



**Fayoum University**



**Agric. Eng. Dept.**



**Faculty of Agriculture**

**EFFECT OF USING A COMBINATION UNIT FOR  
PLANTING SMALL HOLDINGS ON PERFORMANCE,  
OPERATING COST AND YIELD OF WHEAT CROP  
UNDER FAYOUM CONDITIONS**

**By**

**REHAB ABDEL-ATY MOHAMED IBRAHIM**

**B.Sc. Agric. Sci. (Soils and Water), Fac. of Agric.,  
Fayoum University, Egypt, 2018**

**A Thesis**

**Submitted in partial fulfillment of the requirements  
for the degree of**

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**In**

**Agricultural Sciences  
(Agricultural Engineering Sciences)**

**Agricultural Engineering Department, Faculty of Agriculture,  
Fayoum University**

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## ABSTRACT

It is imperative to study the different planting methods of wheat to select the proper machinery systems for grains sowing operation. This study aims to evaluate the effect of using a combination unit for planting smallholdings on performance, operating cost and yield of wheat crop under Fayoum conditions. The combination unit compared with seed drill and traditional methods for preparing the seedbed of the soil. Field experiments were conducted at the Faculty of Agriculture Farm (Demo), Fayoum University, Fayoum, Egypt. The soil texture is sandy loam. The total area of field experiment about 1.47 ha and was divided into three main strips to received three used planting methods. The first and second main strips area (33.3 m of width  $\times$  154 m of length) were planted by seed drill and traditional methods, the third main strip area (28.6 m of width  $\times$  154 m of length) was planted by the combination unit. Each main strip was divided into three sub-main strips to received three forward speeds of the tractor (4, 6 and 8 km h<sup>-1</sup>). All treatments were combined in the complete randomized block design in split plot with three replicates. Wheat seeds (*Triticum aestivum* L., cultivar Misr<sub>1</sub>) was planted in two seasons (2019/2020 and 2020/2021). Some soil physical properties, seed drill and combination unit performance, required energy, wheat crop production and economical evaluation were determined. The results indicated that soil bulk density, total porosity, penetration resistance and meso-aggregates values were significantly improved at forward speed of tractor 4 km h<sup>-1</sup> with combination unit method, especially under soil surface layer (0-15 cm). Under seed drill and combination unit planting methods, the highest values of field efficiency were 73.74 and 81.76% and required energy were 147.24 and 77.69 kW h ha<sup>-1</sup> respectively, with forward speed of tractor 4 km h<sup>-1</sup>. Also, under seed drill and combination unit planting methods, the highest values of actual field capacity were 1.65 and 0.67 ha h<sup>-1</sup>, respectively, forward speed of tractor 8 km h<sup>-1</sup>. The increases in values of wheat crop weight were 30.78, 33.32 and 0.13% for grains and 14.62, 15.66 and 4.48% for straw with seed drill method, and were 71.66, 73.70 and 58.33% for grains and 29.86, 30.54 and 13.12% for straw with combination unit method at forward speeds of tractor 4, 6 and 8 km h<sup>-1</sup>, respectively, as compared to traditional method. Wheat growth parameters and yield production are significantly improved at forward speeds of tractor as descending following order: 6 > 4 > 8 km h<sup>-1</sup>. Combination unit planting method at forward speed of tractor 8 km h<sup>-1</sup> gave the lowest values of wheat total costs (14657.27 and 18047.66 L.E. ha<sup>-1</sup>) at the first



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and second seasons, respectively, while the traditional method gave the highest values (16554.25 and 20000.39 L.E. ha<sup>-1</sup>) at the first and second seasons, respectively. According to  $C_2/C_1$  ratio {free market price (L.E. t<sup>-1</sup>) / cost per ton (L.E. t<sup>-1</sup>)}, combination unit at forward speed of tractor 6 km h<sup>-1</sup> found to be the best planting method, since it had the highest return were, 3.16 and 2.73 for the first and second seasons, respectively. Also, Combination unit method at 6 km h<sup>-1</sup> had the highest values of net return (31957.0 and 31314.7 L.E./ha) for first and second seasons, respectively. It can be recommend that using the combination unit to planting wheat crop in smallholdings as minimum tillage with not increase the forward speed of tractor more than 6 km h<sup>-1</sup> to obtain the best values of soil physical properties, field efficiency, required energy, wheat yield production and economic return of wheat crop. The difference, whether it was an increase or a decrease which resulted of the effect forward speeds of tractor 4 and 6 km h<sup>-1</sup> of all the studied traits is small and not significant.

**Key words:** combination unit, seed drill, traditional method, smallholdings, field efficiency, performance, required energy, operating cost, wheat crop.