THE EFFECT OF MOISTURE CONTENT OF SOME RICE VARIETIES ON HUSKING EFFICIENCY

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ABSTRACT:

The effect of moisture content at three different level of 9-11%,11-13% , and 13-15% on rice husk quality cultivar jasmine (JA), Mishkhab 31(M31) , and Amber (AM) using a husking machine with rubber rolls (Satake rubber roll – THU-35A type). The experiment was carried out three replication in factorial experiment under Complete Randomized Design (CRD) with three replications .

The results showed that the JA cultivar is significantly better than MC31 and AM cultivars in all studied parameters , they achieved production process 1.572t\h , 1.502 t\h and 1.414 t\h , power consumption 15.103kw,15.791kw and 16.015kw, milling recovery 64.478% , 64.016% , and 63.634% , husking efficiency 81.702% , 80.824, and 80.041% , brown rice 78.440% , 77.846% , and 77.201% , and the full rice percentage 64.793% , 62.523% , and 59.779% respectively . The moisture content of grain at range of 9-11% was significantly superior to other ranges of 11-13% and 13-15% in all studied condition

Keywords : Husking , Rice , Moisture content , Machine , Performance evaluation .

تأثيرالمحتوى الرطوبي لبعض أصناف الرز على كفاءة عملية التقشير

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المستخلص

تضمن البحث دراسة تأثير ثلاثة مستويات مختلفة من الرطوبة 9-11% , 11-13 % و 13-15% على كفاءة التقشير لثلاثة اصناف من الرز ياسمين (JA)، المشخاب 31 والعنبرباستخدام ماكنة تقشير ذات رولات مطاطية .(Satake rubber roll – THU-35A type) .

نفذ البحث كتجربة عاملية باستخدام التصميم العشوائي الكامل (CRD)وبثلاث مكررات حيث أظهرت النتائج تفوق الصنف JA معنويا على الصنف مشخاب 31 والصنف عنبر في كل الخصائص التي شملتها الدراسة .وأظهرت النتائج ان كمية الإنتاج 1.572 طن / ساعة ، 1.502طن / ساعة و1.414 طن / ساعة ،استهلاك الطاقة 15.103كيلو واط ، 15.791 كيلوواط و 16.015 كيلو واط ، كفاءة الطحن 64.478 % ، 64.016 % و 63.634٪، وكفاءة تقشير 81.702% ، 80.824%و 80.041%، والرز البني 78.440%، 77846% و 77.201% ,والحبة الكاملة نسبة 64.793% ، 62.523% و 59.779% . وكان المحتوى الرطوبي للحبوب في المستوى 11-9٪ متفوق إلى حد كبير على المستويات 13-11% و15-13% ولجميع الظروف المدروسة .

الكلمات المفتاحية : التقشير , الرز , المحتوى الرطوبي , الماكنة , تقييم الأداء

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INTRODUCTION

Rice is an important crop , it is in the third rank after wheat and barley in terms of area planted and production and is considered a vetal food material for more than half of 2the world s population , Its importance as a food crop has been increasing with the encrease of population . It is estimated that the paddy production in Iraq is grossly inadequate to meet the populations the start is dealt with through importing from the neighboring states . ”Chaitep et al (2008)" the compressive load resistance of rice grain is based on its characteristic of yield strength of which can be expressed as relationships of the shear strength . Two similar experiments , both parallel and cross grain position were conducted on the rough rice and brown rice to determine the power consumption of the machines as well as lowering the broken rice during the rice mill processes . " Al sharifi et al (2016 a) " . The values of productivity and head rice decrease with increase cracked grain and broken rice , reflected negatively on values of total costs ." Zareiforoush et al (2010)" investigated the mechanical properties of two rice varieties. They recommended that lower rates of compressing load can minimize the percentage of cracked grain . " Alsharifi et al (2017) " There was a significantly influence of machine type on total cost at different moisture content and clearance between cylinders as obtain on high values of costs with increased moisture content and decreased the clearance between cylinders ."Al Sharifi,2010.The breakage of grain to a quarter of its original length is due to several reasons, including the moisture content of the grain and the organization of the machine and mechanical factors exposed to the grain before manufacturing Mead et al(2003). The moisture content is a major factor affecting the milling quality of rice .If the moisture content is too low or too

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high there will be a decline in the milling recovery and head rice . "Al Maamouri and Al

Sharifi ,(2008)". Chalkiness an opaque white discoloration of the endosperm reduces the value of head rice kernels and decreases the ratio of head to broken rice produced during the milling proces The main goal of this research is to study the effect of husking machine (Satake) on rice , Jasmine (JA) , Amber(Am) and Mchkab (Mc31) cultivars at different ranges of grain moisture content.

