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EFFECT OF COMPARTMENTALIZATION IN KERNEL OF PADDY *(ORYZA SATIVA)* BY HUSK COVER IN ATMOSPHERIC MOISTURE ABSORPTION

H. BARMAN and G. U. AHMED

Department of Biotechnology, Gauhati University, Guwahati-14, India.

The husk and endosperm ratios of the kernels of five paddy variety were determind. Husk-endosperm ratios were different in these varieties. Atmospheric moisture absorption pattern by husked and dehusked kernels of these varieties were determined. Experimented results show that dehusked kernel absorbed moisture at high rate and in different pattern than their husked counterpart regardless of paddy variety. Dehusked kernel of Bora paddy absorbed moisture at highest rate and dehusked kernels of Aijung paddy absorbed moisture at lowest rate. The pattern of moisture absorbtion by dehusked kernel of Bashmoti and Mala paddy was similar. Husked kernel absorbed moisture at slow rate and in dissimilar pattern than their dehusked kernel. Husked kernel of Bashmoti and Mala paddy absorbed moisture in an altered and dissimilar pattern than their dehusked kernel. Thick husk cover facilitate a more faster rate of moisture absorption. In atmospheric moisture absorption the husk cove was found to have a controlling rule contriibuted by compartmentalization effect of husk cover. Correlation co-efficient of husk percentage and moisture absorption indicated a positively significant correlation.

Keywords : Compartmentalization; Dehusked; Husked; Kernel.

Introduction

In storage of foodgrains for different periods in different agroclimatic conditions and at the tiime of sale and purchase, the grain moisture is an important factor to be concerned. During storage period certain deteriorating biological activities, viz. fungal infestation, insect infestation besides physiological activities particularly grain heating, moisture migration are enhanced by high level of moisture in grain. During storage quality deterioration of grain stock has been observed to be different depending upon the grain variety. Being a part of the plant body the moisture status of the kernel in standing crop depends on moisture status of the mother plant. After detachment from the mother plant kernel absorbs or releases moisture depending upon its immediate physical environment. In storage condition paddy kernel shows fluctuation in moisture level. This fluctuation is different in different varieties of stored kernels. According to variety paddy kernels are different in size, shape, colour texture, husk thickness, chemical composition of endosperm and their husk cover. Grain temperature, grain hygroscopicity and relative humidity since long been established as important factors in moiture absorption in grain. Grain temperature and relative humidity are physical factors directly influenced by the physical environment. Grain hygroscopicity is a physiological factor of endosperm determind by its chemical composition. The husk cover of kernel is an important physical feature that might play influencing role in absorbing moisture by the endosperm from atmosphere. In this context of study the role of husk cover in moisture absorption was considered.

Materials and Methods

Kernel samples of 5 different varieties of paddy, dissimilar in kernel size and endosperm quality were drawn as per the procedure prescribed in ISTA (1966). Samples were collected from farmers domestic stocks in several districts of Assam. Five samples, each containing 1g kernel of each variety were carefully and manually husked to find out husk-endosperm ratio using an electronic balance. The husk percentage was calculated by the formula-

$$\text{Husk percentage (\%)} = \frac{W_1 - W_2}{W_1} \times 100$$

where W_1 = weight of dehusked kernel

W_2 = weight of husked kernel

Five clean and dried petridishes were weighed blank. Dehusked and husked kernel in 5g lot of each variety were taken in the petridishes and oven dried at 100±1 °C to constant weight. The kernel lots in petridishes were then exposed to ambient room condition. At different time intervals, each lot of dehusked and husked kernels were weighed along with petridish and then were again exposed for next reading. These works were carried out at a stretch. The moisture percentage at every time interval of exposure was calculated by the formula - Percentage of moisture absorbed (%)

$$= \frac{(W_3 - W_1) - (W_2 - W_1)}{(W_2 - W_1)} \times 100$$

where W_1 = weight of blank petridish
W_2 = weight of petridish with kernel lot dried to constant weight
W_3 = weight of petridish with kernel lot after exposure for each time interval

Results and Discussion

The results of the experimentations are presented in Table 1-3. Husk percentage of the kernel of paddy varieties was different in the five varieties (Table 1). Kernels of Bashmoti paddy had thickest husk cover and Ranjit paddy had thinnest husk cover. Percentages of atmospheric moisture absorption by dehusked kernels of experimented varieties in Table 2, are dissimilar to each other before attaining atmospheric-grain moisture equilibrium. Dehusked kernel of Bora paddy absorbed moisture at a high rate at all time levels (Fig. 1). Dehusked kernel of Aijung paddy initially absorbed moisture at a high rate and after 44 hours it absorbed moisture at lowest rate (Fig. 1). Dehusked kernel of Bashmoti absorbed moisture at a high rate at all time level with the exception of Bora paddy (Fig. 1). Dehusked kernel of Bashmoti and Mala paddy exhibited a similar pattern of atmospheric moisture absorption (Fig. 2).

