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The Effect of Clearance on the Performance of Machine Husking Rubber Rolls for Two

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Abstract:

The effect of clearance between cylinders of machine husking rubber rolls (type Yanmar rubber roll – ST 50) on rice husk quality and breakage percentage was evaluated for two cultivars of rice. Tarm Hashemi (TH) and Daillman (DM) and clearance between cylinders of machine husking rubber at three different levels of 0.4, 0.6 and 0.8mm.The experiment was done in factorial experiment under complete randomized design (CRD) with three replications the results indicate that the TH cultivar is significantly better than the D M in all studied traits. There was a negative relationship between increased clearance with head rice percentage and brown rice percentage in addition to the positive relationship between the increased percentage of cracked grain ,broken rice percentage and husking efficiency.

Keywords:Clearance, Cylinder, Husking, Quality, Rice.

الخلاصة:

تاثير الخلوص بين الاسطوانات لنوع الماكنة Yanmar rubber roll- ST 50 على نوعية تقشير الرز ونسبة التكسر لتقييم صنفين من الرز تارم هاشمي وديلماني والخلوص بين الاسطوانات لمكائن التقشير تحت ثلاث مستويات مختلفة ٠,٤،٠,٦ و ٠,٨ ملم. باستخدام تصميم التجربة CRD وبثلاث مكررات اظهرت النتائج تفوق صنف الرز تارم هاشمي معنويا على صنف الرز ديلماني في جميع الصفات المدروسة. كانت هناك علاقة ايجابية بين زيادة الخلوص على نسبة الحبة الكاملة والرز الخام وعلاقة سلبية مع زيادة نسبة الحبوب المتشققة والتكسر وكفاءة التقشير .

الكلمات المفتاحية: الخلوص، الاسطوانات، التقشير، النوعية، الرز.

1.Introduction:

Paddy is an important crop, it is in the thrid rank after wheat and barley in terms of area planted and production and is considered a vital food material for more than half of the world's population, Its importance as a food crop has been increasing with the increase of population. It is estimated that the paddy production in Iraq is grossly inadequate to meet the populations the startage is aealt with through importing from the nieghbouring states (Najim,2000). explored that the machine productivity is affected by moisture content as increasing machine productivity with increasing moisture content of grain and low percentage of breakage.(Abu Al khair *et al*.,2005). Reported that the organizing machine has a direct effect on the productivity of the machine.The more the organization of the machine, the higher productivity well be because of the low percentage of break-up and this is reflected positively on the increase of machine productivity due to the increase, efficiency of the existing work (Al Saadi, 2012). explained that type of machine and the moisture content of the grain

have significant effect on the energy consumed and concluded that the energy consumed depends on the type of machine whenever the organization of the machine is well. The less energy is consumed the higher moisture content decreases the consumption capacity of the machine.(Bai *et al*.,2005). the study on the effect of moisture conditioned for brown paddy on milling characteristic is advantageous to enhance the processing technical level of paddy and improve the taste quality of paddy and have obtained the conclusion that it takes 8h to make the moisture inside and outside paddy homogenized, and that the processing and taste quality of paddy are improved after the brown rice (Troung,2007). explained that the cause of the cracking is harvesting, drying, moisture content and concluded that cracked and weak grain is Almswolh for breakage during manufacturing stages.(Chung *et al*., 2003). explored that the comparison of milling efficiency factors between experimental results and simulation results. The differences of hulling efficiency,milling efficiency, milled paddy recovery between experiment and simulation are 0-4, 0-7, 0-4%, respectively. Although the simulation results are a little lower than experimental ones, they are close. The materials produced in the processes of simulation are compared to those in experiment.(Williaams *et al*., 2002).the effect of clearance between the cylinders has a significant effect the more clearance between the cylinders leads to a precentage of breakage and they concluded that the excess clearance proportion gives less break unlike little clearance is due to an increase in the mechanical effort,which involved a rice grain during the milling (Chaitep *et al*.,2008). Reported that compressive load resistance of rice grain 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 positions are conducted on the rough rice to brown rice and determine power consumption of the machines as well as lowering the broken rice during the rice mill processes.

