SUMMERY AND CONCLUSION

Continuous growing of world population increases pressure on the available area to cultivate crop, demand for a more intensive and mechanized agriculture to meet the demand of food. Mechanization of agriculture plays a major role in timely and economic operations to produce high yield with low inputs. In agriculture region, out of the many operations, spraying and weeding are two important operations to be performed by the farmers for protection of crops from weeds and insects including pests. These are to be controlled for satisfactory production and for this purpose insecticides/pesticides/weedicides are being used as per recommended practice. Different types of spraying methods are being used which includes hand operated, engine operated and tractor operated sprayers and dusters. Pesticides are critical inputs for crop production worldwide and are expected to continue to play a major role for protect most crops from insect-pests and disease. Mechanization of plant protection equipment needs for timely application of pesticides to produce good yield.

The aimes of the present study were to:

1. Design and construction of a field sprayer to be operated and controlled by remote control for spraying chemicals or pesticides under Egyptian conditions.
2. Reach the most appropriate operation factors of the machine in terms of the forward speed, spraying pressure, spraying height and nozzle type.
3. Test The prototype spraying machine in the faculty of Agriculture and Natural Resources – Aswan - Egypt. Tests were carried out to evaluate the machine performance in terms of laboratory.

To reach the main goals, the following points were done:

1. Collecting researches in the field of field spraying systems and identifying the mechanisms of work of these machines, whether local or global.
2. Determine the required requirements of the material, bearings, pully , gears and the power transmission systems.

3. Perform the calculations, analysis of the forces affecting the various parts of the machine and select the appropriate materials to manufacture each part.
4. Implementation of the design after drawing the detailed drawing of each component and the assembly of the machine with complete specification for the manufacturing processes suggested.
5. Test the Performance parameters such as forward speeds, spraying pressure, discharge rate, spraying width, uniformity coefficient, spray overlap, theoretical field capacity, fuel consumption, application rate and cost economics were determined.
6. Test the efficiency of machine performance in the laboratory by studying the following variables:
   a) Forward speeds: 2.49, 3.22, 3.84, 4.46, 5.39 and 6.33 km/h.
   b) Spraying pressure: 6.0, 7.0, 8.0, 8.5 and 9.5 bar.
   c) Nozzle type of hollow cone ceramic: 422HCC02, 422HCC025, 422HCC03, 422HCC05.
   d) Spraying height: 30, 40 and 50 cm.

Results of the experimental work could be summarized as follows:

The following major conclusions were drawn from the present investigation.

- The overall dimensions of spraying machine are 234 × 163 × 163 cm with 627 cm spraying boom and the weight of machine was 600 kg approximately with full tank and 400 kg approximately with empty tank.
- The forward speed of the spraying machine increased with increasing the servo motor angle that asocated with the dimmer and the forward speed of the spraying machine as follow 6.33, 5.39, 4.46, 3.84, 3.22 and 2.49 km/h.
- The consumed power for operating the machine was observed to be average 2.96 kW at th frist forward speed (6.33 km/h) and 1.36 kW at the sixth forward speed (2.49 km/h).
- Results shows that increasing the pump engine speed increasing the pump pressure from (6.00 to 9.5 bar), and also the flow rate increased from (13.33 to 24.58 L/min).

