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THE UTILIZATION OF A DRILLING PLANTER FOR RICE BAND SOWING

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ABSTRACT

During the last decade, the Agric. Minster of Egypt gave a great deal of attention to planting rice by drilling machine. Further, increase in rice production by increasing the yield per unit area is required to increase the drilling intensity, which it may be realized by band sowing rice. The objective of this study is to evaluate two sowing methods and it's interaction between the primary and secondary tillage treatments.

Using the band sowing, as new method of rice planting has no significant effect on the yield as compared with the common mechanical sowing, although the first recorded the better percentage distribution of seeding per area. The effect of secondary tillage system (disc harrow two strips followed with rotary-"d_2r") at the moldboard "m" or dick plow "dp" during band sowing "S_2" recorded slightly increase, in general, compared with the common mechanical method "S_1". On the other hand the good yield may be due to good soil surface roughness, good pulverization suitable reduction conditions, good establishments and distributions of roots and also good weed control which is affected by good pulverization and plowing depth.

INTRODUCTION

Rice is the main food crop for majority of people in the whole world; it is considered as a staple food in Asia, Africa, and South America. In Egypt rice production play a significant rule in the strategy to overcome food shortage and improvement of self-sufficiency. The yearly average planted area was about one million feddan during the past ten years with an approximate production of 3 million metric tons per year. Increase in rice production from increased yield per unit area is needed to face the increasing in the population. It is evident that the increases of rice production in quality and quantity, dose not depend only on the improvement and conservation of soil fertility, new promising varieties control of plant insects and diseases but also depends on using improved methods and technology to develop suitable methods of planting.

Planting or seeding is an important operation in crop farming. The choice of seed, time and a suitable method of seeding are essential for the future crop. At seeding seeds are placed on a seedbed at a desired depth and an interval to provide each plant with an area of nutrition (Konokhova, 1982). Good results can be obtained only when a crop is seeded or planted on a good seedbed by a suitable method, at a proper date, optimum rate and covered at an adequate depth.

Sowing require that an area around its roots called the plant area. It is sufficiently large to make an efficient use of essential soil nutrients (Grist, 1975). The provision of an optimum plant area for each individual plant is extremely important for a high level of production. Kanetani and Mansor (1991) reported that rice-farming system in the Muda area in Peninsula

Malaysia made great changes in sowing rice, which were represented by a rapid shift from transplanting to direct seeding. They obtained in their study about mechanized direct seeding of rice, the paddy yields of the drilled plots were slightly higher in general as compared to those of the broadcasted plots. Moreover, the drill seeding method would be effective in reducing harvesting losses. They also reported that the most appropriate space of rows would be in the range of 20 to 25 cm for direct seeding in that area.

In Egypt, the manual transplanting is the common method for cultivating rice. Hamad et al. (1983) studies the ability of transplanting in dry condition with manual feeding rice transplanting designed by Ismail (1981) to overcome some of transplanting problems in wet conditions. Many of our farmer nowadays distribute the plants to permanent fields in dry condition to be more easily but all that trials not completely enough to overcome the disadvantage of transplanting. On the other face, the direct-seeded rice area is increasing year after year in Egypt as one of the last labor consuming practice (Mahrous and Badawi, 1990). So that it is needed to look for another method for, rice cultural, practices including new land preparation method and planting. Therefore, the utilization ability of a drilling planter for rice band sowing as one of the methods to overcome the disadvantages of rice transplanting method is considered the aim of this work.

MATERIALS AND METHODS

The Tye Oriental drill machine was used to drill the seeds by two methods, the first was drilling the seeds under the soil surface with 1-2 cm (common methods, "S_1") and the second, was drilling the seeds above the soil surface with 20 cm to achieve the proper band sowing rice "S_2". The operating width of the drilling machine was 2.88 m, which have 16 rows and the distances between them, was 18 cm. It has two hoppers one for seeding and the other for fertilizing.

