

# SHRINKAGE AND MOISTURE LOSS OF DRIED MELON SEEDS

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## ABSTRACT

Samples of 100g clean, mature, freshly washed melon seeds were dried at intervals of 1/4, 1/2, 1 and 2h in an air-oven at 60° C. The experiments were carried out with five different bulk samples of melon seeds. The moisture content of the seeds at each drying stage was determined.

The moisture loss in grams per kilogram dry matter(gkg<sup>-1</sup> DM) and the percentage shrinkage(%) of the melon seeds when dried from 10 moisture content levels to 25.6, 21.8, 19.2, 15.3, 10.1 and 7.4 % moisture content (wb) were determined.

The study showed that fresh melon seeds dried to 7.4% moisture content (wb) lost 539.2 grams of moisture per kilogram dry matter and the percentage shrinkage of the seeds was 33.9%. Graphs of moisture loss in grams per kilogram dry matter were plotted against percentage shrinkage. A straight line relationship was found to exist between the moisture loss and shrinkage of melon seeds dried down to 7.4% mc (wb).

**Key words:** Drying, moisture loss, shrinkage

## INTRODUCTION

Moisture control of melon seeds by drying provides an opportunity for long period of storage without deterioration. To prevent losses, the seeds must be stored and maintained at the proper moisture content. Marketing and storage of grains and seeds are based on their moisture content. It is not economical to dry below the required moisture content for marketing and storage.

When moisture is removed from grains and seeds with heated air, there is an overall reduction in volume of the grains and seeds. Wileman (1941) found that reducing the moisture content of corn by 25% gave a bulk volume shrinkage of 33%. In drying wheat, shrinkage of 25 and 10 % were obtained when dried from 30 to 15 and from 30 to 10% moisture content(wb) respectively(Johnson, 1958). A nearly straight line relationship was found to exist between the percentage volume shrinkage and percentage moisture removed to 25% for corn(Hall,1980).

This study was undertaken to determine moisture loss and shrinkage of melon seeds when dried. The study was also to establish the relationship between the moisture loss and shrinkage in dried melon seeds.

## MATERIAL AND METHODS

Fresh melon seeds were harvested from the University of Calabar experimental farm between the months of May and July. The pods were preserved for a week and the seeds

were washed manually. Five bulk samples of clean, mature seeds were obtained for the experiments after sorting. From each bulk sample, 40 samples of 100g each were dried in an air oven set at 60° C. The samples were divided into four sets and dried for 1/4, 1/2, 1 and 2h respectively. At the end of

each interval, each set of ten samples were removed from the oven, cooled, weighed and put back into the oven. After the drying process, all the 40 samples were further dried for 48-60h at 102° C until constant "bone dry weights" were obtained.

### Moisture content determination

From each bulk sample, five representative samples, 100g each were also drawn for moisture content determination. The moisture content of the dried samples were determined according to ASAE(1979).

### Calculations

The amount of moisture in the melon seed at the end of each drying stage was first determined. Then the amount of moisture lost in grams per kilogram of dry matter(gkg<sup>-1</sup> DM) in drying from 10 moisture content levels to 25.6, 21.8, 19.2, 15.3, 10.1 and 7.4% mc(wb) were calculated.

The percentage dry matter in wet seed was calculated as a ratio of the mass of dry matter and the initial wet mass multiplied by 100. The percentage dry matter in dry seed was a ratio of the mass of dry matter and the dried mass multiplied by 100. The percentage shrinkage(%) of the

**TABLE I:**  
**MOISTURE LOSS IN GRAMS PER KILOGRAM DRY MATTER**  
**(gkg<sup>-1</sup> DM)**

ORIGINAL MOISTURE CONTENT, %WET BASIS	FINAL MOISTURE CONTENT, % (WET BASIS)					
	25.6	21.8	19.2	15.3	10.1	7.4
38.3	271.2	340.0	387.5	437.5	510.6	539.2
34.4	176.1	244.9	292.4	342.4	415.5	444.5
32.3	127.9	196.7	244.2	294.2	367.3	396.3
28.2	36.7	105.5	153.0	203.0	276.1	305.1
25.6	-	68.8	116.3	166.3	239.4	268.4
21.8	-	-	47.5	97.5	170.6	199.6
19.2	-	-	-	50.0	123.1	152.1
16.4	-	-	-	14.0	87.1	116.1
13.2	-	-	-	-	47.2	76.2
10.1	-	-	-	-	-	28.0

melon seeds was calculated based on moisture loss and a dry matter(DM) loss of 0.5% as shown below(Hall, 1980):

$$\text{Shrinkage, \%} = 100 - (X/Y * 100) + 0.5$$

Where: X = Percentage dry matter in wet seed  
y = Percentage dry matter in dry seed

**Graph**

A graph of moisture loss(gkg<sup>-1</sup> DM) was plotted against the percentage shrinkage(%) for different initial moisture contents (wb).

