

IMPACT OF RELATIVE HUMIDITY ON VIABILITY AND MOISTURE CONTENT IN SOME OIL SEEDS DURING STORAGE

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The effect of storage on the moisture content and germination were studied in cultivars of safflower (Bhima and Tara), sunflower (Morden and Surya), sesame (Phule Til No.1 and Punjab Til No. 1) seeds at different relative humidities (32, 63 and 92%). The mean moisture content decrease with decrease in RH. Difference in moisture content were noted with the varieties and crop. There were progressive deterioration in the germination of seed with respective increase in RH and storage time.

Keywords: Germination; Moisture content; Relative humidity; Safflower; Sesame; Sunflower.

Introduction

It is a known fact that high moisture affects seed viability. The most important factors of the storage environment, effecting maintenance of seed quality during storage, are relative humidity and temperature^{1,2}. Of these, relative humidity has a greater influence on longevity of seed in storage because seed moisture content is directly related to the relative humidity of the atmosphere^{3,4}. The moisture content, thus, influence the storage behaviour of seeds and other biological agencies depend on them. Absorption of moisture under RH hastens deterioration. While considerable information on this aspect of physical property of cereal grains and leguminous seeds is available, similar data on oil seeds are not available. In the present investigation, moisture content - relative humidity relationship of safflower, sunflower and sesame seeds under three sets of RH was studied. The effect of moisture content on germination of seed was also evaluated.

Material and Methods

Seeds of respective cultivars were used in the various phases of this study, produced in 2003. Seeds of safflower, sunflower and sesame were cleaned, dried and the moisture content was equilibrated to 7, 7 and 5%, respectively. The seeds of all these crops were stored at 32, 63 and 92% relative humidity. 32% RH was adjusted by preparing the saturated solution of magnesium chloride⁵ (MgCl₂), 63% RH by sodium nitrate³ (NaNO₃) and 92% RH by saturated solution of sodium sulphate⁶ (Na₂SO₄). The range of relative humidity was maintained in desiccators separately and the seed samples were stored in cloth bages over the saturated solution in desiccator for 18 months. The

observation on seed moisture and germination were recorded at trimonthly interval.

The moisture content of the seed was determined by the air-oven method^{1,7}. Four replicates of 100 seeds each, were placed for germination at 25°C. The germination percentage was evaluated on the value of percent normal seedlings.

Results and Discussion

Results obtained in the present investigation on seed moisture content are presented in Table 1. Seed moisture content specifically refers to the percentage of moisture present on dry weight basis at the end of specified period of storage under constant relative humidity.

Storage of seeds at lower (32%) RH caused desiccation and at higher RH (63 and 92%) resulted in higher moisture absorption by the seeds of safflower, sunflower and sesame cultivars under investigation. Thus, it is observed that seed moisture content decreased from the initial moisture at 32% RH in all cultivars, whereas, it increased proportionately at 63 and 92% RH. Paricha *et al.*⁸ have also reported that mean moisture equilibrium values decreased with decrease in RH of the ambient atmosphere. Coleman and Fellows⁹ and Snow¹⁰ showed relationship between moisture content and relative humidity. These workers concluded that when the RH raised from 50 to 65%, the equilibrium moisture content of seeds increased slightly, but as RH raised from 65 to 85%, the moisture content of the seeds increased rapidly and this was due to the absorption of moisture by seeds. All the seeds sample stored at 32, 63, 92% RH and ambient condition showed decrease in germination with corresponding increase in the storage period (Table 1).

Table 1. Changes in moisture content and germination of safflower, sunflower and sesame seeds during storage at various relative humidity.

