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V- SUMMARY AND CONCLUSION

Study on Using Alternative Trays for Mechanical Transplanting

Rice is the most important staple food after wheat for Egyptian people. Also, it considers as the second major foreign exchange earning among agricultural. The goal of mechanized transplanting of crops is not only to increase labor productivity and reduce labor costs hut also to include systems, which would ensure optimum number of plants per hill and number of hills per unit area for realizing high yields. However, the mechanical transplanting system did not spread out as expected. The reasons may be due to the highest cost of the mechanical transplanting system generally, and expensive price of plastic seedling trays (10 LE for Japanese model plastic tray and 6 LE for Egyptian model plastic tray) required for rising rice specially.

Therefore, the main objective of this investigation was to find and evaluate different types of alternative seedling tray to standard plastic trays for rice rising nursery, which ensure low costs with high working efficiency and planting accuracy for rice transplanter under the actual field conditions.

1- Scope of variables:

To realize the purpose from this study, a series of field experiments were carried out under the following different variables: -

1- Four types of alternative seedling trays compared with standard seedling trays as follows:

a) Wooden strips, T1 (The frame and the bottom of these trays were made from eucalypt wood strips with the same inner and outer dimensions of the standard plastic trays).

b) Plastic mesh, T2 (The frame of this type was made from eucalypt wood strips and the bottom was made from plastic mesh, with the same inner and outer dimensions of the standard plastic trays).

c) Perforated polyethylene sheet, T3 (The frame of this type was made from eucalypt wood strips and the bottom was made from perforated polyethylene sheet. with the same inner and outer dimensions of the standard plastic trays).

d) 5-mat frame, T4 (The frame of this type was made from wooden strips with inner (140x58x3 cm) and outer (142x60x3 cm) dimensions to make 5 seedling trays. However, the bottom of this type was made from perforated plastic sheet and not fixed on the frame)

e) Standard plastic seedling tray, T5 (imported from Japan or manufactured in Egypt using imported materials with same specification of Japanese trays, with inner (58 x 28 x 3 cm) and outer (60 x 30 x 3 cm) dimensions).

2- Two different adjusting settings of forward planting speed: low speed of 0.56 m/s and high speed of 0.83 m/s.

3- Three different seeds, namely; 150, 200 and 250 g/tray.

2- Measurements:

To evaluate the alternative seedling trays and sowing density/tray on the seedling growth characteristics and the performance of rice transplanter under the actual field conditions, the following measurements were taken into consideration:

2-1- Measurements for seedling growth characteristics:

a) Seedling height (cm); b) Root length (cm);

c) Leafage; d) Dry weight of seedling (mg);

e) Growing density of seedlings /cm^2.

2-2 Measurements for plauting accuracy of transplanter:

a) Missing hills percentage;

b) Buried hills percentage;

c) Floating hills percentage;

d) Total defective hills percentage.

2-3 Measurements for transplanter field capacity and efficiency :

a) Actual forward speed

b) Slippage

c) Actual transplanting time (productive time)

d) Non productive times (turning time, feeding time and adjusting time)

e) Total time

f) Fuel consumption

g) Field capacity and efficiency calculation

3- Cost analysis:

In this study, the tota transplanting cost of the mechanical system was compared with hand local transplanting cost. The total transplanting cost includes the rising cost of rice seedlings (using seedling tray method and manual method) and transplanting operation cost (by transplanter and by hand).

4- Experimental nursery and field:

The present study was carried out in the research farm at Rice Mechanization Center (RMC), Meet El-Deyba, Kafr El-Sheikh Governorate, Agricultural Engineering Research Institute during 1999 and 2000 paddy seasons. The Kubota SI-800R rice transplanter (Rotary type planting mechanism) was used in this study with rice seedlings of variety Sakha 101.

