PLANTING AND HARVESTING METHOD EFFECTS ON RICE PRODUCTIVITY

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ABSTRACT

The aim of this research is to study the effect of some planting and harvesting methods on rice-crop yield. The main results in this study can be summarized in the following points:

* The maximum seed productivity (4187 kg/fed) was obtained by using manual transplanting and big combine and the minimum yield (2946 kg/fed) was obtained by using seed drill and manual harvesting + Barmeel (Barrel) thresher.

the highest net profit (5556 LE/fed) was obtained with using manual transplanting and big combine and the lowest (3829 LE/fed) was obtained by using seed drill and manual harvesting and Barmeel thresher.

Introduction

Rice is one of the most important cereal in Egypt and worldwide. To increase rice area in Egypt, using mechanical planting and harvesting is very important to increase its production.

The cultivated area of rice is about 1.468 million feddans in year 2001 that produced about 4.79 million ton paddy rice (the production per feddan is about 4.195 ton/fed) (Agricultural Research Center, 2006). Mechanical rice planting and harvesting is very important in saving hand labor, improving production, allowing further mechanization and decreasing production costs.

Awady (1990) stated that rice can be drilled directly on wet land. IRRI, in Philippines, designed a special seed-drill can that be drawn by one man, with feelers operated by ground wheel. The machine productivity is 20 times as big as manual planting

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It can drill about 50 kg/ha in 5.7 . Nevertheless, transplanting is more widespread due to saving of land up to 30 days, and water of up to 100 m^3/fed, in addition to intensive care possible in the nursery.

Morsey (1990) recommended that the optimum forward speed of transplanter be suitable for soil conditions at 1.8 km/h which gave the field effecinecy of 96 %. Hill missing rate was 4 % and grain productivity 3.03 ton/fed.

Shaalan et al. (1983) studied the effect of some planting methods (manual brodacasting, drilling, mechanical broadcasting and transplanting on rice grain yeild. They found that the maximum grain yeild was obtained by using mechanical drilling (7.85 mg/ha) and transplanting (7.8 mg/ha). Whereas, the minimum grain yeild was obtained with manual broadcasting (6.26 mg/ha) and transplanting (6.63 mg/ha).

Helmy et al. (2000) concluded that the grain yeild of rice crop variety Giza 181, by using the mechanical drilling in dry condition, gave the lowest cost (87.5 L.E./Mg) and highest net profit (412.5 L.E./Mg).

El Haddad et al. (1995) reported that combine harvesting gave the lowest cost of about 229 L. E./fed as compared with 283.4 L. E./fed for mounted mower and 300 L. E./fed for manual sickle system. Two types of combines Yanamar models of CA-385 and CA-760 multi-purpose to was used to harvest three rice varities: Giza 178, Sakha 101 and Sakha 102.

Afifiy et al. (2000) investigated the selecting of the proper system of rice harvesting that suits the planting methods. The variety of rice crop was Giza 171. He showed that the minimum cost was obtained by using drill planting and Duetz Fahr combine for harvesting (188.2 L.E./fed). Whereas, the cost of using drilling planting and Yanmar combine was 237.2 L.E./fed. The maximum cost was obtained by using a manual broadcasting and manual harvesting + thresher (619 L.E./fed.

El Khateeb (2005) recommended that using multi-purpose combine harvester (Yanamar mobel CA-760 with cutting width of about 2 m) to harvest rice crop variety Sakha 102 was the most efficient and economic system (89.7 L.E./fed) compared with manual harvesting followed by thresher (181.6 L.E./fed).

The objective of this paper is to study the effect of some planting and harvesting systems on rice-crop yield.

2- MATERIALS AND METHODS

The experiments were carried out in clayey loam soil at El-Gemmiza Research Station, El-Garbiea Governorate (الجميـــزة – غربيـــة) during 2005 season. The physical properties of the experimental soil are summarized in table 1, according to Gemmiza Soil Laboratory.

Experiments were carried out to investigate the effect of four planting methods in furrow and flat soil on Rice-crop yield.

Table 1: Physical properties of the experimental soil.

Fine sand	Coarse sand	silt	clay	Clay ratio	Soil texture
21.50	1.30	31.20	46.00	00.46	Clay-silt loam

Seed-bed preparation and land leveling implements: Chisel plow was used in two passes with depth of 15-20 cm followed by disc harrow with depth of 15 cm and tractor with power of 80 hp (60 kW). A hydraulic leveling scraper was used with different grain-sowing methods.

