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HARVEST MANGMENT AS A KEY TO HIGH HEAD RICE

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ABSTRACT

The relationship of moisture to milling quality gives growers a degree of control over head rice by allowing them to time their harvest according to moisture content. The head rice is highest when rice is harvested at moisture content greater than what is required for safe storage. Three of Egyptian varieties Sakha 101, Sakha 104 and Giza 177 were cultivated at Etai El-Baroud Agricultural Research Station Farm, Egypt in 2007 season, to determine the suitable harvesting time according to the grain moisture content to obtain high quality milled rice (head rice) character. This investigation was done in Rice Technology Training Center (RTTC), Alexandria; at different levels of harvesting time according to moisture content between 30% wet bases to 20% wet bases approximately for each variety in four replicates. Analysis of data showed that the optimum harvest moisture content differs with each variety. The optimum harvest moisture content for maximum head rice were obtained at 21- 23% for Sakha 101, from 20- 24% for Giza 177 and from 23- 26% for Sakha 104. So harvest management preserves rice quality that contribute directly to profit, and then rice growers must harvest rice as carefully as they grow it. Although this study showed that moisture content is very important, there are many factors have effect on milling quality.

Key words: Rice- Harvest-Moisture -Quality

INTRODUCTION

Harvesting at higher moisture levels could give yield increases equivalent to more than 10 years progress in plant breeding at present rates in some Australia areas (Jonathan Banks, 1999). But rice harvesting with high moisture content increases the risk of degrading post harvest quality and the rice needs careful in-store management.

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In Egypt rice production plays an important role in agricultural strategy to overcome food shortage and improve self sufficiency. Rice is grown in about 1.5 million feddens (Anonymous, 2007). Rice growing duration is 125-150 days from the May 15th to mid October. In order to obtain maximum rice yield and total milled rice, it is essential to harvest just on time. Early harvesting may reduce paddy yield and head rice due to the presence of immature kernels. Late harvesting may also reduce rice yield because of grain shattering and lodging. Harvesting time is an important variable which determines the field yield, total and head yield of rice.

Rice farmers decide their harvesting time by examining the percentage of ripened grains in the panicles, when 80% of the panicles are in the hard-dough stage. To avoid fissuring and excessive grain breakage, thresh and dry the grain as soon as possible after cutting. Govindaswami and Gosh (1968), from India, reported that harvesting between 27–39 days after flowering at high moisture content (18–23%) gave maximum head rice recovery. Harvesting before or after that period lead to increase of broken grains. In Japan, Eikichi (1954) found that, the best time to harvest was 20–35 days after heading. While, in California, some rice growers reported that, high head rice obtained at 22-26% of grain moisture content (Jongkaewwattana, 1990), and in Arkansas, rice harvesting at 18-22% moisture content (Bennett,et al, 1993) .

However, at harvest moisture content is very important, there are many factors affecting milling quality so that, it is possible to get high or low head rice over a wide range of harvest moisture. Most adjustments in combine operator's manuals emphasize reducing losses first, which are usually worth more than quality. The objective of this study is to determine the suitable rice harvesting moisture content to obtain high head rice.

MATERIAL AND METHODS

Paddy variety

Three Egyptian rice varieties Sakha 101, Sakha 104 and Giza 177 (as short grains) were used in this study at five levels of harvesting time according to moisture content between 30% wet bases to 20% wet bases approximately for each variety in four replicates .This Egyptian varieties grown in Beheria Governorate, Etai El Baroud Agricultural Research Station, Egypt. An

amount of three kilograms from every variety were harvested at suitable moisture content under our conditions and taken it.

Measuring moisture content

Moisture content was measured in the field. The electrical methods were used as indirect methods, because they are gives us directly in a short time indicator and easy to carried and used it. Figure (1) shows a conductance moisture meter which used. Measuring range from 10-30%, with accuracy ±0.5%

Figure (1) Conductance moisture meter

Rice grain samples were harvested manually from each variety to check its moisture. For best accuracy, takes the sample from lower and topmost panicles. We dried all the samples to achieve to about 14% moisture content to be suitable for milling process by natural air drying which done in Rice Technology Training Center (RTTC), Alexandria.

