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Studies on influence of organic nutrient management on storability of onion bulb

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Abstract
The present experiment was conducted at Main Garden Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola in the year 2015-2016 and 2016-2017. The result revealed the total loss of stored bulbs increased steadily as the period of storage extended. The treatment consisting of 50% RDN through FYM (q ha-1) + 50% RDN through Vermicompost (q ha-1) + Azatobactor (kg ha-1) + PSB (kg ha-1) registered the lowest total loss, Rotting and physiological loss in weight at 120 days of storage during both years of experiment under study. Whereas, the lowest sprouting was recorded under the treatment consisting of 50% RDN through FYM (q ha^{-1}) + 50% RDN through Neem cake (q ha^{-1}) + Azatobactor (kg ha^{-1}) + PSB (kg ha^{-1}). The inorganic treatment consisting of 100 per cent recommended dose of NPK fertilizer significantly varied from organic treatment and recorded maximum storage loss.

Keywords: Biofertilizer, onion, organic manure, storage life

Introduction
Onion (*Allium cepa*) is the most important cultivated bulb vegetable crop commercially grown in India. Onion a seasonal crop has comparatively low storage ability. Sometimes bulbs are to be stored for longer period due to seasonal glut in the market. Significant losses in quality and quantity of onion occur during storage. The annual storage losses of onion have been estimated to be more than 40 percent on different accounts during storage and handling (Maini *et al*., 1984) [5]. The organic farming improves the quality of the produce combine with higher nutritive value and better storage life than those grown conventionally with mineral fertilizers. In onion, the information on studies of organic farming using different kinds of organic manure and biofertilizers are very merge. The present study probably is the first of its kind, to investigate the cultivation prospects of onion under organic farming system, which involves the conservation and management of natural resources like soil and also the post harvest storage life of produce.

Materials and Methods
The field experiments were conducted in the farm of Main Garden, Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola and then storage study was carried out at Post Harvest Laboratory, Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MH) during academic year 2015-2016 and 2016-2017 with local onion cv. Akola safed, a medium sized, round shaped white onion. The experiment comprised of thirteen treatments. The treatments were replicated thrice in Randomized Block Design. The all organic manures and biofertilizers were applied 1 month before transplanting of seedlings. The crop was harvested at 50 percent of the leaf showing yellowing and senescence's of leaves an neck fall. The entire plant was uprooted. And kept in the field for curing purpose for 10-15 days the cured onion bulbs were sorted out and five kg healthy bulbs from each treatment were kept in laboratory for storage studies. The data were recorded 20 days interval and the rotted, sprouted bulbs from each treatment were sorted out at the time of recording data.
The data collected on various observations like physiological loss in weight, rotting, sprouting and total loss of bulb during the course of investigation were statistically analyzed and result was interpreted by using methods suggested by Panse and Sukhatme (1967) [6].

Treatment Details

T_1	50% RDN through FYM (q ha^{-1}) + 50% RDN through Neem cake (q ha^{-1})
T_2	50% RDN through FYM (q ha^{-1}) + 50% RDN through Poultry manure (q ha^{-1})
T_3	50% RDN through FYM (q ha^{-1})+ 50% RDN through Vermicompost (q ha^{-1})
T_4	50% RDN through FYM (q ha^{-1})+ Azatobactor (kg ha^{-1}) + PSB (kg ha^{-1})
T_5	50% RDN through Neem cake (q ha^{-1}) + Azatobactor (kg ha^{-1}) + PSB (kg ha^{-1})
T_6	50 % RDN through Poultry manure (q ha^{-1}) + Azatobactor (kg ha^{-1}) + PSB (kg ha^{-1}
T_7	50% RDN through FYM (q ha^{-1}) + 50% RDN through Neem cake (q ha^{-1}) + Azatobactor (kg ha^{-1}) + PSB (kg ha^{-1})
T_8	50% RDN through FYM (q ha^{-1}) + 50% RDN through Poultry manure (q ha^{-1}) + Azatobactor (kg ha^{-1}) + PSB (kg ha^{-1})
T_9	50% RDN through FYM (q ha^{-1}) + 50% RDN through Vermicompost (q ha^{-1}) + Azatobactor (kg ha^{-1}) + PSB (kg ha^{-1})
T_{10}	Biodynamic 501& 500 + solution (S9) + Biodynamic manure (q ha^{-1})
T_{11}	Biodynamic 501& 500 + solution (S9)
T_{12}	Recommended dose of fertilizer (100:50:50 kg ha^{-1})
T_{13}	Control

Results and Discussion

The physiological loss of bulb weight was influenced by different organic treatments and the data are presented in table. The PLW in stored bulbs increased steadily as the period of storage was extended at ambient storage condition. The highest storage loss was recorded at 120 days after storage. The onion bulbs in storage generally undergo loss in weight, owing to physiological changes like sprouting, rotting and desiccation. The storage loss of onion is mainly due to PLW, rotting and sprouting.