MATERIALS AND METHODS

This study was conducted in 2016 to evaluate the effect of husking machine (Stake).The experiments were done at three level of grain moisture content of 9 -11 % , 11-13% and 13-15% and three rice types jasmine (JA) , Mishkhab 31 (M31) , Amber (AM) caltivars . The clearance between cylinders at levels of , 0.5mm . The Jasmine (JA) cultivar was selected for the experiments and the samples were taken by the probe and collected on the form of heap , which the number

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heap were six and each heap weight was 160kg, according to the method used by Al sharifi et al(2016c). The paddy samples were cleaned by using sieves to remove all foreign matters , broken and immature grains . Thenthe random samples which are taken from each heap in 1000g weight .The initial moisture content of paddy grain was determined by oven drying methods at 103C for 48h Sacilik et al (2003). The paddy of (JA) cultivar was kept in an oven at temperature of 43C and

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monitored carefully for determining the moisture content of grain at 13-15% then the

.PRODUCTION PROCESS : Equation 1(Alsharifi 2007)

$$P = \frac{W \times 60}{T \times 1000}$$

Where : P : production process (ton/h), W – output weight . (kg) and T – time (hr)

POWER CONSUMPTION: Equation 2 (Chaitep 2008)

$$P = \frac{\sqrt{3}}{1000} \cdot v \cdot I \cdot \cos\varphi \cdot E_{FE}$$

Where : P – power consumed .(kw) , V – voltage , I – the current (Am) , Angle between the current and voltage – cos α and E_{FE} – The efficiency of the motor (%).

MILLING RECOVERY PERCENTAGE : Equation 3 Alsharifi et al (2016c)

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samples were taken and placed in the precision divider to get a sample of 200g weight and then the samples were carefully sealed in polyethylene bags . The Satake type machine was adjusted on 0.5mm clearance between cylinders and linear speed of 5.6m/s and then the samples of 200g were placed in the machine . Then the sample was taken out of the machine and placed in a cylindrical insulating device from a Satake type where operating time 2 min , The angle of inclination was 25.All properties were Calculated for each running test .

$$M_r = \frac{W_M}{W_S} \times 100$$

Where : M_r – Is the Milling process.(%) , W_M – Is the weight of milling paddy .(g) , and W_S – Is the weight of sample used (g).

THE HUSKING EFFICIENCY : The husking efficiency was determined by using Equation 5 Minaei et al (2007)

$$P_E = \frac{W_S - W_{RU}}{W_S} \times 100 \qquad (5)$$

Where P_E: is the husking efficiency ; (%) . W_{Ru} : is weight of paddy unpeeled (g) and W_S : is weight of paddy sample used. (g)

.BREAKAGE PROPOTION : The Equation 2 was used to calculate the percentage of the head paddy and broken in the separation process of the broken grain from the head grain (Gbabo and Nadagi , 2014).

Where , P_{Br} Is the proportion of breakage paddy (%) , Wbr is the weight of breakage grain (g) and

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W_S is the weight of paddy sample used (g) .

BROWN RICE PERCENTAGE :

The Equation 3 represent the amount of grain produced by the process of husking which included percentage of breakage and percentage of cracked grain .(Alwakel,1999)

$$P_{obr} = \frac{W_{br}}{W_S} \times 100 \quad (3)$$

Where , P_{obr} : is percentage of brown rice (%) W_{br} : is weight of brown rice (g) . and W_s : is

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weight of rice sample used .(g)

PERCENTAGE OF HEAD RICE :

Percentage of head rice Equation .4 represents the amount of whole grain resulting from the husking process and broken grain and cracked grain percentage . (Ali and Shatti., 2006 and Asharifi et al .,2016 d)

$$P_{Fg} = \frac{W_{Fg}}{W_S} \times 100 \quad (4)$$

Where: P_{Fg} : is the proportion of whole grain (%) . W_{Fg} : is weight w

$$P_{Br} = \frac{W_{br}}{W_S} \times 100$$

hole grain (g) , and W_s: is weight of paddy sample used .(g)

The same method was used with cultivars (JA, AM, MC31) to test Satake machine at moisture content of grain in the range 9-11% , 11-13%, and 13-15% clearances 0.5mm in three replications.