2.Materials and methods

This study was conducted in 2015 to evaluate the effect of hulling machine performance with clearance between cylinders on the guality of rice and breakage percentage for two rice cultivars Tarm Hashemi (TH) and Daillman (DM) the mean lenght was 11.4 ml for (TH) cultivar and 8.9 ml for (DM) cultivar and both vaireties were havested in October 2015 the study was conducted in University of Tehran, College Aburaihan. The hulling machine type Yanmar rubber roll ST SO,was uesd for experiments which consist of afast robber roull that rotates at 100 rpm and an identical slow rubber roll that rotates 1000 rpm which is equal 4.7m\sec (fig1), The clearance between cylinders was set at three levels 0.4, o.6 and 0.8mm. in oder to determine the effect of hulling rolls clearance on milling quality .Initial moisture content of the grains was determmned by automatic moisture meter and was 12-14% for both (TH) and (DM) cultivars. An amount of 1000gm rough rice was husked by hulling machine to get brown rice and then 200g of brown rice was taken by precision divider and different part of cracked rice ,broken ,head rice were separated manually and weighted using digital balance accroding to the method used by (Alsharifi *et al*., 2009).Finally the following technical indicators were calculated:

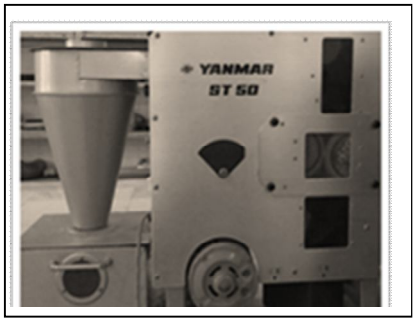

Fig 1 The machine t(ype Yanmar) wich is used for hulling paddy

2.1.Proportion of breakage rice

The Eq; 1 was used to calculate the percentage of the head paddy and broken in the separation process of the broken grain from the whole grains (Gbabo *et al*.,2014).

$$P_{Br}=\frac{W_{br}}{W_s}\times 100 \quad (1)$$

Where, P_{Br} :is the proportion of breakage paddy (%). W_{br}:is the weight of breakage grain(g) and W_s :is the weight of paddy sample used (g).

2.2. Percentage of cracked grain :

The overexposure of mature paddy to fluctuating temperature and moisture conditions leads to development of fissures and cracks in individual kernel. Cracks in the kernel are the most important factor contributing to rice breakage during milling. This results in reduces milled rice recovery and head rice yield.(Eq,2) (Ali *et al*., 2006)

$$P_{Cg}=\frac{W_{Cg}}{W_S}\times 100 \quad (2)$$

Where; P_{Cg}:is proportion cracked grain (%), W_{Cg}:is weight cracked grain (g)and

W_S :is weight sample the original (g).

2.3.Percentage of brown rice :

The Eq.3 represents 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 weight of rice sample used.(g)

2.4.Precentage of head rice

Percentage of head rice (Eq.4) represents the amount of whole grains resulting from the husking process and broken grains and cracked grain percentage. (Ali,2002).

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

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

:is weight of paddy sample used.(g)W_S(g),and

2.5.The husking efficiency; The husking efficiency was determined by using Eq 5 (Minaei *et al*., 2007)

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

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)

Then the same method and measurements were done for both rice cultivars of (TH) and (DM)by using Yanmar type machine ,moisture content of grain in the range 12 to14%, and clearances 0.6,0.4 mm in three replications.Results were analyzed statistically using the design compelite rondomized design CRD and each factor was tested the difference among treatment according to the less significant difference (LSD) test 0.05.(Alsahoeke *et al*.,1990).

3.Results and Discussion

3.1. Cracked grain

The percentage of the cracked grains for different clearance of two rice cultivars and the mean values ofcultivars and clearances are shown in Table .There was a significant influence of the clearance between cylinders on cracked grain percentage for two cultivars. At the clearance of 0.4 mm the means of clearance between cylinders was 5.765% for both cultivars while the least percentage of cracked grain 3.619% was obtained at the clearance of 0.8mm, Because at hgih clearance between cylinders the pressure on the grain in the hulling chamber is low and leads to decreased cracked grain percentage**.** These findings are consistent with the findings of (Troung**,** 2007)**.**The levels of the cracked grainat different conditions is shown in fig 2 for both rice cultivars.

Table 1 The effect clearance on percentage of cracked grain for two rice cultivars.