- The average discharge from hollow cone ceramic nozzles has been increased as a result of the increased operating pressure of the pump where the average discharge for 422HCC02 nozzle ranged between (0.98 to 1.35 L/min), for 422HCC025 nozzle ranged between (1.15 to 1.65 L/min), for 422HCC03 nozzle ranged between (1.23 to 1.76 L/min), for 422HCC05 nozzle ranged between (1.35 to 2.03 L/min), when the pump pressure increased from 6.0 bar to 9.5 bar.
- Volumetric distribution of different hollow cone nozzles at different pressures and heights showed that most of the curves attained maximum value near the center and then declined towards the ends. The trend for 30, 40 and 50 cm heights for all spraying pressures showed a little deviation, by decreasing in the middle and attaining peak towards the right before declining. The average discharge from each channel were decreased with decreasing of the spraying pressure. With increase in nozzle height the average discharge in the channels reduced and the curves became more flat and wide.
- Data of coefficient of variance of the hollow cone ceramic (HCC) nozzles at different pump pressure, The results show that there is no specific pattern in which it is possible to predict the values or method of predicting the value of the coefficient of variation for the performance of the nozzles under the influence of the different pressures and different spray heights. when incresing the spraying height, we find that there is an approximate stability and the differences became almost close and in the case of Relative stability, we also find that the difference value gradually increases at a slight rate, when spraying at a height of 50 cm.
- The Distribution uniformity of spraying machine ranged between (95.88 to 99.10 %) for 422HCC02, (97.76 to 98.54 %) for 422HCC025, (96.99 to 98 %) for 422HCC03 and (96.67 to 99.17 %) for 422HCC05 which shows the uniform coverage of the spraying obtained.
- The maximum coefficient of variation (C.V.) for the average of nozzle discharges was 3.39, 1.91, 2.48 and 2.98 % for hollow cone ceramic nozzle types 422HCC02, 422HCC025, 422HCC03 and 422HCC05 respectively, These results are within the permissible limits because it is less than 10%.

- Results showed that the spray overlap test for 422HCC02 nozzle varies from 7.5 to 36.0 cm, for 422HCC025 nozzle varies from 12 to 38.5 cm, for 422HCC03 nozzle varies from 14.0 to 47.0 cm, and for 422HCC05 nozzle varies from 16 to 47.5 cm, depending on spraying height and pressure.
- The spray angle for hollow cone nozzle ceramic (422HCC02) increased from (58 to 80.26 °) at 30 cm height. The maximum spray angle for (422HCC025) was 89.59 ° at 30 cm height and 9.5 bar. Also, the results indicated that the maximum spray angle for (422HCC03) was 93.25 at 9.5 bar and 30 cm height. And finally we found that the spray angle for (422HCC05) was ranged between (96.77 to 72.89 °) when the spraying pressure increased from (6.0 to 9.5 bar) at constant height.
- The maximum swath for the hollow cone ceramic nozzles were 58.50, 61.75, 69.0 and 71.5 for (422HCC02, 422HCC025, 422HCC03 and 422HCC05) cm at 50 cm height and 9.5 bar.
- The fuel consumption rate of the spraying engine depending directly on the engine speed and the maximum fuel consumption was 0.82 at 1146 r.p.m while the minimum fuel consumption was 0.45 at 684 r.p.m.
- Effective field capacity of spraying machine increased with increase in forward speed with the values of 2.31, 2.99, 3.57, 4.14, 5.01 and 5.88 fed/h forward speeds of 2.49, 3.22, 3.84, 4.46, 5.39 and 6.33 km/h, respectively.
- Fuel demand of spraying machine increased with increase in forward speed and spraying pressure, that the fuel consumption rate of the spraying machine was seen to vary from 1.8 to 1.04 L/h as change in forward speeds of 6.33 to 2.49 km/h and change in pump pressure of 9.5 to 6 bar.
- The least total operating cost was 59.57 EGP/h when the forward speed was (2.10) km/h, and the pump pressure was (6) bar. Also, we found that the largest total operating cost was 60.44 EGP/h when the forward speed was (6.33) km/h, and the pump pressure was (9.5) bar.

In general, it can be said that the field sprayer operated and controlled by GPS in Egypt may be non-existent so the purpose of this Thesis is to design and produce a prototype sprayer suitable for work under the conditions of Egyptian agriculture. It was found that the performance of the

machine is satisfactory for a prototype and has been registered as an invention with a number (82-2021) also, the electronic circuit for ac induction motor speed control remotely has been registered as an invention with a number (85-2021) and is suitable for commercial operation.