A mounted chisel plow (El-Behira Co. شـــركة البحيـــرة) consisted of seven shanks arranged in two rows.

A disc harrow consisted of 4 groups with 28 discs, each 50 cm in diameter.

A hydraulic leveling scraper (El-Behira Co.) with width blade width of 180 cm was used.

A ridger (local manufactured) with four adjustable ridges was used.

Planting implements and methods:

Broadcasting machine tractor mounted was used with rice grain rate of 80 kg/fed.

Mounted seed-drill (Sulky type) 21 row was used with rows spacing 15 cm at forward speed of 4 km/h. Pneumatic planter:

Walking type transplanter (Yanmar-YP400) of 1.2 m width was used with 1.5 km forward speed. 21-days seedlings were transplanted with spacing of 30 x 30 cm.

Manual transplanting was done by a team of 10 laborers using a marked rope method with 20 x 20 cm spacing. 30-days seedlings were transplanted.

Tractors: Nasr tractor 65 hp (50 kW) was used with all broadcasting and seed drill implements and ridger, and Allis-Chalmers tractor 80 hp (60 kW) was used with the seed-bed preparation implements.

Planting methods: Five planting methods were tested: manual broadcasting, drilling, pods planting (about 20 – 30 pregrminated grains with 15 – 25 cm spacing), and manual and mechanical transplanting.

Seed rate and row spacing: Seed rates were 80, 55, 80, and 25 kg/fed with row spacing of 15 cm for manual broadcasting, drilling, pods, and manual and mechanical transplanting respectively.

Forward speed: Forward speed of 2.2 km/h to avoid breakdown of furrow was used at different conditions.

Harvesting machines and methods: Five harvesing methods were tested (manual harvesting + manual threshing, manual harvesting + Barmeel rice thresher, mower + barmeel thresher, small combine and big combine).

- **Manual harvesting**: the sickle bar (Mingel منجل) was used.
- **Mower:** tractor mounted mower model GASRAROD-FB 925 Italian made with cutting width of 1.75 m was used.
- **Manual threshing by hand** was used for control treatment.
- **"Barmeel" rice-thresher** : "Barmeel" rice-thresher locally made was used. The specifications of this machine are: total length = about 5 m, total width 1.97 = m, total hight = 2.1 m, threshing chamber length and diameter = 3 and 1 m respectively. The productivity was = about 4 – 5 ton/h.
- **Small combine**: Yanamar small combine model CA-385 EG Japan made with cutting width of 1.4 m was used.
- **Big conmbine**: Class combine German made with cutting length of 2.1 m was used.

Seed variety and properties: Seed variety of Sakha 101 was used.

The yield: The grain yields were evaluated by taking 4 samples (1 m^2 area) randomly selected from each plot. The plants were harvested and threshed by hand and then weighed.

Estimating costs of using the machines: The rent values of the machines was used according to Agricultural Engineering Unit of Ag. Eng Res. Institute in year of 2006.

The manual planting or transplanting = Labor wages (L. E. /fed) / Actual field capacity (fed/h).

Net profit:

Net profit (LE/ton)=grain production price(LE/t) – total production costs.

4- RESULTS AND DISCUSSION

Effect of planting and harvesting methods on rice grain-productivity.

Table 2 and fig. 1 show the grain productivity of rice crop at different planting and harvesting methods.

Data show that the maximum seed productivity (4187 kg/fed) was obtained by using manual transplanting and big combine and the minimum yield (2946 kg/fed) was obtained by using seed drill and manual harvesting + Barmeel thresher. This may be due to decreasing the number of plants and incresing grain losses by using manual harvesting and thresher.

Using big and small combines gave the maximum increasing of 2.86 – 2.91 and 1.96 – 2.91 % in grain yeild respectively compared with control treatment (manual harvesting + manual threshing by hands). Whereas, using the manual harvesting + Barmeel thresher decresed the grain yeild by 7.5 – 7.6 % and using the mower and Barmeel thresher decreased the grain yeild by 5.3 %. The increasing of grain yeild is due to increasing grain losses by using manual harvesting, mower and barmeel thresher compared with using the combine.

Table 2: Effect of planting and harvesting methods on rice grain productivity (yield), costs and net profit.

