variety performance plays an important role in the selection of genotypes for yield improvement and adaptation to particular environmental conditions (Dhar *et al.* 2019). Haldar *et al.* (2009) identified some early *rabi* season

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varieties suitable for growing under New Alluvial Zone (Gangetic plain) of West Bengal. Similarly Mohanta and Mandal (2014), Mohanta *et al.* (2017), Behera *et al.* (2017), Dhar *et al.* (2019) and Mandal *et al.* (2019) identified *rabi* and *kharif* onion cultivars under Red and Laterite Zone of West Bengal. However, information on performance of onion under Coastal Saline Zone of West Bengal is lacking.

The South 24 Parganas (Sundarbans) comes under Coastal Saline Zone of West Bengal. Here, Agriculture is the mainstay of livelihood for majority of the people. However, specific technology for efficient utilization of natural resources hinders the prospect of raising crop in this region. Here onion is not cultivated commercially. But farmers of this region traditionally grow onion in small area during *rabi* season to meet their domestic need. Farmers mostly use non-descriptive onion varieties for cultivation and they often complain for low productivity. Considering the above aspects the present experiments has been conducted with the objectives to evaluate the onion cultivars for their production performance and storage andto identify suitable type(s) for Coastal Saline Zone of West Bengal.

MATERIALS AND METHODS

The experiment was conducted at Seed Farm, Ramkrishna Ashram Krishi Vigyan Kendra, Nimpith, South 24 Parganas (West Bengal) during *Rabi* season of 2014-15 and 2015-16. Bio-chemical analysis was conducted in Laboratory of Department of Chemistry, Vivakananda Mahavidyalaya, Burdwan. The soil of the experimental field was saline (EC 1.74 dS/m) with medium drainage capasity, uniform texture and neutral in reaction (pH 6.58). The available nitrogen, phosphorus and potassium content was noted 424.29 kg/ha, 56.52 kg/ha and 321.72 kg/ha respectively. Sixteen short day onion 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 and assessed following Randomized Block Design with three replications. Onion seedlings were raised on permanent seedbeds. Fifty days old healthy seedlings of each cultivar were transplanted on 23rd December 2014 and 04th January 2015 in the main field on separate beds as per experiment design.Individual plot sizes were kept 3.0x2.0 m and plant spacing was given 15×10 cm. FYM @ 10 t/ha and N: P: K @ 125:100:100 kg/ha were applied to grow the crops. The observations were recorded for plant height (cm), number of leaves and neck diameter (mm) at 90 days after sowing. Observations were also taken for days to harvest, equatorial and polar diameter (mm), average bulb weight (g) and number of scales/bulb. Yield/ha was computed from the yield obtained per plot and express in quintal (q). Total soluble solids (TSS) content of bulb was estimated with the help of hand refractometer (Pocket Refractometer PAL 1, Atago, Tokyo; *www.atago.net/*). Pyruvic acid content of onion bulbs was tested by using Dinitrophenyl hydrazine (DNPH) reagent using the method of Schwimmer and Weston (1961) and expressed in µ mol/g fresh weight. After harvesting, five kilogram bulbs of each genotype were stored in a traditional store at ambient condition. Data on Physiological Loss in Weight (PLW), rotting and sprouting were taken after six months of storage using the following equation:

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

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

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

The total loss at storage calculated by cumulating all the losses using the following formula:

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

The total variation among cultivars for different characters was tested for significance by 'F' test using analysis of variance technique. The test of significance of difference between means of two genotypes for a character was done by 't' test and for that critical difference (CD) was calculated.