The calibration was conformed under the field conditions to give a seeding rate of 40 kg/fed. The average drilling speeds was adjusted to be about 6 km/h and the space between rows is 18 cm. The experiment was carried out in Sakha research farm (Kafer El-Sheikh Governorate) at the summer season, which, clover was the previous crop. The land preparation for clover was done by chisel plow twice in the two directions and then disked and dry leveling. The soil mechanical analysis and chemical characteristics are carried out at Sakha Research Station Laboratory at Soil Department as shown in table (1).

Table 1: Soil mechanical analysis and chemical characteristics

Clay (%)	Silt (%)	Sand (%)	Residual (%)	Soil texture	pH	E.C (m.mohs/cm)	OM (%)	M (%)	P (ppm)	Zn (ppm)
57.3	36.1	4.2	2.4	Clay soil	8.5	1.5	2.4	0.21	9.2	1.7

Giza-175 was selected as one of the new rice varieties grown in Egypt. Its properties are a medium grain, harvest index (46 – 69), total duration 137, and good grain quality for feeding people.

The experimental field was carried out under the interaction between the primary and secondary tillage of soil bed preparation, and the two methods of sowing rice. The primary tillage operations were divided into five systems (Non-tillage - "no", the moldboard plow – "m" of 20 cm in depth, chisel plow – "c" of 20 cm in depth, disk plow – "dp" of 20 cm in depth and disk harrow – "dh" of 10 cm depth. The secondary tillage operations were done in the perpendicular directions as sub plot treatments. The disk plow – "d1", the disk plow twice – "d2", disk harrow – "d_2h" and the offset disk harrow two strips followed with rotary – "d_2r" were performed as the second tillage treatments.

The latitudinal distribution and number of seedlings per unit area (seedling intensity) were measured 26 days later from sowing by using a wooden frame (100 × 36 cm) which divided into plots (10 × 1 cm) by robs. The latitudinal distribution of seedling was found by collecting the numbers of seedling per each plot around the centerline of row. A wooden frame (18 × 50 cm) was used to calculate the numbers of panicles per square meter for each plot at harvesting time, which replicated four times (four samples from each sub-sub plot). The grain yield was taken form area (1.8 × 3 m) for each treatment and then calculated related to area of feddan.

All data collected for all parameters of different treatments were statistically analyzed. The split-split plot and strip-split plot designs (Gomez and Arture, 1984) were adopted in these studies for statistical analysis of the data. In order to ascertain whether the observed treatment effects were real and discernible from chance effects the "Null Hypothesis" was tested by "F" test at 5 % level of probability as well as LSD at 1 % level of probability (in case of highly significant differences) according to Sendecor and Cochran, 1967. The data of this paper was provided from the M. Sc. of "Mechanization of seedbed preparation and planting of rice crop". Whose supervisor is Prof. Dr. Ismail, (1994).

RESULTS AND DISCUSSION

The experiments were carried out to evaluate the new methods of rice sowing (band sowing) as one of the methods to overcome the disadvantage of transplanting and at the same time evaluate different seedbed preparation methods on rice yield.

1- The latitudinal distribution of seeding

The percentage of rice seedling per meter which scattered in "3 cm" for each side around the center line of the row were calculated to evaluate the seedling distribution for independent variable under study (Fig. -1). Generally, the tillage systems "d_2r" and "d_2h" recorded the lowest variation of seeds distribution in percentage. On the other hand, the band sowing (S_2) recorded the better percentage distribution compared with drilling under the soil surface with 1-2 cm (common mechanical method, S_1). As example, the percentages of rice seedling that scattered in "3 cm" for each side around the center line as the interaction between tillage systems "m-d_2r", "dp-d_2r" and "dp-d_2h" and sowing method S_1 recorded 54.9 %; 63.2 % and 60.83 % respectively. While that percentages under the same methods of sowing,

were 90.29% and 75.1% at tillage systems "m-non" and "dp-non" respectively. Then that tillage system "m-non" recorded the highest percentage of seedlings scattered in "3 cm" for each side around the centerline at sowing method "S_1".