In this present experiment, minimum physiological loss in weight at 20 (3.46%), 40 (8.62%), 60 (10.58%), 80 (13.70%), 100 (16.22%), 120 (18.68%) days after storage observed with the application of 50% RDN through FYM (q ha-1) + 50% RDN through Vermicompost (q ha-1) + Azatobactor (kg ha-1) + PSB (kg ha-1) . However highest loss in weight noted in treatment consisting of inorganic fertilizer.

Table 1: Effect of organic nutrient management on Physiological loss in weight of bulb (Pooled data of over two years)

	Days after storage					
Treatments	**20**	**40**	**60**	**80**	**100**	**120**
T_1	5.38	11.96	15.4	18.71	21.84	22.99
T_2	5.13	11.70	15.05	17.63	21.21	22.84
T_3	4.91	11.04	14.08	17.60	20.36	22.32
T_4	5.58	12.81	16.15	19.58	23.4	24.45
T_5	5.77	13.57	17.45	20.52	24.36	26.39
T_6	4.72	10.79	13.69	17.40	19.30	21.86
T_7	4.08	9.43	11.20	14.44	16.73	19.20
T_8	4.59	10.17	12.58	16.295	18.32	20.58
T_9	3.46	8.62	10.58	13.70	16.22	18.68
T_{10}	5.48	12.67	15.64	19.06	22.59	24.69
T_{11}	6.18	13.99	17.6	20.61	24.66	24.32
T_{12}	6.39	14.57	18.4	21.35	25.19	26.82
T_{13}	6.26	14.40	18.18	22.74	25.25	26.15
SE(m)±	0.12	0.15	0.16	0.18	0.19	0.37
CD@5%	0.35	0.45	0.48	0.56	0.56	1.11

The bulb harvested from all organic manure treatments registered the lowest PLW this can be attributed to the phenomenon that the altered physiology and biochemistry of the bulb as influenced by organic sources of nutrients might have lead to the reduced respiration and evapotranspiration, which in turn resulted in low PLW. This is in close conformity with the finding of Singh *et al* (1999) [8]. These results are also in accordance with the results obtained by Madan and Sandhu (1985) [4] in onion. Similarly, Katung *et al*. (2005) [3] reported lowest PLW (%) in onion during five months of storage period by application of organic nutrient sources.

The increase in rotting was of still higher magnitude due to shift from total organics to total inorganics. The rotting of the onion bulbs is normally met with storage due to the pathogen and development of excess humidity in the storage environment. An inhibition of growth activity of pathogen responsible for rotting of bulb leads to low rotting during storage.

The pooled data shown in table 2. Revealed that the treatment consisting of 50% RDN through FYM (q ha^{-1}) + 50% RDN through Vermicompost (q ha^{-1}) + Azatobactor (kg ha^{-1}) + PSB (kg ha^{-1}) recorded the significantly minimum rotting (1.60, 2.22, 4.14, 6.69, 9.13, and 11.08 % at 20, 40, 60, 80, 100 and 120 DAS respectively). However, significantly, maximum rotting was recorded under inorganic treatment. (3.62, 5.39, 15.12 and 18.26% at 20, 40, 100 and 120 DAS) and in treatment T11 (10.11% at 60 DAS) and T13 (13.54% at 80DAS).

Table 2: Effect of organic nutrient management on Rotting (%) of bulb (Pooled data of over two years)

	Days after storage					
Treatments	**20**	**40**	**60**	**80**	**100**	**120**
T_1	2.28	3.45	6.41	8.75	12.36	13.46
T_2	2.29	3.45	6.42	8.76	12.30	13.45
T_3	2.49	3.77	7.03	9.68	13	15.43
T_4	2.88	4.24	7.40	10.66	13.39	16.27
T_5	2.49	3.77	7.85	11.22	13.79	17.57
T_6	3.50	4.64	7.03	9.66	13.06	15.31
T_7	1.95	2.60	4.52	7.08	10.43	11.89
T_8	1.95	2.56	4.45	7.03	10.35	11.89
T_9	1.60	2.22	4.14	6.69	9.13	11.08
T_{10}	2.89	4.27	7.41	10.66	13.48	16.27
T_{11}	3.3	4.49	10.13	11.71	15.04	18.04
T_{12}	3.62	5.39	10.04	13.49	15.12	18.26
T_{13}	3.30	4.49	8.76	13.54	13.95	18.23
SE(m)±	0.18	0.13	0.12	0.16	0.27	0.23
CD@5%	0.53	0.4	0.36	0.48	0.79	0.68

Higher level of nitrogen also increased rotting per cent in inorganic treatment with soft tissue produced under high N level were more vulnerable to rotting. This is because of the fact that auxin synthesis leads to increase in cell size and thickening of cell wall, consequently the water absorption increased Sirry *et al*. (1974) [10]. Further higher moisture content in onion bulbs (above 85 per cent) make it prone to shrinkage and storage rots.

The application of organic manure resulted in significantly low rotting losses in onion during storage. Beneficial effects of organics in reducing the post harvest rotting of horticultural crops have been reported in onion (Patil, 1995) [7], tomato (Krishna, 2002) [2].