Experimental results were analyzed statistically using complete randomized design CRD and the difference among treatment for each factor was tested according to the LSD test (Alsahoeke et al.,1990)

RESULTS AND DISCUSSION

PRODUCTION PROCESS

The effect of rice cultivars , and grain moisture content on rice production

process t\h is shown in Table 1. The increasing the grain moisture content leads to decrease of the paddy productivity, the results were for 1.882, 1.407 and 1.199 t\h, respectively

when increasing grain moisture, leads to an obstruction process husk of grain and this

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because of the adhesion of grain. These results are consistent with the results of Alsharifi et al(2016 a). it is that the production process of the (JA) cultivar (1.572 t\h) is significantly better performance than the (MI31) and (AM) cultivars 1.502 and 1414 t\h ,(respectively) .because the difference among cultivars kernel lengths .These results are consistent with the results of Mead et al (2003). All the interactions are significantly different and the best results (1.932 t/h) have come from the overlap among 9%-11% grain

moisture content and (JA) cultivar . The levels of the production process at different

conditions are shown in Figure 1 the three rice cultivars (JA ,MI31 and AM).

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Table 1. Effect of moisture content on production process

Production t\h				
Cultivar	Moisture content %			Means of cultivar
	9 -11 %	11-13%	13-15%	
Jasmine (JA)	1.932	1.516	1.269	1.572
Mishkhab31(MC31)	1.893	1.404	1.208	1.502
Amber(AM)	1.821	1.301	1.121	1.414
LSD=0.05				0.038
Means of Moisture	1.882	1.407	1.199	
LSD=0.05		0.101		

POWER CONSUMPTION

The effect of rice cultivar and moisture content on power consumption kw is shown in Table 2. The moisture content of 9-11% showed the lowest power consumption (15.024 kw) , while the highest power consumption of (16.449 kw) was for 13-15% moisture content . This is due to the increased Damocles effect on grains during the hulling process, hence increased consumed capacity with increasing moisture content of grain.

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These results are consistent with the results of Chaitep et al (2008). It is indicated that the power consumption of the (JA) cultivar (15.103 kw) is significantly better than (M31) and (Am) cultivars (15.791 and 16.015 kw, respectively) .These results are consistent with the results of Al sharifi et al (2017).The best results (14.335 kw) have come from the interaction among 9%-11% grain moisture content and (JA) cultivar . The levels of the power consumption at different conditions are shown in Figure 2 the three rice cultivars (JA ,M31 and AM).

Table 2. Effect of moisture content on power consumption

Power consumption KW				
Cultivar	Moisture content %			Means of cultivar
	9 -11 %	11-13%	13-15%	
Jasmine (JA)	14.335	15.012	65.963	15.103
Mishkhab31(MC31)	15.209	15.595	16.569	15.791
Amber(AM)	15.528	15.701	16.815	16.015
LSD=0.05				0.045
Means of Moisture	15.024	15.436	16.449	
LSD=0.05		0.146		

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MILLING RECOVERY PERCENTAGE :

Table 3 indicates that increasing the grain moisture leads to decreasing percentage of milling recovery. The milling recovery levels were 65.179%, 63.863% and 63.085% , respectively . This is due to the characteristics design of engineering, which characterized by Satake machine. These results are consistent with the results of Mead et al (2003). the milling recovery percentage of the (JA) cultivar 64.478% was significantly better performance than the (M31) and (AM) cultivars(64.016% and 63.634%,

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respectively ,because the difference among cultivars kernel lengths .These results are consistent with the results of Al Maamouri and Al Sharifi (2008). The best results (65.618%) have come from the interaction among(9%-11%) grain moisture content and (JA) cultivar . The levels of the milling recovery percentage at different conditions are shown in Figure 3 the three rice cultivars (JA ,M31 and AM).

Table 3. Effect of moisture content on milling recovery percentage

Milling recovery %				
Cultivar	Moisture content %			Means of cultivar
	9 -11 %	11-13%	13-15%	
Jasmine (JA)	65.618	64.144	63.671	64.478
Mishkhab31(MC31)	65.028	64.031	62.988	64.016
Amber(AM)	64.892	63.413	62.596	63.634
LSD=0.05				0.078
Means of Moisture	65.179	63.863	63.085	
LSD=0.05		0.131		

HUSKING EFFICIENCY:

The effect of the rice cultivars and moisture content on husking efficiency is shown in Table 4. The moisture content of 9-11% showed the highest husking efficiency of 81.761%, while the lowest husking efficiency of (80.686% and 80.119%) was for 11-13% and 13-15 % , respectively , The decrease of the husk efficiency is to due to blockage cavities of the machine when high moisture content . These results are consistent with the results of Chung et al (2003) .The husking efficiency of the JA

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cultivar (81.702%) was significantly better than the MI31 and AM cultivars(80.824% and 80.041 % , respectively) .This is due to the difference between cultivars kernel lengths. The longest kernel is subject to more share and friction forces between husk rolls than the shorter one .these results are in correspondence with the results achieved by Minaei et

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al(2007). The best results(83.129 %) have come from the interaction among 9%-11% grain moisture content and (JA) cultivar . The levels of the milling recovery percentage at different conditions are shown in Figure 4 the three rice cultivars (JA ,MI31 and AM).

Table 4. Effect of moisture content on husking efficiency

Husking Efficiency				
Cultivar	Moisture content %			Means of cultivar
	9 -11 %	11-13%	13-15%	
Jasmine (JA)	83.129	81.615	80.361	81.702
Mishkhab31(MC31)	82.021	80.442	80.008	80.824
Amber(AM)	80.134	80.001	79.988	80.041
LSD=0.05				0.113
Means of Moisture	81.761	80.686	80.119	
LSD=0.05		0.228		

BROWN RICE

The o effect f the rice cultivars and moisture content on brown rice is shown in table 5. The moisture content at 9-11% showed the highest brown rice of 78.964 %, while the lowest brown rice of 77.588% and 76.935 % was for 11-13% and 13-15 % at different moisture content , The decrease of the brown rice is to due to blockage cavities of the 11 machine when high moisture content . These results are consistent with the results gained by (Al sharifi et al .,2016 b) .The JA cultivar 78.440 % was significantly better than the MI31 and AM cultivars 77.846 % and 77.201% respectively .This is due to the difference between cultivars kernel lengths. The longest kernel is subject to more share and friction forces between husk rolls than the shorter one .these results are in correspondence with the results achieved by (Alwakel, 1999). The best results 83.129 % have come from the overlap among 9%-11% grain moisture content and (JA) cultivar . The levels of the brown rice percentage at different conditions are shown in Figure 5 for both rice cultivars (JA ,M31 and AM).

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Table 5. Effect of moisture content on brown rice

Brown rice				
Cultivar	Moisture content %			Means of cultivar
	9 -11 %	11-13%	13-15%	
Jasmine (JA)	79.813	78.081	77.426	78.440
Mishkhab31(MC31)	79.014	77.528	76.996	77.846
Amber(AM)	78.066	77.155	76.383	77.201
LSD=0.05				0.102
Means of Moisture	78.964	77.588	76.935	
LSD=0.05		0.178		

HEAD GRAIN

The effect of the rice cultivars and moisture content on head rice is shown in Table 6

. As increasing the moisture content to increase of the head rice percentage ,the results were for 64.105 , 62.133 and 60.856 % ,respectively ,because of the lack of withstanding

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of grains to pressure which facing the grains inside hulling chamber when

increase moisture content , hence percentage of breakage grain decreased and percentage of whole grain increases. The (JA) cultivar 64.793% was significantly better than the (MI31) and (AM) cultivars (62.523% and 59.779% , respectively ,because of the difference on the percentage of husk weight ,The results agreed with the finding of Ali and Shatti(2006).(The best results 66.711 %) have come from the interaction among 9%-11% grain moisture content and (JA) cultivar . The levels of the head rice percentage at different conditions are shown in Figure 6 the three rice cultivars (JA ,M31 and AM).

Table 6. Effect of moisture content on brown rice

Brown rice				
Cultivar	Moisture content %			Means of cultivar
	9 -11 %	11-13%	13-15%	
Jasmine (JA)	66.711	64.781	62.886	64.793
Mishkhab31(MC31)	63.996	62.409	61.165	62.523
Amber(AM)	61.609	59.211	58.517	59.779
LSD=0.05				0.161
Means of Moisture	64.105	62.133	60.856	
LSD=0.05		0.207		

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.CONCLUSION

1- The (JA) rice cultivar was significantly superior to the (M31) and (AM)

cultivars in all studied conditions.

2- The grain moisture content of 9%-11% was significantly superior to the two levels 11%-13% and 13%-15%.

3- The results showed better conditions for the interaction between the(JA)

13 cultivar and grain moisture content of 9%-11% as compared to the

interaction of the (MI31 and AM) cultivars with other moisture grain

contents.

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