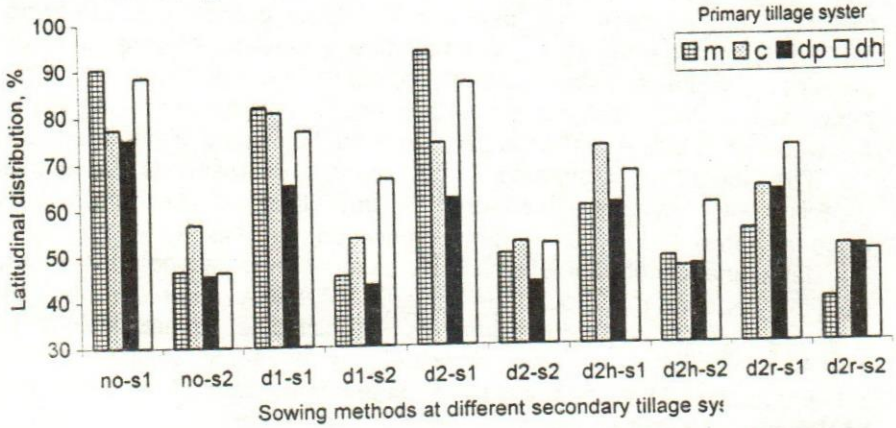

Fig. 1: The sowing methods via the latitudinal distribution of seeding.

2- The seedlings intensity

The second indicator to evaluate the interaction between the tillage systems and sowing method is considered the number of seedling per unit area (seedling intensity). The seedling intensity is illustrated in Fig. (2). Generally, the highest numbers was recorded with "d_2r" and "d_2h" as secondary tillage system with "dp", "dh" and "m" as primary tillage on the band sowing method "S_2". The "S_2" recorded slightly increase compared with the sowing method "S_1".

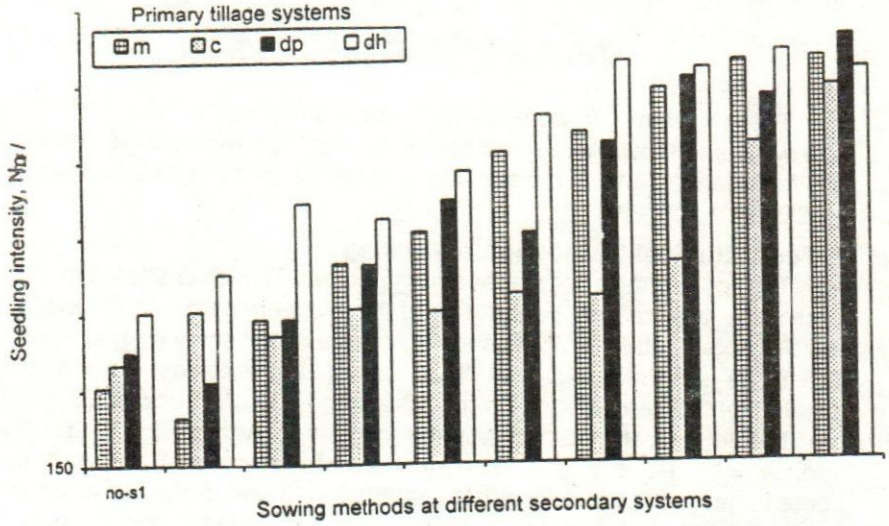

Fig. 2: The sowing methods via the seedling intensity.

As example, the tillage system "m-d_2r-S_2" recorded the highest number of seedling (415 seedling/m^2). Nevertheless, the minimum value is 182 seedlings/m^2 at treatment of "m-non-S_2". Then it may be recommended that the highest number of seedling/m^2 can be obtained at tillage system "m-d_2r-S_2" which gave the MWD 48.12 mm and 36.64 % of soil roughness.