The nursery experiment was conducted to study the influence of the alternative seedling trays and sowing density/tray on the seedling growth characteristics in 3 plots, each plot has area of 2 x 12 m and contain 120 seedling trays. The nursery experiment was designed in split plot experimental design, with three replicates. However, the field experiment was carried out to study the influence of the alternative seedling trays on the planting accuracy and efficiency of the rice transplanter in comparison with plastic trays in area of about three feddans. The experimental treatments were arranged in split-split plot experimental design, with three replicates. The obtained experimental data were statistically analyzed using the ***SPSS*** program in RMC computer division.

4- Results:

The obtained results in this study were summarized and concluded as follows:

4-1- Seedling growth characteristics:

1) In general, the seedling growth characteristics such as seedling height, seedling root length, seedling dray weight and number of leaves /seedling were greatly affected by seedling tray types. However this effect was similar for standard, plastic mesh and wooden strips seedling trays and

various for perforated polyethylene sheet and 5-mat frame seedling trays.

2) The seedling tray of plastic mesh gave the highest values of seedling height, seedling root length, seedling dray weight and number of leaves /seedling (16.38cm, 6.27cm, 46.91 mg and 2.42, respectively) followed by standard (15.58cm, 6.16cm, 43.75 mg and 2.30, respectively), wooden strips (15.41cm, 6.11cm, 43.38 mg and 2.27, respectively), perforated polyethylene sheet (14.78 cm, 5.99cm, 41.88 mg and 2.17, respectively)and 5-mat frame seedling trays (13.67cm, 5.76 cm, 39.77 mg and 2.10, respectively)at given seed rate of 200g/tray.

3) There are no significant differences between the effect of three-used seedling trays of standard, plastic mesh and wooden strips on the seedling growth characteristics. However, there is a significant difference between the effect of standard, perforated polyethylene sheet and 5-mat frame seedling trays on the seedling growth characteristics at any given seed rate / tray.

4) The seedling growth characteristics such as seedling height, root length, seedling dray weight and number of leaves /seedling were greatly influenced by seed rate/tray. Increasing seed rate/tray results in a decrement in seedling growth characteristics under any given seedling tray.

5) Using different seedling trays did not affect the number of seedlings/cm^2. It were 4.85, 4.94, 4.98, 4.93 and 4.86 for 5-mat frame, wooden strips, plastic mesh, perforated polyethylene sheet and standard seedling trays, respectively at the seed rate of 200g/tray. Also, the statistical analysis indicated that, there are no significant differences between the values of the number of seedlings/cm^2 resulted from using different seedling trays in the study.

6) The number of seedlings/cm^2 was highly affected by seed rate/tray. Increasing seed rate/tray results in an increment in the number of seedlings/cm^2. Therefore, the other seedling conditions such as seedling height, seedling leafage, dry weight and seedling root length were greatly affected by this increment in the number of seedlings/cm^2.

7) The seed rates of 150g or 250g/tray gave a number of seedlings/cm^2 less than or more than the recommended number of seedlings per unit area (4-6 seedlings), respectively. However, the seed rate of 200g/tray gave the best results of the number of seedling/ cm^2, which in agreement in the recommend numbers of seedling/cm^2 for the national test code of the mechanical transplanting.

4-2- Planting accuracy of rice transplanter:

1) The standard seedling trays gave the lowest values of the total defective hills flowed by plastic mesh, wooden strips and perforated polyethylene sheet seedling trays. While, the 5-mat frame seedling trays gave the highest values of the total defective hills percentage at any given forward speed of rice transplanter and seed rate/tray.

2) The total defective hills prcentage was increased from 7.48 to 9.16% anf from 9.57 to 11.34% for standard and 5-mat frame seedling trays, respectively by increasing forward speed from 0.43 to 0.71 m/sec at the seed rate of 150 g/tray. The crossponding values at the seed rate of 250 g/tray were from 6.46 to 7.95% and from 8.51 to 10.23% for standard and 5-mat frame seedling trays, respectively by increasing forward speed from 0.43 to 0.71 m/sec.