**RESULTS AND DISCUSSIONS**

The moisture loss of dried melon seeds at different moisture content levels is shown in Table I. Fresh seeds at 38.3% mc(wb) lost 217.2 to 539.2 grams of moisture per kilogram dry matter(gkg<sup>-1</sup> DM) when dried to 25.6 and to 7.4% mc(wb). This represented 43.8 and 87.7% of the

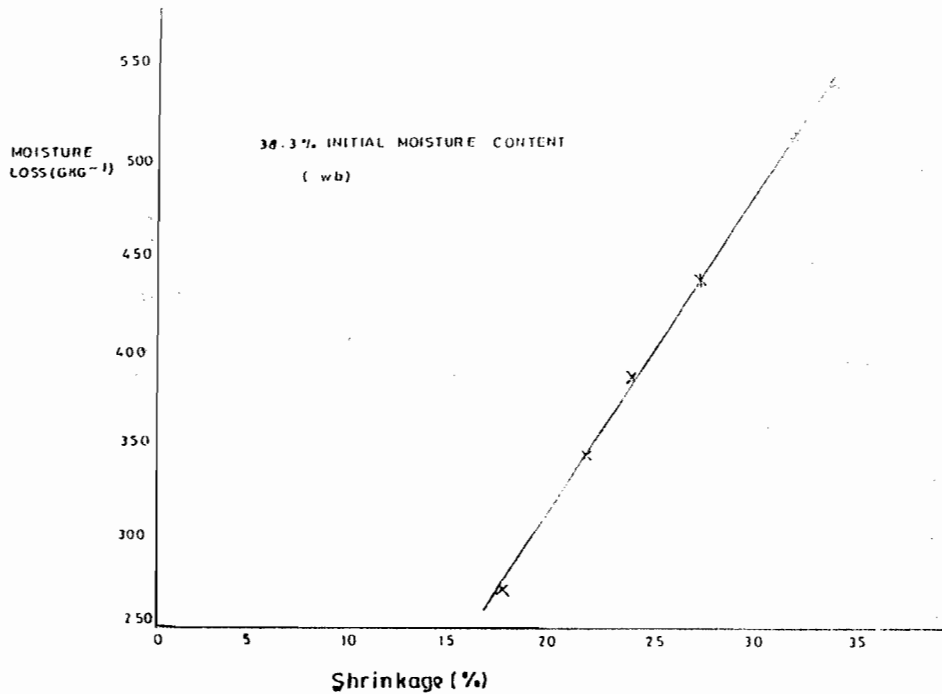


Fig1 Plot of moisture loss against shrinkage

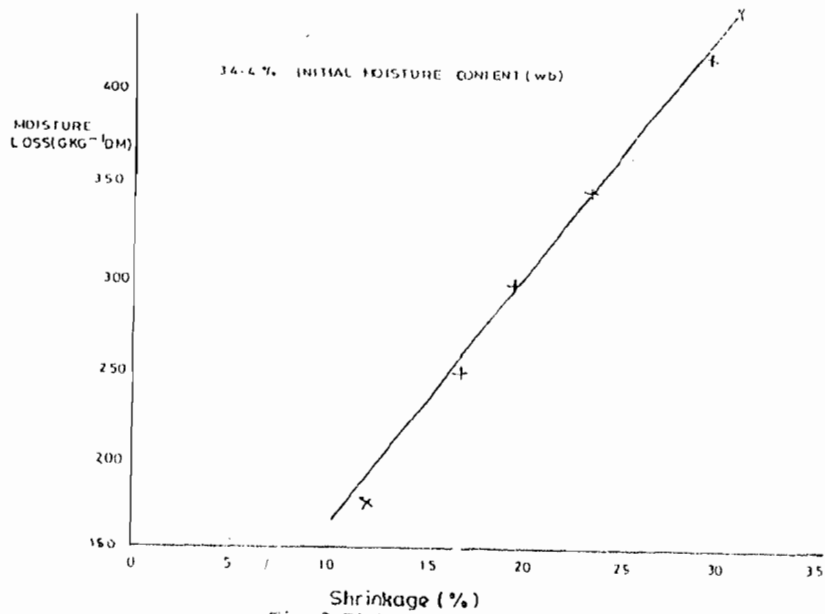


Fig. 2 Plot of moisture loss against shrinkage

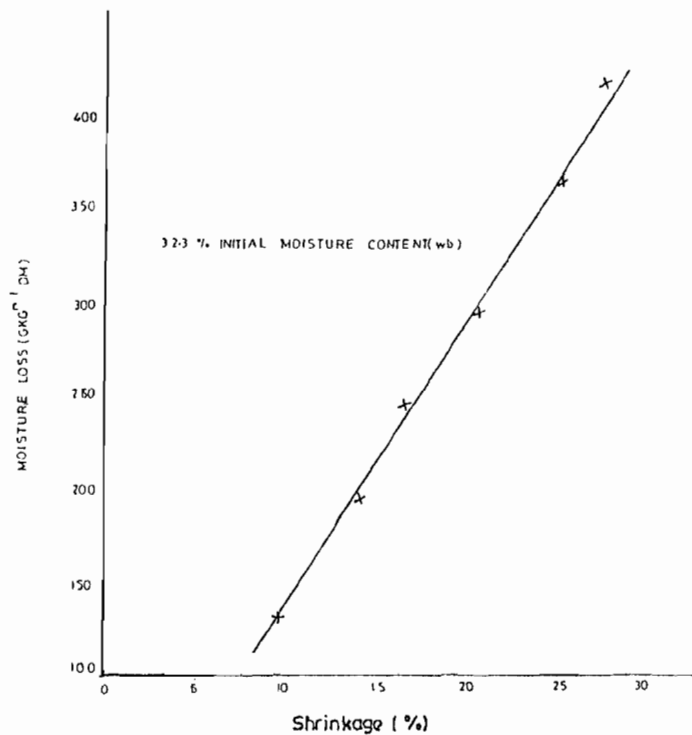


Fig. 3 Plot of moisture loss against shrinkage

TABLE II: PERCENT SHRINKAGE (%)

ORIGINAL MOISTURE CONTENT, %WET BASIS	FINAL MOISTURE CONTENT, % (WET BASIS)					