Harvesting method	Planting method	Grain Yield, ton/fed	Operating cost, L.E./fed	Operating cost, L.E./ton	Total cost, L.E./fed	Crop value, L.E./fed	Net profit, L.E./fed
M. harvesting + M. threshing (Control)	Manual broadcasting	3.444	Control				
	Seed drill	3.169					
	Pods planting	3.510					
	Manual transplanting	4.066					
	Transplanter	3.761					
M. harvesting + B. thresher	Manual broadcasting	3.202	75	23.4	645	4803	4158
	Seed drill	2.946	82	27.8	590	4419	3829
	Pods planting	3.264	170	52.1	725	4896	4171
	Manual transplanting	3.780	170	45.0	675	5670	4995
	Transplanter	3.495	160	45.8	593	5243	4651
Mower + B. thresher	Manual broadcasting	3.271	65	19.9	635	4906	4271
	Seed drill	3.010	72	23.9	565	4515	3951
	Pods planting	3.334	160	48.0	715	5001	4286
	Manual transplanting	3.861	160	41.4	680	5792	5112
	Transplanter	3.572	150	42.0	583	5358	4776
Small combine	Manual broadcasting	3.513	173	49.2	728	5269	4541
	Seed drill	3.262	180	55.2	673	4894	4221
	Pods planting	3.591	268	74.6	838	5386	4548
	Manual transplanting	4.164	268	64.4	788	6245	5457
	Transplanter	3.874	258	66.6	676	5811	5135
Big combine	Manual broadcasting	3.545	125	35.3	680	5318	4638
	Seed drill	3.263	132	40.5	640	4894	4255
	Pods planting	3.614	220	60.9	790	5421	4631
	Manual transplanting	4.187	220	52.5	725	6281	5556
	Transplanter	3.874	210	54.2	628	5811	5183

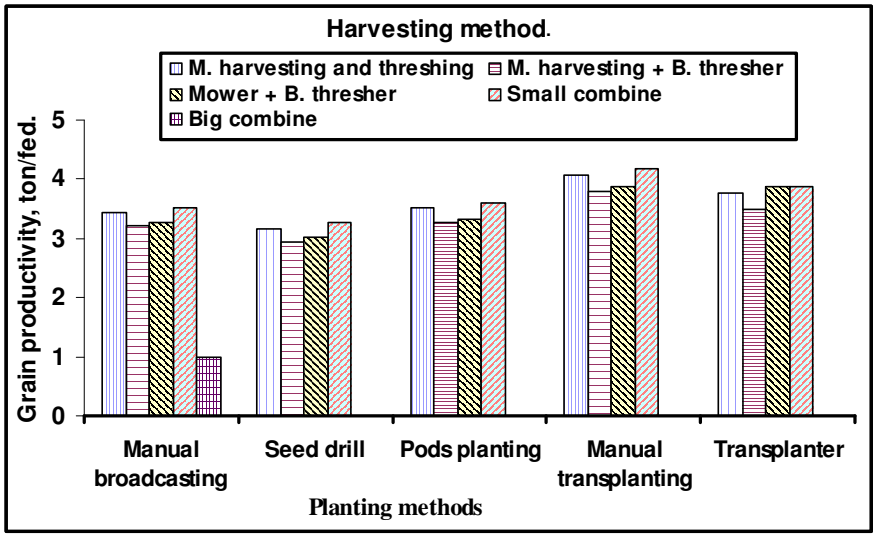

Fig. 1: Effect of planting and harvesting methods on rice grain productivity.

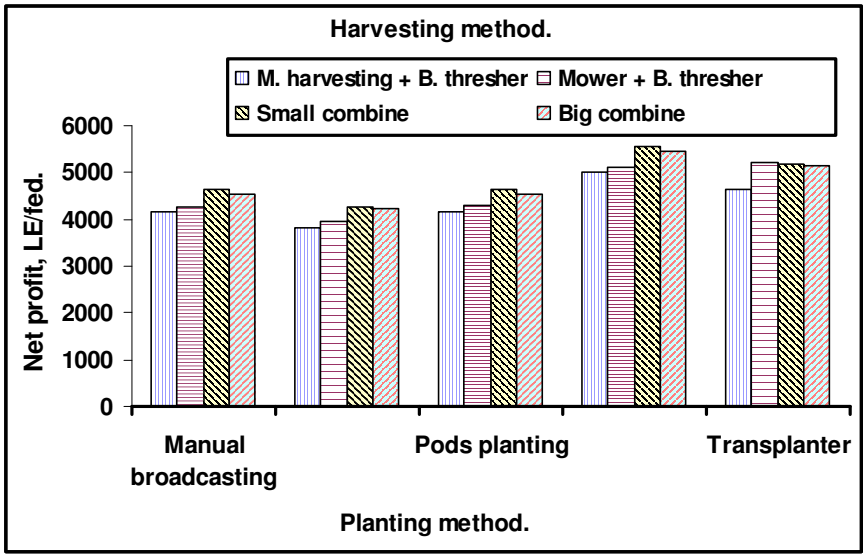

Fig. 2: Effect of planting and harvesting methods on net profit.