Cultivar	Clearance between cylinders mm			Means of Cultivar
	0.4	0.6	0.8	
Taem Hashemi	5.217	4.101	3.214	4.177
Daillman	6.313	5.009	4.023	5.115
LSD=0.05				0.043
Means of clearance	5.765	4.555	3.619	
LSD=0.05		0.101		

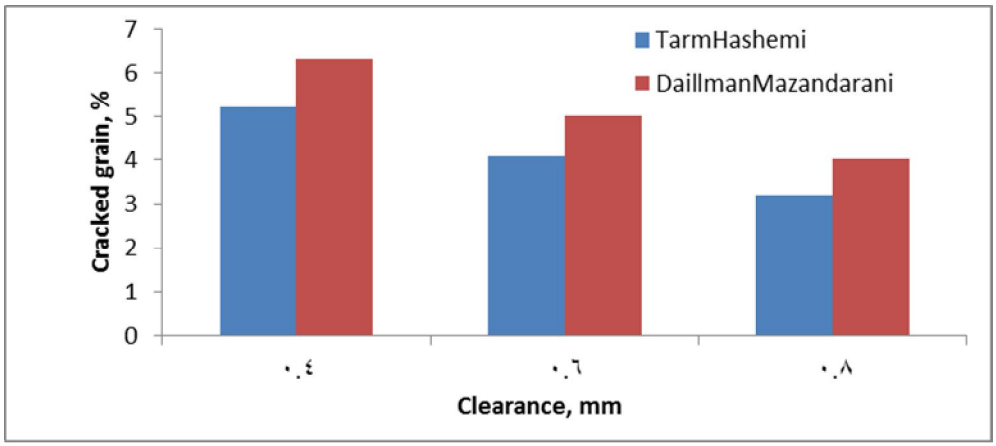

Fig. 2 The effect of clearance on the percentage of craked grain for two rice cultivars

3.2.Broken rice

Table (2) shows the percentage of the broken rice of two cultivars at different levels of clearance and the mean. The results showed significant effects of difference in clearance between cylinders on breakage percentage.Increasing the clearance between cylinders achieved decreases the breakage percentage for both cultivars which is 5.880%.Whereas the highest breakage percentage accompanies 7.817% with high increase because the ease grain flow, leads to the decrease of the proportion of breakage of grain, with increased clearance between cylinders. There is a significant

effect for the interference between clearance and cultivar which gives the highest breakage percentage of cereal at 0.4mm and cultivar (DM) is 8.108 % while for (TH) cultivar is 5.429 % at the clearance of 0.8 mm. The results also show that rice cultivar has a significant effect on rice breakage percentage property. Tarm Hashemi achieves th lowest means which is 6.391 % while Daillman cultivar gives 7.295 %.mean value. These findings are consistent with the findings of (Williaams *et al*.,2002). The levels of the breakage grain at different conditions is show in fig 3 for both rice cultivars.

Table 2 The effect of clearance on percentage of breakage grain for two rice cultivars.

Cultivar	Clearance between cylinders mm			Means of Cultivar
	0.4	0.6	0.8	
Taem Hashemi	7.526	6.219	5.429	6.391
Daillman	8.108	7.445	6.331	7.295
LSD=0.05				0.055
Means of clearance	7.817	6.832	5.880	
LSD=0.05		0.103		

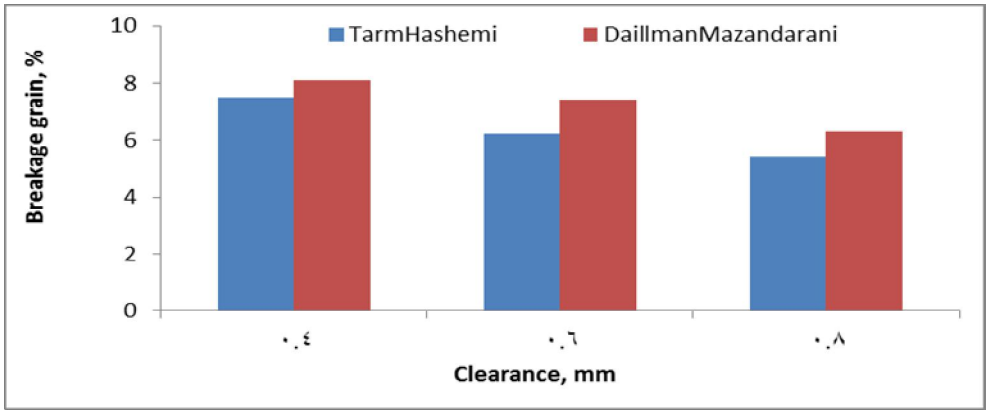

Fig. 3 The effect of clearance on the percentage of breakage grain for two rice cultivars