Milling process

Cleaning

Paddy rice samples were mechanically cleaned to remove foreign materials such as straw, soil particles. Mud balls and weed seeds according to the different shapes, sizes and specific weight. Such cleaning may be done using a precleaning electric apparatus, Cater-Day Dockage tester (Model TRG). To ensure high degree of cleanliness, recycling in the apparatus was done. Mechanical cleaning may be completed by hand.

Husking

The first step in the actual rice milling operation is removing hulls to obtain brown rice. Therefore, a Satake laboratory rubber roll sheller model (THU-

35A) with a capacity of 40 kg/ hr was used. From the outside we can confirm the husking condition. Brown rice, husks and immature paddy are separated by an aspirator automatically. The sheller consists of two rubber rolls, each of 100 mm diameter and 35 mm wide. The rolls are driven mechanically by motor 400W, and rotate in opposite inward directions.

Milling

A Satake Testing Mill model (TM-05), with an input capacity of 200 grams of brown rice in one time, was used. This whitening machine consists of abrasive roll ≠36 is of 20 cm. diameter and rotate at a speed of 450 rpm. The roll rotate inside a fixed cylinder is of 22 cm. diameter made of perforated steel. The bran layer is removed from the brown rice as a result of the friction between rice kernels and both cylinders.

RESULTS AND DISCUSSION

Many studies show that head rice is highest when rice is harvested at moisture content greater than what is required for safe storage. Data in figure (2) showed that the effect of grain moisture content at harvest on head rice percentage in Sakha 101 rice variety.

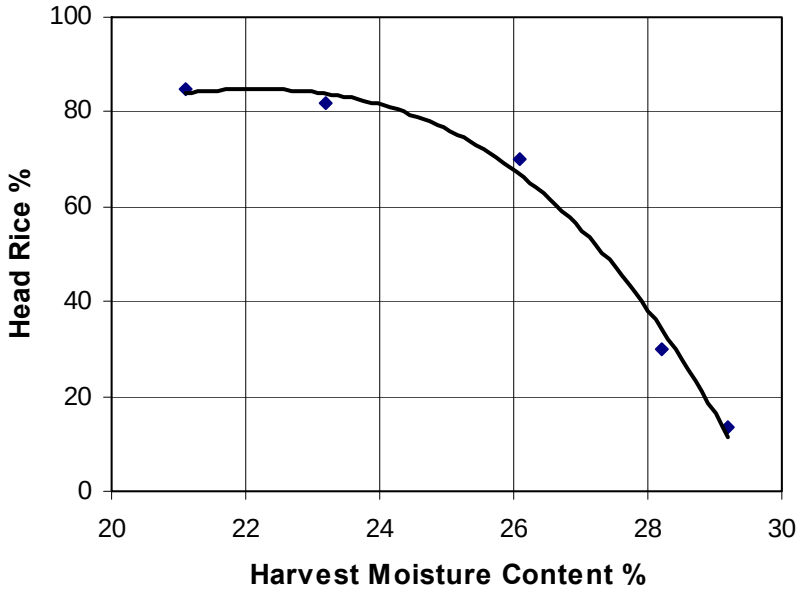

Figure (2): Head rice % for Sakha 101as affect by harvest moisture content %

The relationship between harvest moisture content percentage and the head rice percentage can be expressed in the equation:

Head rice % (Sakha 101) = 817.16 + 116.1 M + 6.004 M^2 - 0.1018 M^3
Where: ***M*** is the grain moisture content percentage in wet bases.
With the ***R^2 = 0.9903***

From the statistical analysis and mathematical equation which described the relationship shows the power of moisture content of grain during the grain harvest on head rice %. This study improved the importance operating moisture content of grain during harvest on the quality of grain. The obtained data showed that, the harvest moisture content from 21 to 23 % gives the lowest broken percentage, so highest head rice percentage and might help raising the efficiency of some of the factors which affected on rice quality.
Data in figure (3) showed that head rice percentage in Sakha 104 rice variety as affected by moisture content in grain during harvesting.