	25.6	21.8	19.2	15.3		7.4
38.3	17.6	21.6	24.1	27.2	31.9	33.9
34.4	12.2	16.5	19.3	23.1	29.0	30.7
32.3	9.5	13.9	16.7	20.6	25.2	27.4
28.2	4.0	8.7	11.6	15.7	20.6	23.0
25.6	-	5.4	8.4	12.7	17.7	20.2
21.8	-	-	3.7	8.2	13.5	16.1
19.2	-	-	-	5.1	10.6	13.2
16.4	-	-	-	1.8	7.5	10.2
13.2	-	-	-	-	3.9	8.6
10.1	-	-	-	-	-	3.4

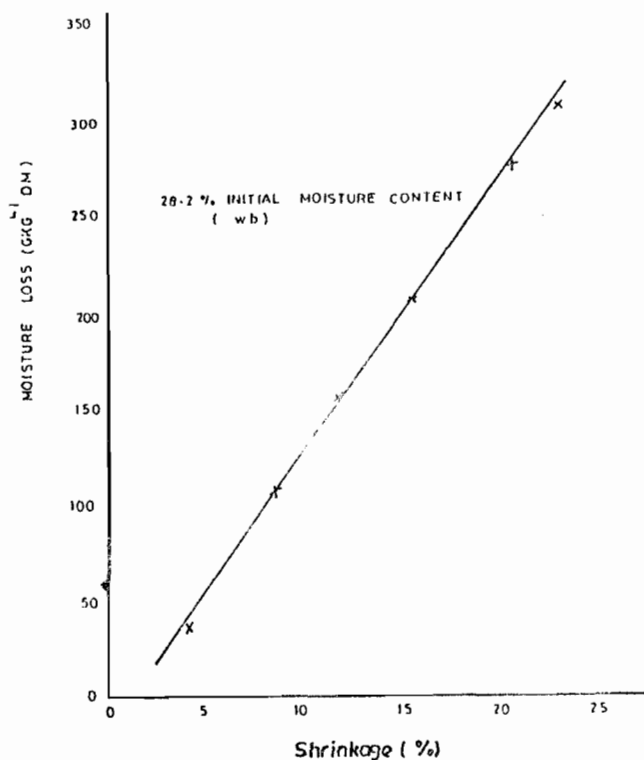


Fig.4 Plot of moisture content against shrinkage

initial moisture in the seeds. In an earlier work, the average moisture content of melon seeds under normal storage condition was found to be 7.4%, wb (Okokon, 1997). Similarly, at 34.4% mc, 176.1 to 444.5 of moisture in gkg<sup>-1</sup>