Results of the experimentation with husk kernel gave a dissimilar pattern of moisture absorption. Husked kernel of Bora absorbed moisture at lowest rate in initial state and after 46 hours it started absorbing moisture at higher rate than Ranjit, and after 142.30 hours than Bashmoti and finally achieved atmospheric-grain moisture equilibrium equal to Mala, Bashmoti and Aijung (Fig. 3). Husked kernel of Mala absorbed moisture at a lower rate at initial state and after 30 hours it absorbed moisture at highest rate (Fig. 3). Husked kernel of Ranjit attained a lower atmospheric-grain moisure equilibrium by absorbing moisture at the lowest rate (Fig. 3). The pattern of moisture absorption by husked kernel of Bashmoti and Mala paddy was dissimilar (Fig. 4).

Regardless of kernel size and shape, the husk cover differs in thickness according to paddy variety. The lots of both dehusked and husked kernels of all the experimented varieties were oven dried to 0% moisture level before exposing for moisture absorption. Thus, the atmospheric-grain moisture gradient was equal at the first state. Time level of 44 hours exposure was considered as the ideal time level for statistical analysis. Correlation co-efficient of the data of husk percentage and moisture absorption was found positively significant. It was calculated 1.336 at 44 hours time level.

The comparative study of the data give a dissimilar pattern in moisture absorption by dehusked and husked kernel of all experimented varieties. Dehusked kernels absorbed moiture rapidly than husked kernels in all the varieties. Dehusked kernel of Bashmoti absorbed 13.7% moisture in 44 hours while its husked kernel absorbed 13.3% moisture in 190.30 hours. Similarly dehusked kernel of Bora paddy absorbed 14.39% moisture in 44 hours while its husked kernel absorbed 14.5% moisture in 290.30 hours.

Accoding to Hukill[1], cereal grains are hygroscopic and have certain similarities in moisture relation properties and absorb moisture as per atmospheric-grain moisture gradient. The experimentation on equilibrium by Banaszek and Siebenmorgen[2] with long grain rough rice under adsorptive conditions established the effect of initial

Table 1. Varietal variation of husk percentage in different varieties of paddy.

Sl. No.	Name of paddy Variety	Initial Weight in gram (W_1)	Finial weight In gram after Husking (W_2)	Weight of Husk in gram (W_1-W_2 = W_3)	Percentage of Husk In terms of weight	Husk rice ratio (W_3 : W_2)
1.	Bora Paddy	1	0.76924	0.23076	23.076	0.3
2.	Ranjit Paddy	1	0.81819	0.18181	18.181	0.222
3.	Bashmoti Paddy	1	0.75	0.25	25	0.333
4.	Aijung Paddy	1	0.77778	0.22222	22.222	0.285
5.	Mala Paddy	1	0.76	0.24	24	0.315

Table 2. Atmospheric moisture absorption by dehusked grain of paddy variety.

Sl. No.	Paddy Variety	Weight of sample in gram (w_1)	Weight of sample in gram after drying to 0% MC (W_2)	MOISTURE ABSORPTION BY DEHUSKED KERNEL (%)				
				After 20 Hours	After 44 Hours	After 71 Hours	After 142 Hours	After 165 Hours
1.	Bora Paddy	5.00	4.30	11.14	14.39	14.62	14.62	14.85
2.	Ranjit Paddy	5.00	4.36	10.53	13.51	13.73	13.96	14.19
3.	Bashmoti Paddy	5.00	4.38	10.73	13.70	13.70	14.16	14.16
4.	Aijung Paddy	5.00	4.36	11.01	13.31	13.31	13.31	13.31
5.	Mala Paddy	5.00	4.39	10.25	13.44	13.44	13.90	13.90

Table 3. Atmospheric moisture absorption by dusked grain of paddy variety.