RESULTS AND DISCUSSION

Analysis of variance of 16 genotypes of onion for various traits revealed that cultivars were significantly differed among themselves. The range of plant height was noted 56.2 to 60.3 cm with mean 58.8 cm. The maximum plant height was noted in Bhima Kiran which was found statistically similar to NHRDF Red, Early Grano, NHRDF Red-2, Bhima Shakti, Arka Niketan, NHRDF Red-3, Pusa White Flat, Pusa Madhavi, Agrifound Light Red and N-53. The variation in plant height among different onion cultivars may be due to their different genetic makeup and adaptation ability to particular environment. Mandal *et al.* (2019) observed a wide range of variation in onion plant height (64.1 to 81.3 cm) in West Bengal condition. Correlationand path coefficient analysis studiesof Chattoo *et al.* (2015) indicated that plant height was positivelyassociatedwith bulb yield andit also had positive direct effect on total bulb yield of onion.Maximum number of leavesper plant was noted Arka Kalyan, Arka Niketan and N-53 which was found statistically similar to Agrifound Light Red, Pusa White Flat, Pusa White Round, Bhima Kiran, Pusa Ridhi, NHRDF Red-2, NHRDF Red, Superior Light Red and Pusa Madhavi. Through photosynthesis leaves converts solar energy to stored energy in the form of carbohydrates. In onion, photosynthates are translocated in storage organ *i.e.* bulb. Kushal *et al*. (2015) noted significant and positive interrelationship of bulb yield with leaf area and leaf area index in onion.Among various factors which determine onion bulb storage ability, neck diameter of bulbs is very important. Usually, bulbs with thinner neck stored well (Tarai *et al.* 2015). On the other hand, bulb yield have positive and significant association with bulb neck thickness (Chattoo *et al.* 2015). In this study, the range of neck diameter was noted 10.0 to 13.1 mm with mean 11.8 mm. The maximum neck diameter was recorded

in NHRDF Red-2 which was found statistically similar to Early Grano and NHRDF Red. On the other hand, the minimum neck diameter was noted in Pusa Ridhi which was found statistically similar to Arka Kalyan and Pusa White Round. Mandal *et al.* (2019) noted a wide range of variation for bulb neck thickness (12.3 to 20.9 mm) in onion.In this experiment, onion cv. Sukhsagar followed by Agrifound Light Red, Pusa Ridhi, Arka Niketan and Superior Light Red took relatively less time to mature. Khosa and Dhatt (2013) obtained good range of variation for days to maturity (110 to 155 days) in onion. Chattoo *et al.* (2015) found positive correlation between total bulb yield and days to harvest. Their path coefficient analysis study revealed that days to harvest had positive direct effect on total bulb yield in onion.

Grading of onion bulb to proper sizes is very important to fulfill specific market demand. The medium sized varieties (3.5-5.0 cm) are more preferred in Indian market (Islam *et al.* 2019). In this investigation, maximum equatorial diameter of bulb was observed in NHRDF Red-3 which was noted statistically similar to N-53, Pusa Madhvi and Agrifound Light Red. Similarly, maximum polar diameter of bulb was noted in NHRDF Red-3 which was found statistically similar to Arka Niketan, Agrifound Light Red and Sukhsagar. Singh *et al.* (2010) observed a wide range of variability for bulb size index (21.31to 23.09cm^2) in onion. Variation in onion bulb diameter has also been reported byTarai *et al.* (2015). Path coefficient analysis revealed that onion bulb diameter exerted positive and direct effect on bulb yield (Chattoo *et al.* 2015). Bulb weight is an important yield attributing trait in onion. Study of Chattoo *et al.* (2015) and Dangi *et al.* (2018) revealed that bulb weight exhibited positive and significant association with bulb yield in onion. The range of average bulb weight was noted 38.9 to 78.5 g with mean 47.9 g. In both the year of study and also in pooled analysis, the maximum average bulb weight was noted in Sukhsagar. Variation in onion bulb weight has been reported by Khosa and Dhatt (2013) (44 to 87.03 g), Behera *et al.* (2017) (50.2 to 82.5 g), Dangi *et al.* (2018) (25.85 to 75.99 g) and Mandal *et al.* (2019) (53.0 to 84.1 g). Dangi *et al.* (2018) stated that short day onion varieties have an average bulb weight of less than 100 g since they mature in 120-150 days. In cultivation of any crop, yield of the crop is the prime concern. Present study registered ample variation in bulb yield (62.8 to 124.5q ha^{-1}). The overall meanbulb yield was found 103.3q ha^{-1}. The maximum bulb yield was recorded in Sukhsagar which was found statistically similar to Agrifound Light Red, Bhima Shakti, NHRDF Red-2, Pusa white Flat and NHRDF Red-3. Singh *et al.* (2010) observed a wide range of variability for gross yield (301.99 to 387.81 q ha^{-1}) and marketable yield (239.33 to 338.49q ha^{-1}) in onion and observed a wide range of variability for bulb yield (11.51 to 33.01 t ha^{-1}) in onion. In West Bengal, variation in onion bulb yield was reported by Haldar *et al.* (2009), Behera *et al.* (2017), Dhar *et al.* (2019) and Mandal *et al.* (2019).