3) The analysis of variance showed no significant differences for the values of percentage of total defective hills and its sources due to using seedling trays of standard, plastic mesh

and wooden strips seedling trays. However, the differences between the values of total defective hills percentage resulted from using standard, perforated polyethylene sheet and 5-mat frame seedling trays was found to be significant at any given seed rate / tray.

4) An increase in seed rate/tray decreased the total defective hills percentage for all seedling trays under the study at any given forward speed. The effect of seed rate/tray on the total defective hill percentage was found to be highly significant for all types of seedling tray and forward speed of rice transplanter.

5) The percentage of missing hills gave the highest percent distribution of the total defective hills (more than 4.5%) followed by floating and buried hills percentages at any given forward speed, seedling tray and seed rate/tray. The percentage of missing hills was affect by seed rate/tray and uniformity of seedling tray thickness, however the percentage of buried hills and the percentage of floating hills greatly depends on forward speed of rice transplanter.

4-3 Field capacity and efficiency of rice transplanter:

1) The total time consumed by rice transplanter using standard plastic seedling trays was 1.74 and 1.25 hour/fed. at low and high level (0.43 and 0.71 m/s) of forward speed of rice transplanter, respectively. While it were found to be similar to standard trays by using plastic mesh and wooden strips seedling trays. However it were for perforated polyethylene sheet 1.80 & 1.30 hour/fed. and 1.84& 1.34 hour/fed. for 5-mat frame seedling tray at the same low and high level of forward speed of rice transplanter, respectively .

2) The field capacity and efficiency of rice transplanter was not influenced due to using plastic mesh or wooden strips

seedling tray as alternative seedling trays for standard plastic trays. However, it was significantly influenced by using perforated polyethylene sheet and 5-mat frame alternative seedling trays instead of standard plastic trays.

3) Increasing forward speed of rice transplanter the field capacity was increased and the field efficiency was decrease at any given type of seedling trays.

4-4 Total transplanting cost:

1) Using the standard plastic seedling tray was found to be very costly (90 LE/fed) for rising cost of rice seedlings comparing with using other alternative seedling trays under study. Moreover, the alternative seedling tray like plastic mesh seedling tray and wooden strips cost only 25 and 15 LE/ fed, respectively against 22.5 and 23.5 LE/ fed when using perforated polyethylene sheet and 5-mat frame, respectively.

2) The total transplanting cost were reduced to 206, 198, 208, 205 LE/fed due to using alternative seedling trays of 5-tray frame, wooden strips, plastic mesh and perforated polyethylene sheet seedling trays, respectively comparing with standard plastic trays (273 LE/ fed).

3) Using alternative seedling trays like plastic mesh or wooden strips or 5-tray frame instead of standard plastic seedling tray saved about 23-27 % in the total transplanting cost according to the type of seedling tray.

4) The savings in transplanting cost due to using mechanical transplanting system was about 33-36 % when using an alternative seedling tray and about 13% when using standard plastic seedling tray.

5) In spite of the savings in mechanical transplanting costs using standard plastic trays were not higher relatively compare with hand local transplanting at current prices. But by using alternative seedling trays with raising wages and scarcity of hand labor future prospects for mechanical transplanting look better.

6) Better economy also, may be obtained by manufacturing alternative seedling trays in a large scale with good quality to increase annual working times, working life/tray and to decrease the initial fabricated cost /tray. Specially, the main component needed for manufacturing the alternative seedling trays preparing from eucalypt wood trees which available and easy to obtain for farmers.

Recommendations

This study recommended to use wooden strips seedling trays with wooden frame and base made from eucalypt wood or plastic mesh seedling trays with wooden frame made from eucalypt wood and plastic mesh base made from plastic mesh (which used for windows) as alternative seedling trays to standard plastic seedling trays for rising rice seedlings for mechanical transplanting with Japanese rice transplanter. Also it is recommended to use seed rate of 200 g/tray (pre-germinated seeds) to obtain good seedlings for mechanical transplanting.