Sl. No.	Paddy Variety	Weight of sample in gram (w_1)	Weight of sample in gram after drying to 0% MC (W_2)	MOISTURE ABSORPTION BY HUSKED KERNEL (%)									
				18 Hours	46 Hours	71 Hours	93.30 Hours	117.30 Hours	167 Hours	190.30 Hours	215.30 Hours	290.30 Hours	263.30 Hours
1.	Bora Paddy	5.00	4.39	6.8	11.6	11.9	11.9	12.5	13.1	13.3	13.9	14.5	15
2.	Ranjit Paddy	5.00	4.39	8.5	11.9	12.5	12.5	13.1	13.3	13.6	14.2	14.8	15
3.	Bashmoti Paddy	5.00	4.39	7.9	12.2	12.2	12.5	12.5	12.8	13.3	13.9	14.5	15
4.	Aijung Paddy	5.00	4.41	7.6	11.6	11.6	11.6	12.1	12.5	12.7	13.6	14.1	14.7
5.	Mala Paddy	5.00	4.39	7.6	12.8	12.8	12.8	13.6	13.9	14.2	14.5	14.8	15

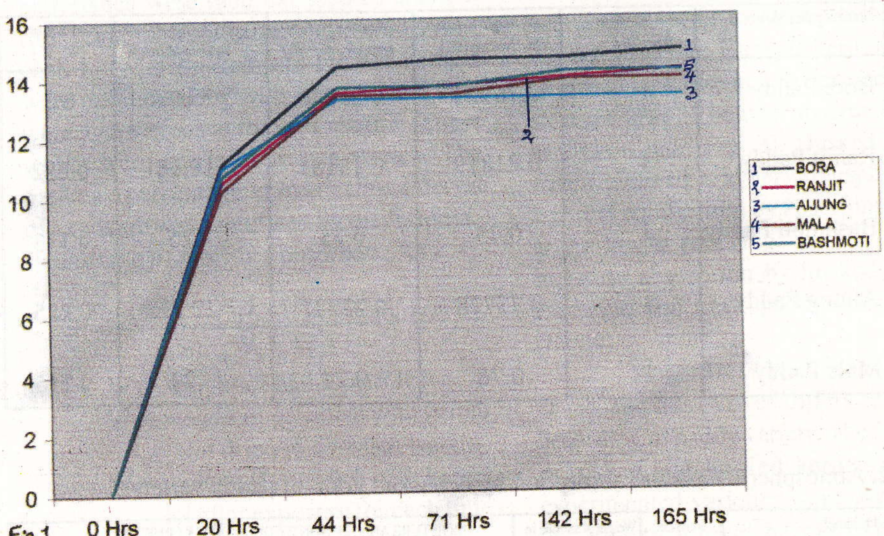

Fig.1.

Fig.1. Pattern of atmospheric moisture absorption by dehusked paddy kernel in ambient condition.

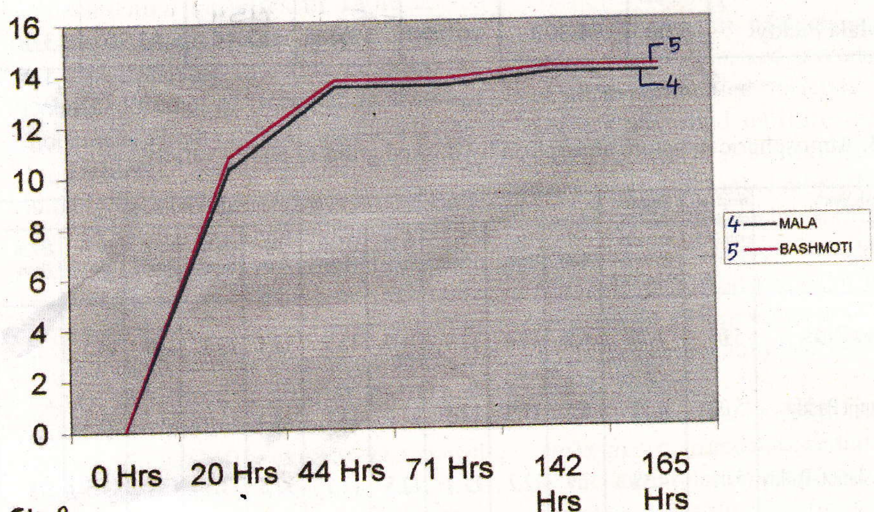

Fig.2.

Fig.2. Relationship between dehusked Bashmoti and dehusked Mala in atmospheric moisture absorption in ambient condition.