The range of number of scales per bulb was recorded 8.0 to 11.3 with mean 9.9; while TSS was varied from 11.3 to 13.7°Brix with an average value of 12.7°Brix. Studying on short day onions, Dangi *et al.* (2018) obtained overall mean TSS of 11.52°Brix. Estimation of total soluble solids (TSS) gives an indirect estimate for the recovery of dehydrated onion (Islam *et al.* 2019). Path analysis study revealed that TSS had positive direct effect on average bulb weight

Table 1: Growth and yield attributes of onion cultivars (pooled data of 2014-15 and 2015-16).

Genotypes	Plant height (cm)	Number of leaves plant^{-1}	Neck Diameter (mm)	Days to harvest	Equatorial Diameter (mm)	Polar Diameter (mm)	Average bulb weight (g)	Yield (q ha^{-1})
Arka Kalyan	58.0^{cde}	7.0^{a}	10.3^{f}	106.5^{cde}	43.5^{cd}	43.7^{cde}	51.0^{c}	101.7^{cde}
Arka Niketan	59.2^{abcd}	7.0^{a}	11.6^{de}	106.0^{def}	43.9^{cd}	46.9^{ab}	42.5^{fgh}	107.7^{bcd}
Agrifound Light Red	58.9^{abcde}	6.9^{ab}	12.3^{bc}	105.3^{ef}	45.2^{abcd}	45.5^{abc}	43.2^{efg}	121.6^{ab}
NHRDF Red	59.8^{ab}	6.9^{ab}	12.6^{ab}	108.0^{abcd}	43.2^{cde}	44.1^{cde}	46.9^{d}	95.6^{def}
NHRDF Red-2	59.7^{abc}	6.7^{abc}	13.1^{a}	108.2^{abcd}	44.8^{bcd}	44.1^{cde}	41.3^{ghi}	113.2^{abc}
NHRDF Red-3	59.2^{abcd}	6.6^{bc}	12.3^{bc}	110.2^{a}	47.6^{a}	47.3^{a}	60.1^{b}	110.7^{abc}
Sukhsagar	58.1^{bcde}	6.7^{abc}	11.7^{cde}	103.8^{f}	44.5^{bcd}	45.5^{abc}	78.5^{a}	124.5^{a}
N-53	58.9^{abcde}	7.0^{a}	11.9^{cde}	106.8^{bcde}	47.0^{ab}	45.1^{bc}	51.1^{c}	104.2^{cde}
Bhima Shakti	59.7^{abc}	6.4^{c}	12.2^{bcd}	108.8^{abc}	40.7^{ef}	45.2^{bc}	39.5^{hi}	120.3^{ab}
Bhima Kiran	60.3^{a}	6.7^{abc}	12.3^{bc}	110.5^{a}	43.3^{cd}	44.1^{cde}	38.9^{i}	104.1^{cde}
Early Grano	59.8^{ab}	6.6^{bc}	13.0^{a}	108.7^{abc}	42.8^{de}	43.2^{de}	53.0^{c}	84.3^{f}
Pusa White Flat	59.2^{abcd}	6.9^{ab}	11.4^{e}	109.2^{ab}	38.4^{f}	45.2^{bc}	44.5^{def}	111.5^{abc}
Pusa Madhabi	59.2^{abcd}	6.8^{ab}	11.8^{cde}	108.7^{abc}	45.6^{abc}	42.9^{e}	42.7^{efg}	100.2^{cde}
Pusa White Round	57.5^{def}	6.7^{abc}	10.4^{f}	109.5^{a}	35.3^{g}	39.7^{f}	44.7^{def}	62.8^{g}
Pusa Ridhi	56.2^{f}	6.7^{abc}	10.0^{f}	105.8^{def}	32.5^{h}	34.7^{g}	45.6^{de}	90.2^{ef}
Superior Light Red	57.2^{ef}	6.9^{ab}	11.3^{e}	106.2^{cdef}	38.8^{f}	44.8^{cd}	42.5^{fgh}	100.7^{cde}
Mean	58.8	6.8	11.8	107.6	42.3	43.9	47.9	103.3
CD (P=0.05)	1.7	0.3	0.6	2.6	2.5	1.8	3.0	14.4

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

Table 2: Scale number, TSS and pyruvic acid content of onion cultivars.