DM were lost, representing 33.6 to 84.8% of the initial moisture; and at 32.3% mc, 127.9 to 396.2 of moisture in gkg<sup>-1</sup> DM were lost, representing 26.9 to 83.2% of the initial moisture. Similarly, at 28.2% mc, 36.7 to 305.1 of

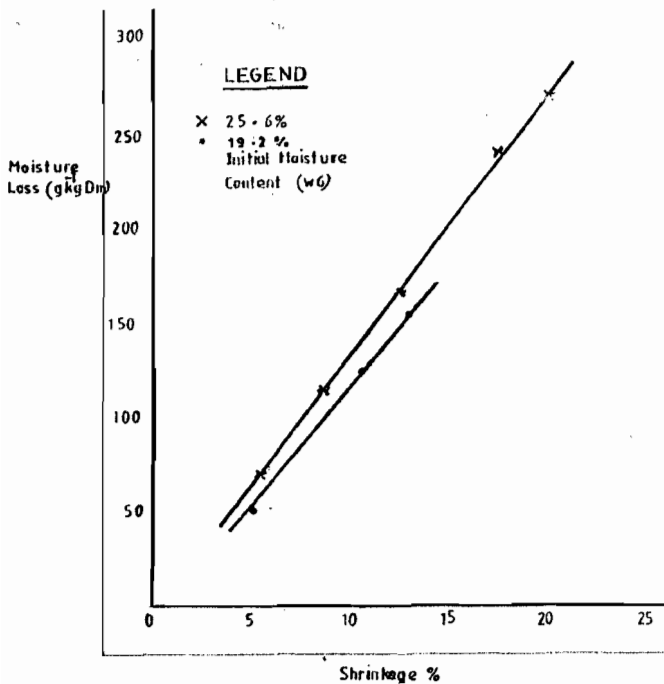


Fig. 5 Plot of Moisture Loss against Shrinkage

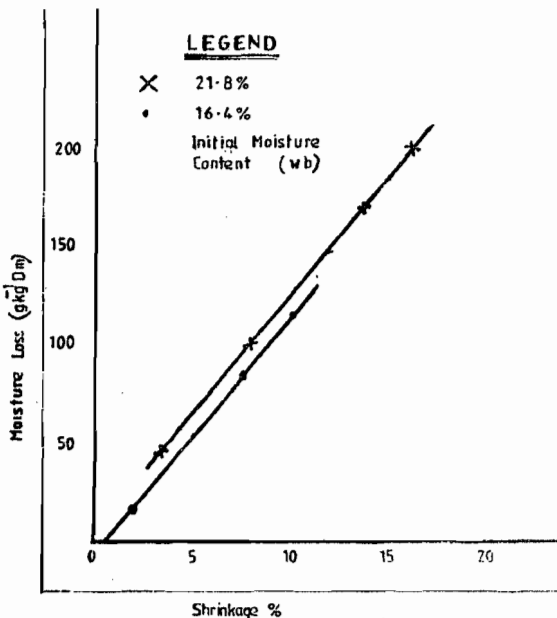


Fig. 6 Plot of Moisture Loss against Shrinkage

moisture in  $\text{g kg}^{-1}$  DM were also lost, representing 9.5% to 79.3% of the initial moisture.

Melon seeds at 25.6% mc were dried to 21.8% mc and to 7.4% mc, while those at 21.8% mc were dried to 19.2% mc and to 7.4% mc. The moisture loss were 20 to 77.6% and 16.8 to 71.4% respectively of the initial moisture. Similarly, seeds at 19.2% mc and 16.4% mc were dried to 15.3% mc and to 7.4% mc, where 21.6 to 65.5% and 7.1 to 59.2% of moisture were lost respectively. The moisture reduction from 13.2% mc and 10.1% mc to 7.4% mc were also presented. Table II shows the percentage shrinkage(%) of dried melon seeds. It was found that for reducing the moisture content of fresh melon seeds from 38.3% mc to 25.6% mc and to 7.4% mc, the percentage shrinkages were 17.6 to 33.9%. This showed a considerable reduction in the volume of the seeds. Figures 1 to 6 show graphs, each at the specified initial moisture content, of moisture loss plotted against percentage shrinkage. In each of the graphs, a nearly straight line relationship was found to exist between moisture loss and percentage shrinkage. A similar straight line relationship was found to exist in corn between the percentage shrinkage and percentage moisture removed down to 25% wb (Hall, 1980).

## CONCLUSION

This study showed that fresh melon seeds dried to 25.6% and to 7.4% mc, lost 271.2 to 539.2 grams of moisture per kilogram of dry matter and the corresponding percentage shrinkage were 17.6% to 33.9%. A straight line relationship between moisture loss and the percentage shrinkage of dried melon seeds was established.

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