3.3.Brown rice

Table (3) showes significant influence of the changing of the clearance between cylinders on percentage of brown rice.Increase clearance between cylinders to 0.8mm gaved the best brown rice percentage for two rice cultivars which was 81.167 % whereas the lowest percentage of brown rice was 79.607 % at clearance 0.4mm. This is due to the decrease of compressive strength with the increase the clearance and this leads to decrease the percentage of breakage of grain hence increases percentage of brown rice. The results also show a significant influence of changing rice cultivar on brown rice percentage.The level is higher for Tarm Hashemi than it is for Daillman in the percentage of brown rice which were 80.915% and 79.931% respectively because of the difference of the percentage of husk weight, this agrees with the result of (Alsharifi *et al*.,2009).The levels of the brown rice at different condition are shown in fig 4 for both rice cultivars

Table 3 The effect of clearance on percentage of brown rice for two rice cultivars

Cultivar	Clearance between cylinders mm			Means of Cultivar
	0.4	0.6	0.8	
Taem Hashemi	80.022	81.001	81.721	80.915
Daillman	79.191	79.988	80.613	79.931
LSD=0.05				00.62
Means of clearance	79.607	80.495	81.167	
LSD=0.05		0.097		

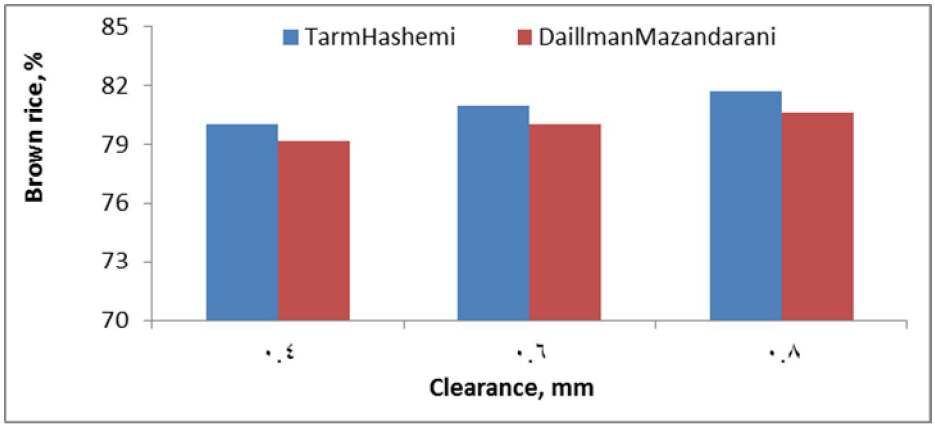

Fig. 4 The effect of clearance on the percentage of brown rice for two rice cultivars

3.4.Husking efficiency

Table(4) showes significant influence of the clearance between cylinders on husking efficiency for both TH and DM cultivars, Increasing the clearance between cylinders for 0.4, 0.6 and 0.8mm leads to decrease the husking efficiency to 83.959, 81.523 and 80.533 % respectively by a decrease of (2.9 and 1.2)%.The decrease of the husk efficiency is to due to blockage cavities of the machine when low clearance. These results are consistent with the results gained by (Chung *et al*.,2003) which indicate that the cultivar has a significant effect on rice husk efficiency property. The TarmHashemi showed the highest level which was 82.612% and its mean value was also the highest in husk efficiency which was81.397 % .This isdue 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 level of the husking efficiency at different conditions is shown in fig 5 for both rice cultivars

Table 4 The effect of clearance on husking efficiency for two rice cultivars

Cultivar	Clearance between cylinders mm			Means of Cultivar
	0.4	0.6	0.8	
Taem Hashemi	84.406	82.367	81.064	82.612
Daillman	83.511	80.678	80.001	81.397
LSD=0.05				0.068
Means of clearance	83.959	81.523	80.533	
LSD=0.05		0.124		