3- The panicles intensity

The average number of panicles per unit area (panicles intensity) as influenced by primary tillage, secondary tillage and sowing methods are figured in Figs. (3 and 4). The data demonstrated that the interaction between tillage treatments "m-d_2r-S_2" gave the maximum intensity of 518 panicles/m^2, while the tillage treatment "Non-non" with sowing method, "S_2 " gave the lowest number of panicles (371 panicles/ m^2). On the other hand, as shown in Fig. (3) the maximum were recorded 474 and 471.9 panicles/ m^2 with "dp" and "m" as primary tillage respectively, while the minimum was 441.9 panicles / m^2 recorded with non primary tillage.

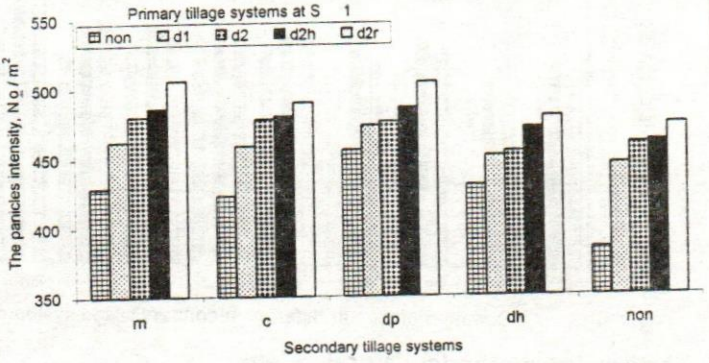

Fig. 3: The tillage systems via the panicles intensity at S_1.

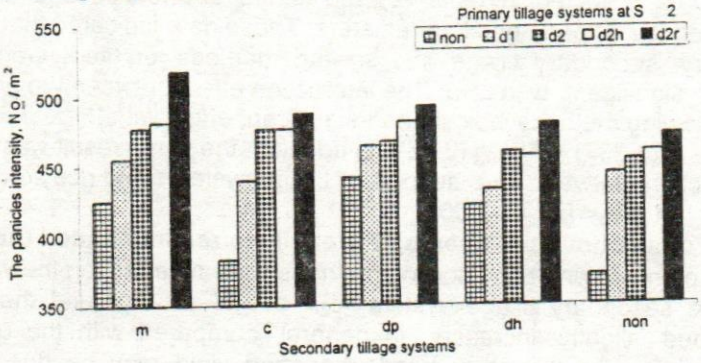

Fig. 4: The tillage systems via the panicles intensity at band sowing (S_2).

The tillage system "d_2r" as secondary tillage recorded the maximum 489.9 panicles/m^2 at "dp" and "S_2" compared with the other secondary tillage systems in that experiment (Fig. 4). Primary tillage, secondary tillage systems, and sowing method are the factors had highly significant effect on the number of panicles/m^2 (pr > 0.0001).

4- Grain yield

Rice grain yield (ton/fed) as influenced by primary tillage, secondary tillage and sowing methods is graphically drawn in Fig. (5). The highest average of grain yield as showed in Fig. (5) is 3.78 ton/fed at tillage systems "m-d2r- S_2" come in descending value (3.63 ton/fed) at dp-d_2r of tillage system while, the lowest value (2.635 ton/fed) is recorded at "Non-non" of tillage systems at "S_2". The results indicated that highly significant effect on the average of rice grain yield due to the effect of primary and secondary tillage. The average of yield for primary tillage "dp" and "m" at the sowing methods S_1 and S_2 recorded 3.29, 3.08, 3.16 and 3.02 t/feddan respectively. While the primary tillage treatments "no"; "dh" and "c" were recorded 2.68, 3.09, and 3.08 t/feddan respectively at "S_1".