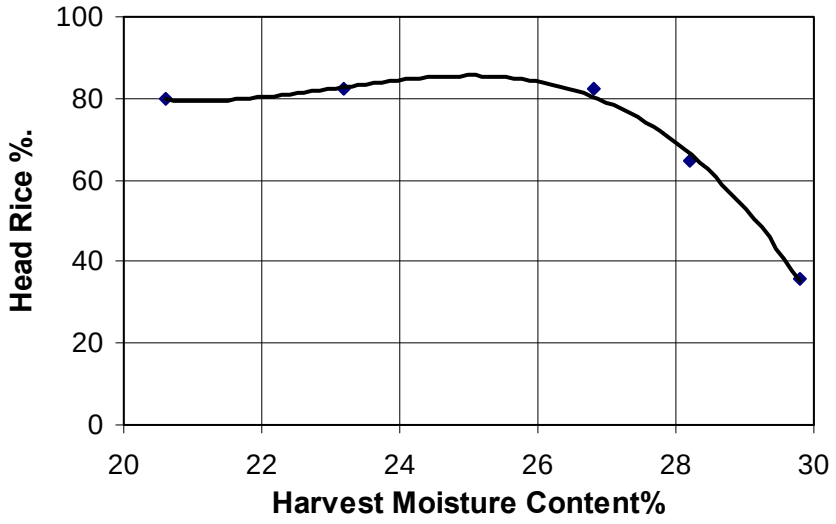

Figure (3):Head rice % for Sakha 104 as affect by harvest moisture content %

Data showed that, the highest head rice percentage was obtained when Sakha 104 rice variety was harvested in range between 23 to 26 % grain moisture content. The best correlation clarify that relationship is specified by:

Head Rice %(Sakha104) = 5071.8- 648.25M + 28.337M^2 -0.4099M^3
With the ***R^2 = 0.9954***
Outside this range leads to low grain quality of rice may be due to the majority of broken grains or to a higher proportion of grain-full maturity.

Referring to the data in figure (4) could be concluded that, the highest head rice percentage was obtained when Giza (177) rice variety was harvested in 22% grain moisture content. The range between 20 to 24 % grain moisture content for harvesting Giza (177) rice variety gives the best head rice percentage.

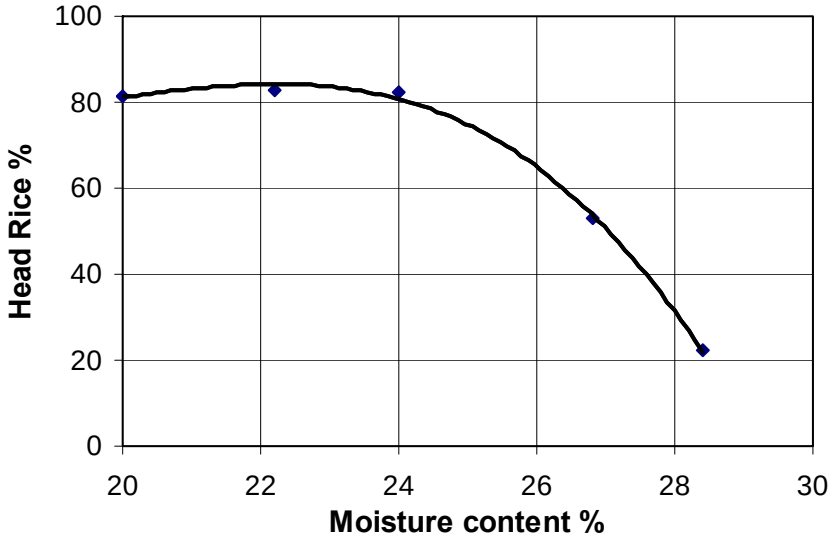

Figure (4):Head rice % for (Giza 177) as affect by harvest moisture content%

The relationship between harvest moisture content percentage and the head rice percentage for Giza (177) rice variety can be expressed in the following equation:

$$\textit{Head Rice \% (Giza177)} = 957.72 - 137.66M + 7.0833M^2 - 0.1196M^3$$

With the $R^2 = 0.9976$

The holistic view of data, we find that any field of rice at harvest time is a mixture of wet and dry kernels. The dry kernels in this mixture, those below approximately 16% moisture, are the problem. If they are rehydrated, from any source of moisture, they can crack. When these cracked kernels are milled, they usually break, so you get lower head rice. This relationship of moisture to milling yield gives growers a degree of control over head rice by allowing them to time their harvest according to moisture content.

