SUMMARY AND CONCLUSION

In trying to meet horizontal and vertical production increases, due to population pressure, a shortage of agricultural labor becomes evident on a seasonal basis.

As a result, the Egyptain government has lunched a major mechanization effort.

To assure successful mechanization in most agricultural operations, the land has to be levelled, which is considered the most important factor influences its application.

The aim of this study is to identify the relationships between land levelling and: soil physical properties, water irrigation efficiencies, the performance of seeding; and harvesting machines, the yield of some crops as an indicator for the final benefit of land levelling practices, and finally, selecting the economical levelling technique under different studying conditions, throughout the following three experiments, to determine the levelling uniformity coefficient "LUC":

a- Comparison between three types of land levelling as: multi-steel angle, blade-box system and traditional wooden zahhafa, on berseem and maize yields.

b- Comparison between three forward speeds of levelling as: 3,4 and 5 km/h., on sorghum forage yield.

c- Comparison between three times of levelling passes as: one, two and three passes, on wheat yield.

The experiments were carried out an area of 2-5 fed. at the Agr. Research and experiment station of the Fac. of Agr. at Moshtohor, Zagazig Univ., Kalubia Governorate, Egypt, during the years of 1984-1988.

The analysis of obtained results may help in concluding the following new scientific achievements as :

Part I:

1. The levelling uniformity coefficient index "LUC":

a- The increasing in LUC due to land levellers had a descending order as follows :

Blade box system (82%) > multi steel angle (80%) > traditional wooden zahhafa (58%) > non levelled (48%).

b- Using blade box system leveller with 4 km/h. forward speed gave better LUC (81%) followed by 3 km/h. forward speed (75%) followed by 5 km/h. forward speed (72%).

c- The LUC as affected by times of levelling passes has a descending order as :

Three passes (83%) > two passes (75%) > one pass (57%) > non levelled land (35%).

2. The soil physical properties :

a- Soil bulk density (ρ_b) at the soil depth (10 cm.) significantly increased by increasing LUC, but the change in soil bulk density was more at the surface layer (10 cm.) depth than deeper layers.

The values of void ratio at different layers under LUC were influenced by levelling operation, which decreased with different amounts depending upon the LUC, this change is expected since void ratio is oppositely related to soil bulk density.

b- Increasing LUC value (good levelling) breaks soil granules and distributes these granules after reducing their diameters, and, increases the percentage of medium aggregate sizes (50-20 mm.) and the fine aggregate sizes (less than 10 mm.) more than other LUC values.

c- The effect of land levelling on the compaction in $k.N/cm^2$, at soil layer of 20 cm. depth, indicated that the compaction increase as LUC increased, but it was very small.

3. Irrigation efficiencies :

In both cases of furrow and strip irrigations under different LUC values, the efficiencies of distribution (Ed); storage (Es) and application (Ea) as well as the overall irrigation efficiency (Eov.) were higher, depending on increase of LUC.

The regression equations for furrow irrigation efficiencies were as :

$E_d = 38.99 + 0.64\ (LUC)$;

$E_s = 61.99 + 0.26\ (LUC)$

$E_a = 42.97 + 0.58\ (LUC)$

$E_{ov.} = -270.639 + 14.662\ (LUC) - 0.234(LUC)^2 + 0.0013(LUC)^3$.

And, for strip irrigation efficiencies, the regression equations as :

$E_d = 47.20 + 0.56\ (LUC)$

$E_s = 54.91 + 0.44\ (LUC)$

$E_a = 39.36 + 0.63\ (LUC)$

$E_{ov.} = -139.486 + 9.026(LUC) - 0.151(LUC)^2 + 0.0009(LUC)^3$

4. Seeding machine performance:

Land levelling resulted in increasing the coefficient of useful time (C.u.t.), field capacity (F.C.) and germination capacity as compared with unlevelled land by about : 13.55%, 11.2% and 13.48% for seeder machine, and: 9.76%, 8% and 18.62% for planter machine.

The regression equations for germination capacity was resulted as :

$G.C. = 68.9255 + 0.2667(LUC)$, %

5. Harvesting machine performance:

Land levelling resulted in increasing the harvesting machine performance as, coefficient of useful time, field

capacity, and harvesting efficieny (η_H) by about: 10.00%, 26.98% and 17.22% for harvesting berseem and wheat, and by about: 23.26%, 28.85% and 14.82% for harvesting maize and sorghum crops.

The regression equations for harvesting machine efficiency for all crops under studying, and losses were as:

$$\eta_H = 70.8321 + 0.2639\ (LUC) \quad , \%$$

$$losses = 29.1679 - 0.2639\ (LUC) \quad , \%.$$

Part 2:

Crop yields:

It was found that, land levelling increased the yield components and total yields in ton/fed. as follows:

a- Forage sorghum yield:

The increases in total weight yield (3 cutting) were: 49.02% and 78.66% for both fresh and dry yields, resp. these increment was caused as a result of effect of land levelling on increasing the: plant height, number of plants per sq.m., high germination of seeds and, fresh and dry weights per plant.

b- Wheat crop :

There were continuous and significant increases in the characteristics of wheat plants and yield component as: plant height, stem length, number of spikes/sq.m., number

of spikeltes/spike, spike length and weight, number of seeds/spike and seed weight/spike, with the LUC value increased.

Grain and straw yields of wheat were, also, significantly affected by land levelling, the increases in grain and straw yields were: 69.64% and 53.33% resp., as a result of LUC equal to 83%.

Part 3: Economical evaluation

a- Energy consumption per unit output:

It was found that, the energy consumed in kW.h./fed. increased by increasing LUC. The energy consumed in kW.h./ton of output was low due to high production of levelled land.

The reductions in energy consumed in kW.h./ton of output were : 20.48% and 15.94% for sorghum and wheat productions, resp., due to good land levelling.

b- Cost per unit area:

It was found that, total yield revenue in L.E./fed. increased with LUC up to LUC = 83.

Total cost (production costs plus losses) in L.E./fed. decreased with LUC for : sorghum production.

Meanwhile, in wheat production, the total cost decreased by increasing LUC up to 84%, and increased again with LUC value more 84%.

The levelling cost increased due to more passes with a diminishing return. The net income (profit) in L.E./fed., increased due to levelling by about: 198.06% and 290.04% for production of production of sorghum and wheat crops, resp.