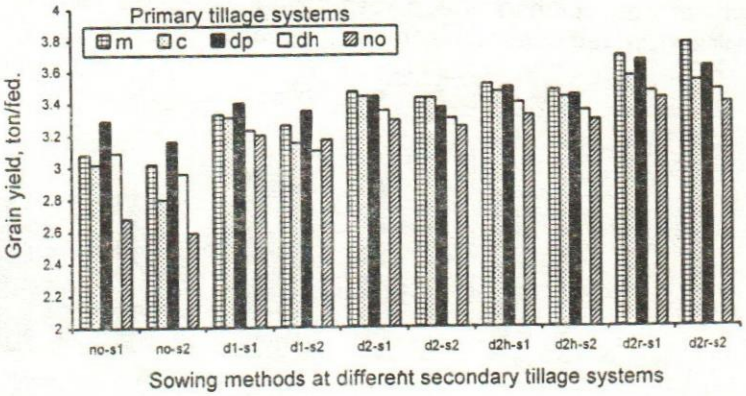

Fig. 5: The sowing methods via grain yield.

Data collected in table (2) shows the analysis of variance for yield as affected by experimental parameters. These data indicated that the effect of primary, secondary tillage and sowing methods on the average yield were highly significant with LSD. The interaction effect between the primary tillage and sowing methods indicate non-significant effect with "F" test at 0.1 % level [$F_{c\ at\ 0.1}$ (1.237) < $F_{t\ at\ 0.1}$ (2.06)]. In addition, the same result was found at the interaction between the secondary tillage systems and rice sowing methods [$F_{c\ at\ 0.1}$ (1.52) < $F_{t\ at\ 0.1}$ (2.06)].

For all above treatments, it is easily to recommended that:

- The common and band sowing methods have no effect on the yield of rice.
- The secondary tillage system "d_2r" at "m" or "dp" and the method S_2 recorded slightly increase, in general, compared with the other sowing method S_2. On the other hand, the good yield may be due to good soil surface roughness, good pulverization, suitable reduction conditions (Konokhova, 1982), good establishments and distributions of roots and also good weed control which affected by good pulverization and plowing depth.

Table 2: Analysis of variance for rice grain yield.

Source of variance	Df	SS	MS	F value	Prob
Replication	2	0.001	0.001	0.0714	
Primary tillage	4	1.378	0.345	46.9137	0.0001**
Error (A)	8	0.059	0.007		
Secondary tillage	4	6.079	1.520	234.5585	0.0000**
Error (B)	8	0.052	0.006		
AB	16	0.648	0.040	7.6867	0.0000**
Error (C)	32	0.169	0.005		
Sowing method	1	0.134	0.134	35.0943	0.0001**
AC	4	0.019	0.005	1.2374	0.3071^{NS}
BC	4	0.068	0.017	1.5251	0.0034^{NS}
ABC	16	0.039	0.002	0.6423	
Error (D)	50	0.191	0.004		
Total	149	8.837			

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استخدام آلات التسطير للزراعة العريضة للأرز

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فى السنوات العشر الأخيرة تتجه وزارة الزراعة إلى محاولة لزراعة الأرز باستخدام آلات التســـطير وذلك في محاولة منها للتغلب علي مشاكل الشتل الآلى والشتل التقليدى ولتحقيق الزيادة الإنتاجية للمحصـــول عن طريق زيادة عدد البادرات في المتر المربع . لذلك كان الهدف من هذه الورقة دراسة إمكانيـــة اســـتخدام آلات التسطير لتحقيق الزراعة العريضة لمحصول الأرز في محاولة لزيادة الإنتاج. لتحقيق هذا الـــهدف تـــم استخدام آله التسطير لتحقيق نظامين مختلفين الزراعة العريضة- والزراعة التقليدية مع نظم حرث مختلفـــة. أوضحت التجارب انه يوجد فرق في الإنتاج بين طرق الزراعة إلا أن هذا الفرق غـــير معنـــوي- كمـــا أن افضل إنتاج تم تحت نظم الحرث التي تحقق افضل إعداد جيد للحرث (استخدام مشط قرصي يتبعه دورانـــي مع محراث قلاب مطرحي).