The optimum harvest moisture content differs with each variety, as shown in Table (1). Data cleared that , the highest head rice percentage was obtained when Sakha 101 rice variety harvester at 22% which gives about 85 % head

rice ,but when Sakha 104 rice variety harvested at 25% gives also about 85% head rice , while Giza 177 rice variety gives 84% of head rice when harvested at 22% grain moisture content. In fact it is very difficult in the field determine the only one percentage of grain moisture content because there are differences in grain within panicles and also differences between different parts of the field and the possibility of harvesting at the same time, which may lead to differences in the optimum moisture content For that there is the. optimum period for the harvest moisture content of each type of rice, which only shows the non significant difference in the quality of grain. The treatments means were compared using the least significant difference test (LSD) at 5% probability level according to CoHort software (2005).

Table (1): The predicted head rice % as affected by the interaction between grain moisture content at harvest and three rice varieties Sakha 101, Sakha 104 and Giza 177.

Harvest	Sakha101	Sakha104	Giza177
M.C%	Head rice %	Head rice %	Head rice %
29	16.9588 g	53.15455 e	6.0041 g
28	38.9124 f	69.1524 d	31.3648 f
27	55.7716 e	79.00985 c	50.7997 e
26	68.1472 d	83.9932 abc	65.0264 d
25	76.65 c	***85.36875 a***	74.7625 c
24	81.8908 b	84.4028 ab	80.7256 b
23	84.4804 a	82.36165 abc	83.6333 ab
22	***85.0296 a***	80.5116 bc	***84.2032 a***
21	84.1492 a	80.11895 bc	83.1529 ab
20	82.45 b	82.45 abc	81.2 b
LSD 0.05	1.30363437	5.310	2.987866639

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الملخص العربى

إدارة الحصاد مفتاح لأعلى نسبة حبوب كاملة في الأرز

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العلاقة بين المحتوى الرطوبى و جوده ضرب الأرز يعطي المزارعين درجة من التحكم في نسبة الحبوب الكاملة عن طريق السماح لهم بالحصاد وفقا لمحتوى الرطوبة. النسبة المئوية لحبوب الأرز الكاملة أعلى عند حصاد الأرز عند محتوى رطوبى اكبر مما هو مطلوب لتخزينها بشكل آمن.

تم زراعة ثلاثة أصناف مصرية من الأرز (سخا ١٠١ ، سخا ١٠٤ ، جيزة ١٧٧) بمزرعة محطة البحوث الزراعية بإيتاي البارود(مركز البحوث الزراعية) وذلك في موسم ٢٠٠٧ وذلك لتقدير التوقيت المناسب للحصاد حسب نسبة المحتوى الرطوبة في الحبوب للحصول على أعلى نسبة حبوب كاملة عند ضرب الأرز بعد الحصاد. تم حصاد الأصناف الثلاثة في أربع مكررات عند درجات مختلفة من المحتوى الرطوبة في الحبوب تتراوح بين ٣٠- ٢٠ %. تم إجراء التجارب وتحليل العينات في معامل مركز تدريب تكنولوجيا الأرز بالإسكندرية .

وقد أوضحت النتائج الرئيسية المتحصل عليها ما يلي:-

أعلى نسبة حبوب كاملة تم الحصول عليها عند حصاد الصنف سخا ١٠١ عند محتوى رطوبى للحبوب ٢١-٢٣%. أما الصنف جيزة ١٧٧ فكانت أعلى نسبة حبوب كاملة عند الحصاد عند درجة رطوبة حبوب ٢٠-٢٤% أما الصنف سخا ١٠٤ فكانت أعلى نسبة حبوب كاملة عند الحصاد عند رطوبة حبوب قدرها ٢٣-٢٦%.

لهذا تعتبر إدارة الحصاد و خاصة عملية تقدير نسبة الرطوبة بالحبوب قبل الحصاد مهمة جدا لأنها تساهم بشكل مباشر في العائد الاقتصادي للمحصول و كذلك توجه مزارعي الأرز بالاهتمام بالحصاد كما يهتم المزارع بزراعة الأرز.

*باحث - مركز تدريب تكنولوجيا الأرز بالإسكندرية

**رئيس بحوث- مدير مركز تدريب تكنولوجيا الأرز بالإسكندرية- معهد بحوث المحاصيل الحقلية- مركز البحوث لزراعية