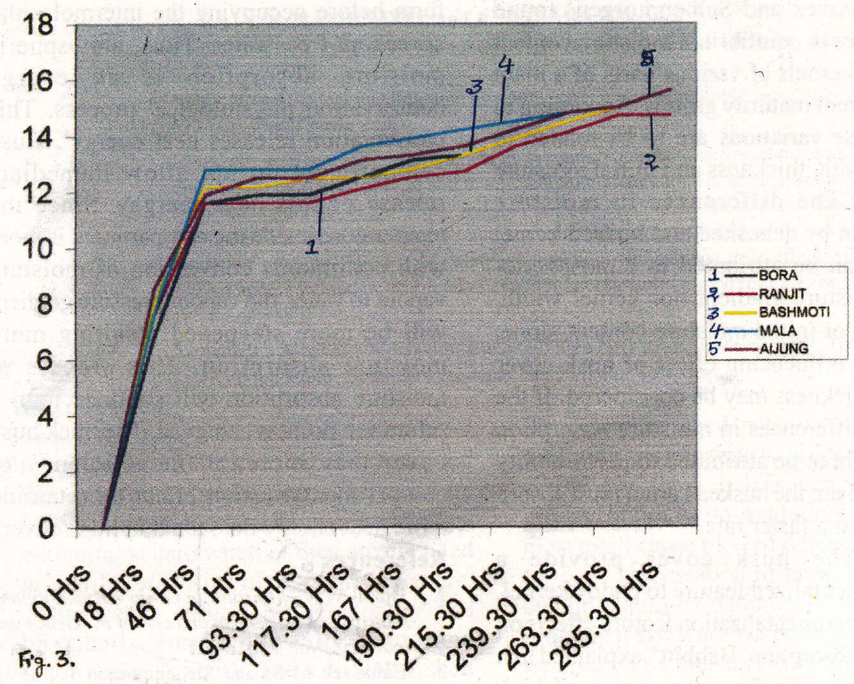

Fig.3. Pattern of atmospheric moisture absorption by husked paddy kernel in ambient condition.

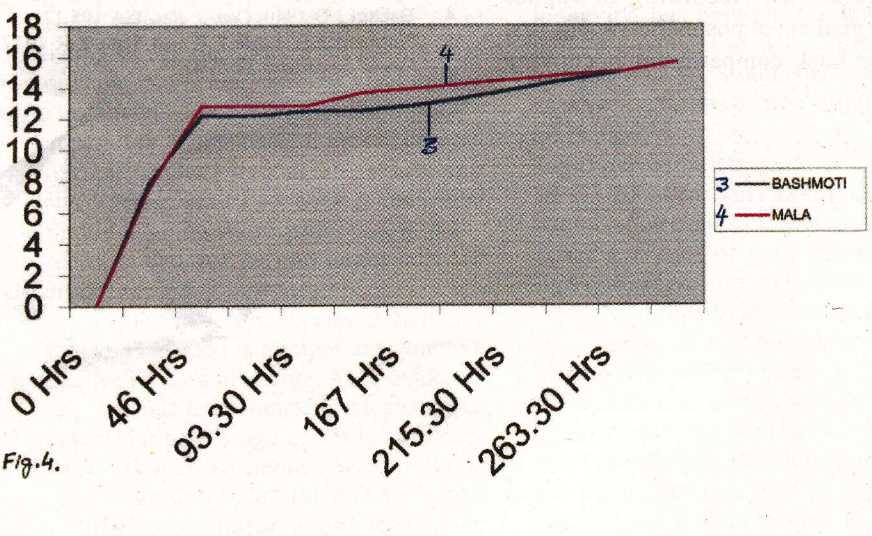

Fig.4. Difference between husked Bashmoti and husked Mala in atmosphericmoisture absorption in ambient condition.

moisture content along with temperature and RH. Banaszek and Seibenmorgen[3] found differences in equilibrium moisture content between kernels of various parts of a plant and different maturity groups. According to them these variations are to be related to kernel width, thickness and initial moisture content. The differences in moisture absorbtion by dehusked and husked kernel neither can be attributed to atmospheric-grain moisture gradient nor kernel width, thickness or initial moisture content alone, rather an influencing effect of husk cover and its thickness may be considered. If the varietal differences in moisture absorption are thought to be attributed to permeability of husk cover, the husked kernel must absorb moisture at a faster rate.

The husk cover provide a compartmentalized feature to paddy kernel. This compartmentalization feature effects on moisture absorption. Babbitt[4] explained that moisture flow is from the region of high vapour pressure to low vapour pressure. According to Hukill[1] the grain moiture is in liquid form compartmentalization facilitates a sharp vapour pressure gradient from atmosphere to inside environment of dehusked kernel. According to vapour pressure gradient atmospheric vapour first enter the husk compartment occupying available spaces, and must convert to liquid form before occupying the intermolecular spaces as free water. Thus, atmospheric moisture absorption is an energy conservation physiological process. This conservation releases heat energy[5]. Husk compartment do not allow immediate release of this heat energey. Since the temperature inside the compartment is more with continuous conversion of moisture vapour to water, the vapour pressure gradient will be more steepened resulting more moisture absorption. This process of moisture absorption will continue until a saturation point is achieved. The thick husk cover may increase the efficiency of compartmentalization effect by retaining more heat energy than the thin husk cover.

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