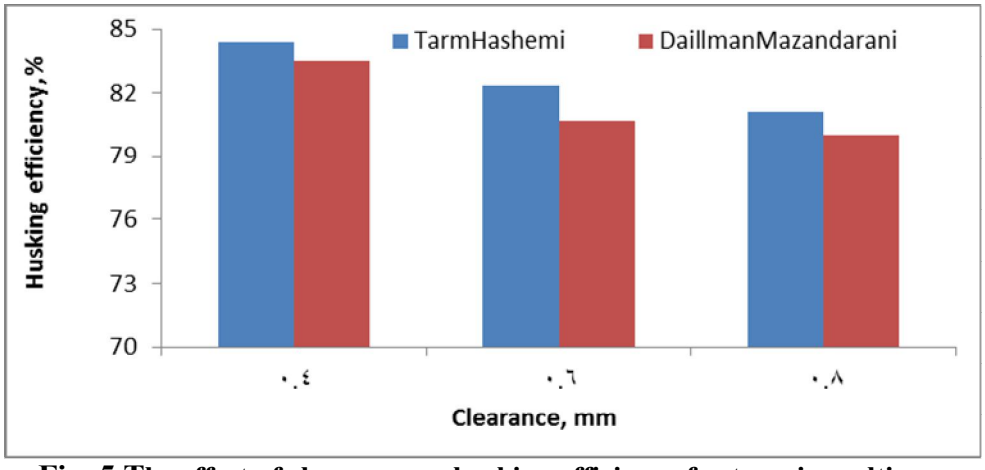

Fig. 5 The effect of clearance on husking efficiency for two rice cultivars

3.5.Head rice

Table (5) shows the levels of head rice at different conditions. There is a significant influence of the clearance between cylinders on head rice percentages .The best head rice percentage increased between cylinders to 0.8mm for both cultivars and it is 70.783 % whereas the lowest percentage of head rice cereal is 66.118 % at clearance 0.4mm, because effort on grain decreases with the increasing percentage of clearance between cylinders, hence percentage of breakage grain decreased and percentage of whole grain increases. The results also show significant influence of changing rice cultivar on the head rice percentage. Tarm Hashemi showed higher level than Daillmandoes in terms of the percentages of head rice which are 64.37% and 63,72% respectively because of the difference on the percentage of husk weight,The results agreed with the finding of (Ali,2002). The levels of the head rice at different conditions are shown in fig 6 for both rice cultivars.

Table 5 The effect of clearance on head rice percentage for two rice cultivars

Cultivar	Clearance between cylinders mm			Means of Cultivar
	0.4	0.6	0.8	
Taem Hashemi	67.183	68.448	71.559	69.063
Daillman	65.052	67.181	70.007	61.413
LSD=0.05				0.047
Means of clearance	66.118	67.815	70.783	
LSD=0.05		00.99		

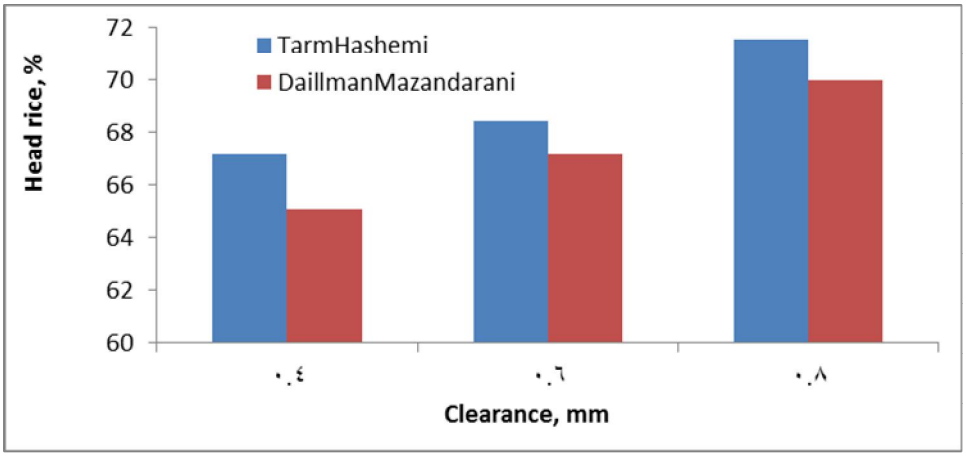

Fig. 6 The effect of clearance on the percentage of head rice for two rice cultivars