Crop Variety	Storage (Months)	Relative Humidity							
		32	63	92	AC	32	63	92	AC
		% Moisture				% Germination			
Safflower Bhima	0 Jan. 2005	7.00	7.00	7.00	7.00	98	98	98	98
	3 Mar.	6.19	7.97	12.80	8.20	97	96	90	97
	6 Jun.	6.14	7.90	12.97	8.00	96	94	70	95
	9 Sept.	6.10	8.40	13.75	7.71	95	91	38	90
	12 Dec.	6.40	8.81	14.17	6.98	92	86	10	80
	15 mar. 2006	6.20	8.72	14.15	8.00	91	80	00	70
	18 June	6.00	8.41	13.98	8.23	90	70	00	58
Tara	0	7.00	7.00	7.00	7.00	85	85	85	85
	3	6.40	7.95	12.87	8.33	83	83	78	80
	6	3.35	7.81	12.75	8.19	82	80	60	79
	9	6.66	8.55	12.69	7.80	80	76	35	75
	12	6.80	8.91	14.31	6.96	78	72	08	68
	15	6.40	8.71	14.19	8.14	75	67	00	60
	18	6.00	8.55	13.90	8.61	70	61	00	47
Sunflower Morden	0	7.00	7.00	7.00	7.00	80	80	80	80
	3	6.15	9.71	15.21	8.01	80	78	50	80
	6	5.98	9.40	14.99	7.34	78	72	12	75
	9	6.00	10.92	15.90	11.61	70	63	00	66
	12	6.14	10.99	16.15	9.41	65	45	00	55
	15	5.89	10.90	15.75	10.11	59	15	00	94
	18	5.61	10.98	15.30	10.80	54	00	00	15
Surya	0	7.00	7.00	7.00	7.00	78	78	78	78
	3	6.21	9.20	14.91	8.21	76	72	33	76
	6	6.13	9.31	14.65	7.57	76	66	00	70
	9	6.21	10.93	15.80	11.90	70	50	00	68
	12	5.90	11.07	16.35	9.75	67	15	00	54
	15	5.89	10.92	16.12	10.27	62	00	00	38
	18	5.91	10.90	15.99	10.91	51	00	00	20
Sesame Phule Til No. 1	0	5.00	5.00	5.00	5.00	94	94	94	94
	3	4.81	5.51	10.36	5.30	91	93	70	90
	6	4.30	5.41	10.42	5.10	90	90	38	90
	9	4.15	6.20	11.20	6.91	89	86	16	87
	12	4.26	6.81	11.51	6.90	86	76	00	78
	15	4.11	6.60	11.21	6.21	83	60	00	68
	18	4.15	6.40	11.11	6.11	75	40	00	52
Punjab Til No. 1.	0	5.00	5.00	5.00	5.00	86	86	86	86
	3	4.70	5.70	10.21	5.37	84	85	64	83
	6	4.77	5.53	10.11	5.27	79	77	29	8
	9	4.51	6.20	10.90	6.70	80	72	00	77
	12	4.30	6.70	11.61	6.99	76	64	00	68
	15	4.21	6.45	11.33	6.85	74	45	00	54
	18	4.31	6.40	11.21	6.31	68	23	00	38

These findings are in conformity with earlier studies^{11,12}.

At 32% RH and ambient condition, seeds of all crops were found to retain germinability during the experimentation period. At 63% RH Surya and Modern cultivars of sunflower lost its germinability after 12 and 15 months, respectively, but safflower and sesame cultivars retain its germinability. Similarly, at 92% RH Bhima, Tara (Safflower), Surya Morden (Sunflower), Phule Til No.1 Punjab Til No.1 (Sesame) cultivars lost their germinability after 12, 12, 3, 6, 9 and 9 months, sunflower seeds were found to be most susceptible in respect of germination followed by sesame and safflower¹³. The viability of seeds deteriorated rapidly when stored at 75 and 90% RH. Storage of seeds under reduced moisture has been found to maintain biability for long periods^{14,15}.

The loss in germinability is thus correlated with the excessive moisture content¹⁶. A significant negative correlation between moisture content and germination of seeds was observed. From the results obtained, it is concluded that safflower, sunflower and sesame seeds stored under various conditions deteriorated with the increase in moisture content of the stored seeds.

In the present study safflower, sunflower and sesame seeds were found to be better stored at constant 32% RH, compared to those at 63 and 92% RH, respectively. Thus, results obtained are in good accord with those of eminent worker¹⁷. Safflower seeds have been observed to be better in retaining germination than sunflower and sesame. This could be explained due to the presence of hard seed coat.

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