Sprouting is one of the major causes of qualitative as well as quantitative deterioration of stored bulb. Sprouting of bulbs increased with the increase in storage period. A perusal of data given in Table 3 revealed that there was no sprouting up to 40 DAS in all the treatments. However, significant variation with respect to sprouting (%) was observed among the various treatments at 60, 80, 100 and 120 days after storage. From the attempt of organic farming versus inorganic farming it is obvious that the organic farming treatment consisting of 50% RDN through FYM (q ha^{-1}) + 50% RDN through Neem cake (q ha^{-1}) + Azatobactor (kg ha^{-1}) + PSB (kg ha^{-1}) (1.26, 2.74, 4.15 and 5.97 % at 60, 80,100 and 120 DAS respectively). However maximum loss due to sprouting (3.47, 6.61, 10.08 and 13.15% at 60, 80,100 and 120 DAS) observed in inorganic treatment.

The combined application of organic manure and biofertilizers showed their definite superiority over inorganic alone. The present result on sprouting was in agreement with the finding of kristove *et al* (1986) [1]. Also the potash decreasing the sprouting during storage may be attributed to the increase concentration of inhibitors apparently by facilitating release of potassium ion from the guard cell these result was in accordance with Madan and Sandhu (1985) [4]. Another reason for this may be that high amount of nitrogen produced thick necked bulbs which increased sprouting due to greater access of oxygen and moisture to the central growing point. Similar result noted by Singh and Dhankar (1991) [9].

Table 3: Effect of organic nutrient management on Sprouting (%) in onion bulb (Pooled data of over two years)

	Days after storage			
Treatments	**60**	**80**	**100**	**120**
T_1	1.7	3.65	6.73	8.35
T_2	2.04	4.41	6.8	8.59
T_3	2.18	4.86	7.08	8.90
T_4	2.39	5.04	7.55	10.12
T_5	3.08	5.34	8.71	10.73
T_6	2.3	5.14	7.35	9.83
T_7	1.26	2.74	4.15	5.97
T_8	1.62	3.56	5.61	7.52
T_9	1.45	3.05	4.49	6.43
T_{10}	2.89	5.18	8.31	10.42
T_{11}	3.26	4.69	9.1	11.31
T_{12}	3.47	6.61	10.08	13.15
T_{13}	3.39	6.10	9.49	11.43
SE(m)±	0.23	0.3	0.42	0.28
CD@5%	0.69	0.89	1.23	0.82

The pooled data shown in table 4 revealed that, revealed that minimum total storage losses of onion bulb at 20 (5.09%), 40 (10.83%), 60 (14.71%), 80 (20.38%), 100 (25.34%), 120 (29.75%) days of storage period were recorded with the treatment 50% RDN through FYM (q ha-1) + 50% RDN through Vermicompost (q ha-1) + Azatobactor (kg ha-1) + PSB (kg ha-1) and it was significantly superior over other treatment. However, maximum storage losses pertaining to this parameter at each stage of storage period of onion bulbs were noted under the inorganic treatment.

Similar results were also obtained by Warade *et al* (1996) [11] the reported application of chemical fertilizer has adverse effect on total losses of onion bulbs. Organic manure like FYM treated plot had lower per cent losses of weight when compared to inorganic fertilizer application which recorded higher percent total loss.

Table 4: Effect of organic nutrient management on Total loss (%) of bulb (Pooled data of over two years)

	Days after storage					
Treatments	**20**	**40**	**60**	**80**	**100**	**120**
T_1	7.81	15.4	21.8	27.45	34.19	36.44
T_2	7.42	15.14	21.46	26.38	33.5	36.28
T_3	7.53	14.8	21.1	27.27	33.35	37.74
T_4	8.61	17.04	23.54	30.24	36.79	40.71
T_5	8.38	17.33	25.29	31.73	38.15	43.95
T_6	8.35	15.42	20.72	27.05	32.35	37.16
T_7	6.17	12.02	25.71	21.51	27.16	31.08
T_8	6.66	12.72	17.02	23.32	28.66	32.47
T_9	5.09	10.83	14.71	20.38	25.34	29.75
T_{10}	8.58	16.93	23.04	29.71	36.06	40.95
T_{11}	9.65	18.48	26.35	32.31	38.6	44.19
T_{12}	10.33	20.55	28.53	36.27	40.83	43.58
T_{13}	10.01	19.31	28.22	34.83	39.77	44.02
SE(m)±	0.17	0.25	0.25	0.24	0.39	0.36
CD@5%	0.51	0.75	0.75	0.72	1.17	1.08

Conclusion

From this experiment it is concluded that, the application of 50% RDN through FYM (q ha-1) + 50% RDN through Vermicompost (q ha-1) + Azatobactor (kg ha-1) + PSB (kg ha-1) is found most superior treatment than others and were significantly improves the post harvest storage life of onion bulb under organic culture.

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