4.Conclusion

Increasing clearance between cylinders leads to the increase of head rice percentage, percentage of brown rice and to the decrease of rice kernels, breakage ratio husking efficiency and percentage of cracked grain,for two cultivar of TarmHashemi and DaillmanMazandarani. Tarm Hashemi achieves higher than Daillman cultivar and The Tarm Hashemi cultivar is significantly superior in all the studied traits than the Daillman**,** In addition to the positive relationship between increasing clearance with percentage of cracked grain,broken rice percentage and husking efficiency.There was also a negative relationship between increasing clearance with head rice percentage and brown rice percentage.

5.Recommendations

- The present study recommends carrying out future studies using other machinery types and other varieties of paddy.
- Conduct other organizations on machine and the moisture content of grain to know their effects on the qualitative characteristics of paddy.

6.Acknowledgement

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7.References

AbuKhair, M. M, Abdul-Hussein, Z. Mohamedhelmi, I., Tariq, K. Al- Din., 2005, Entrance in Agricultural Engineering-College of Agriculture-Alexandria University. Egypt.

Ali, M. M., 2002, Rice milling in Bangladesh.

Ali, A. L., Shatti. R., 2006, The impact of harvest dates in the manufacturing qualities in some varieties of rice . Journal Al Fatih Vol (1) No (26) P 97- 112.

AL- Maamouri, S. A. and Al- sharifi, S. K., 2008, studies effect different types of machine crunches and bleaching on the rice kernels varieties Anbbar 33 and Abasiya. Journal of the University of Babylon:17.(1): 134-153.

Al Saadi, F. T, Al Ayoubi, T., 2012, Study some of the technical characteristics of the type of excessive and the impact feed speed and drying temperature and their impact on the nutritional value of maize crop. Euphrates Journal of Agriculture Science-2 (3):70-76.

Alsahoeke, M. M., and Creama, M.,1990, Applications of deisgn and analysis of experiment Baghdad university, college of agriculture,ministry of edecation and scientific research P:49-88.

Al Sharifi, S. K., Mousa, A. S., 2009, Study of some qualitative characteristics to two varieties of rice, the effect of two types of machines bleach and crunches and weighted moisture content, Journal of the University of Babylon.17(1);121-141.

Al Wakel, A., Abdul Karim, 1999, Changes in the changes in the rice oil during storage and its relationship with flavor. Master Thesis. College of Agriculture. Baghdad University.

Bai, S. G., Jia, F. G., Nan, J. F., 2005, Study on the optimum moisture amount added to brown paddy once during the wet conditioning [J]. Journal of Northeast Agricultural University,(2): 23-25.

Chaitep, S., Chaiy, R. and Pipatpong, W., 2008, Compressive load resistance characteristies of rice grain.American Journal of agricultural and biological (1).325-329 .

Chung, J. H., Lee, Y. B., 2003, Simulation of a Rice Mill Process.Biosystems Engineering (2003) 86 (2),145–150.Available online at www.sciencedirect.com.

Gbabo, A., Ndagi, B., 2014, Performance evaluation of a rice mill developed in NCRI International Journal of Engineering Research Volume No.3, Issue No.8, pp : 482-487.

Minaei, S., Alizadeh, M. R, Khoshtaghaza M. H., Tavakoli T.,2007, Effects of de-awning and moisture content on husking characteristics of paddy in rubber-roll husker. American-Eurasian J Agric & Environ Sci.; 2(1): 01-05.

Najim, A., N., 2000,The effect of nutrition levels and speed in fragments and crop moisture on factory productivity corn .Master thesis. Machinery . University of Baghdad.

Toğrul, I. T., and Pehlivan, D., 2004, Modelling of thin layer drying kinetics of some Fruits under Open-Air Sun Drying Process. Journal of Food Engineering. 65(3): 413-425.7.

Williams, J. F., Thomson, J. F., and Mutters, R. G., 2002, Rice milling quality. University of California Rice Research Quartly. Vol. 1 Califo.