Costs and net profit of using the machines.

The operating and total costs of different planting and harvesting methods are shown in table 2.

The minimum operating cost of 19.9 LE/ton was obtained with manual broadcasting and mower + Barmeel thresher. Meanwhile, the maximum

operating cost of 74.6 LE/ton was obtained with using pods transplanting and small combine.

Table 2 and fig.2 show that the highest net profit (5556 LE/fed) was obtained with using manual transplanting and big combine and the lowest (3829 LE/fed) was obtained with using seed drill and manual harvesting and Barmeel thresher.

Conclusion

Using manual rice transplanting and big combine gave the highest yield of 4.187 ton/fed and highest net profit of 5556 L.E./fed as comparing with manual broadcasting, planting by seed drill, pdos transplanting, transplanter, "manual harvesting + Barmeel thresher", "mower + Barmeel thresher" and small combine.

References

Agricultural Recerach Center Issue, 2006, Technical recommendaion for rice crop, Ministry of Ag., Rice prog., Issue No. 1014, Egyp: 5-7.

Afify, M. K., Nada, A. and Mechail, W. M., 2000, Selection of the proper system of planting and harvesting rice crop, Misr J. Ag. Eng., 17(2): 388-400.

Awady, M. N.,1990, Engineering of agricultural machinery, Text Book, Ag. Col., Ain Shams U.: 99-103. In Arabic.

El Haddad, Z. A.; El Ansary, M. Y. and Aly, S. A., 1995, Cost benfit study under integrated mechanization systems, Misr J. Ag. Eng, 12(1): 27-35.

Helmy, M. A., Gomaa, S. M., Sorour, H. M. and El Khateeb, H. A., 2000, A compartive study of different planting methods for rice yield at Kafr El Shekh region, , Misr J. Ag. Eng, 17(2): 349-361.

El Khateeb, H. A., 2005, A study on performance of axial flow combine harvester in rice crop harvesting, 13th Conf. of Misr Soc. of Ag. 14-15 Dec., 22(4): 381-401.

Morsey, E. M., 1990, A study of selecting a proper system rice mechanical planting under Egyptian conditions, M. Sc., Fac. of Ag.. Zagazig U.: 115-130.

Shaalan, M. I., Badawi, A. T., Mahrous, F. N. and Carigmiles, J. P., 1983, Combined effect of improved land preparation and planting methods on rice yield, 3rd Nati. Rice Inst. Conf., Feb., Egypt: 21-24.

الملخص العربى

تأثير بعض أنظمة الزراعة والحصاد على إنتاج محصول الأرز

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يهدف البحث دراسة تأثير بعض أنظمة الزراعة (نثر يدوى، باللقمة "حبوب سابقة الإنبات"، سطارة، شتل يدوى، شتالة) والحصاد ("حصاد يدوى + آلة الدراس البريميلية"، "محشة معلقة على الجرار + آلة الدراس البريميلية"، آلة جامعة "كومباين" صغيرة، آلة جامعة "كومباين" كبيرة) على إنتاج على إنتاج محصول الأرز.

تم الحصول على النتائج التالية:

(1) الإنتاجية: تم الحصول على أعلى إنتاجية حبوب أرز(4187 كج/فدان) عند استخدام الشتل اليدوى والآلة الجامعة الكبيرة، كما تم الحصول على أقل إنتاجية (2946 كج/فدان) عند الزراعة بالسطارة والحصاد اليدوى والدراس بآلة الدراس البرميلية.

(2) العائد الصافى: تم الحصول على أعلى عائد صافى (5556 جنيه/فدان) عند استخدام الشتل اليدوى والآلة الجامعة الكبيرة، كما تم الحصول على أقل عائد (3829 جنيه/فدان) عند الزراعة بالسطارة والحصاد اليدوى والدراس بآلة الدراس البرميلية.

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