Genotypes	Number of scalesbulb^{-1}	TSS (°Brix)	PyruvicAcid (µ mol g^{-1})
Arka Kalyan	8.0^{d}	13.6^{a}	12.2^{ab}
Arka Niketan	10.7^{ab}	12.6^{abcd}	7.5^{c}
Agrifound Light Red	10.7^{ab}	13.7^{a}	11.2^{b}
NHRDF Red	9.7^{abc}	11.9^{bcd}	12.4^{ab}
NHRDF Red-2	10.3^{abc}	12.7^{abcd}	12.4^{ab}
NHRDF Red-3	10.0^{abc}	12.3^{abcd}	10.5^{b}
Sukhsagar	8.7^{cd}	13.7^{a}	11.5^{b}
N-53	9.7^{abc}	12.2^{abcd}	12.8^{ab}
Bhima Shakti	10.3^{abc}	11.8^{cd}	12.9^{ab}
Bhima Kiran	10.3^{abc}	12.8^{abcd}	14.8^{a}
Early Grano	9.3^{bcd}	11.3^{d}	7.6^{c}
Pusa White Flat	11.3^{a}	12.7^{abcd}	10.8^{b}
Pusa Madhabi	9.6^{bcd}	12.5^{abcd}	11.3^{b}
Pusa White Round	10.3^{abc}	12.7^{abcd}	10.6^{b}
Pusa Ridhi	10.0^{abc}	12.9^{abc}	11.5^{b}
Superior Light Red	9.7^{abc}	13.4^{ab}	11.2^{b}
Mean	9.9	12.7	11.3
CD (P=0.05)	1.6	1.1	2.8

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

Table 3: Losses of onion cultivars after six months in store.

Genotypes	PLW (%)	Rotting (%)	Sprouting (%)	Total loss (%)
Arka Kalyan	31.6^{ef}	30.2^{i}	11.7^{c}	73.5^{h}
Arka Niketan	28.8^{cd}	6.3^{b}	0.0^{a}	35.1^{a}
Agrifound Light Red	29.4^{cde}	16.4^{cd}	0.0^{a}	45.8^{c}
NHRDF Red	34.5^{gh}	33.8^{j}	0.0^{a}	68.2^{g}
NHRDF Red-2	36.3^{h}	26.1^{g}	0.0^{a}	62.4^{f}
NHRDF Red-3	28.2^{c}	29.4^{hi}	0.0^{a}	57.6^{e}
Sukhsagar	20.0^{b}	0.0^{a}	0.0^{a}	20.0^{a}
N-53	47.0^{k}	16.7^{de}	0.0^{a}	63.7^{f}
Bhima Shakti	39.3^{j}	19.5^{f}	0.0^{a}	58.8^{e}
Bhima Kiran	32.3^{fg}	19.4^{f}	0.0^{a}	51.7^{d}
Early Grano	35.9^{h}	63.7^{l}	0.0^{a}	99.6^{j}
Pusa White Flat	18.6^{b}	44.5^{k}	0.0^{a}	63.2^{f}
Pusa Madhavi	53.6^{l}	36.3^{j}	0.0^{a}	89.9^{i}
Pusa White Round	30.9^{def}	26.5^{g}	0.0^{a}	57.3^{e}
Pusa Ridhi	32.1^{fg}	24.8^{g}	0.0^{a}	56.9^{e}
Superior Light Red	38.9^{ij}	4.0^{b}	9.0^{b}	51.9^{d}
Mean	33.6	24.8	1.3	59.7
CD (P=0.05)	2.5	2.7	1.2	2.8

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

(Chattoo *et al.* 2015). Onion bulb pungency and TSS are important quality attributes for fresh market, processing and storage.Highly pungent onions are popular in India, whereas, less pungent ones are preferred in other countries. The pungent flavor of onions is produced by hydrolysis of the flavor precursor compounds, like, S-alk (en)yl-L-cysteine sulfoxides, when the cells are mechanically ruptured. The hydrolysis reaction is catalyzed by allinase (Schwimmer and Weston, 1961). The determination of pyruvate as an indicator of pungency is highly established method for pungency assessment in onion, as the pyruvic acid content of onions is highly correlated with their pungency (Gallina *et al.* 2012). In this study the range of pyruvic acid content was recorded 7.5 to 14.8 µmolg^{-1} withmean 11.2 µmolg^{-1}. The maximum Pyruvic acid content was recorded in Bhima Kiran which was found statistically similar to Bhima Shakti, N-53, NHRDF Red, NHRDF Red-2 and Arka Kalyan.On the other hand, minimum Pyruvic acid content was obtained from Arka Niketan and Early Grano. Islam *et al.* (2019) in her study noted lowest pyruvic acid content in Early Grano (4.67 µmol). According to Randle (1992) that the genetic background seems to be the most important factor because different cultivars have different abilities to control sulphur uptake and assimilation in the biosynthesis pathway that results in the flavour. Lee *et al.* (2009) also found that pungent onions synthesizea greater amount of ACSOs from the same content of sulphur com-pounds in the tissues.

Harvested onion bulbs under goes several physio-chemical changes like increase in respiration, physiological loss in weight (PLW), rotting and sprouting andchemical 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. Onion is stored at ambient storage condition in most of the tropical countries where the storage losses are very high. About 40-50% of the stored onion never reaches to consumers because of various types of losses (Tripathi and Lawande, 2019). In this study the range of PLW was recorded 18.6 to 53.6% with mean 33.6%. Onion cultivars Pusa White Flat and Sukhsagar recorded minimum PLW of about 20% after six months of storage; while maximum PLW was recorded in Pusa Madhvi. The range of rotting was recorded 0.0 to 63.7%. Maximum rotting was recorded in Early Grano. On the other hand, no rotting was recorded in Sukhsagar. This may be due to the inherent capability of this variety. Superior Light Red and Arka Niketan were also performed well for this trait with a rotting percent of 4.0 and 6.3 after six months of storage respectively. Pathogens of genera *Aspergillus*, *Alternaria*, *Botrytis*, *Colletot-richum*, *Erwinia*, *Fusarium*, *Lactobacillus*, *Penicil-lium*, *Pseudomonas* and *Rhizopus* are responsible for rotting of onion bulbs in store. They cause considerable economic loss andare also harmful for human health as they produce pathogenic toxins (Fink-Grernmels, 1999). In recent study, Yurgel *et al.* (2018) detected several potential fermenters in onion tissue. They suggest that the fermentation plays a role in the storage spoilage of onion bulbs.Sprouting was detected only in two onion varieties *viz*., Arka Niketan and Superior Light Red. Other onion varieties were sprout free throughout the storing period. The range of total loss in weight was recorded 20.0 to 99.6% with mean 59.7%. The minimum and maximum total loss was

recorded in Sukhsagar and Early Grano respectively. The ability of bulb storage is a cultivar-specific genetic trait. It is highly connected to market destination, as itseparates fresh and storage cultivars (Sekara *et al.* 2017). 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 for this character. It recorded a storage loss of 20% after six month of storage in ambient condition. Tripathi and Lawande (2019) indicated that the locally adopted short day onion varieties tend to have better storage quality. It was revealed from the storage experiment that Early Grano, which recorded almost total loss (99.6%) after six months of storage, was not at all suitable for storing.

CONCLUSION

Thus, in conclusion it may be stated that onion cv. Sukhsagar, Agrifound Light Red, Bhima Shakti, NHRDF Red-2, Pusa White Flat and NHRDF Red-3 can be suggested to grow under Coastal saline Zone of West Bengal for higher productivity. However, among these identified varieties, only Sukhsagar can be advocated for long term storage.

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