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PEA CROP YIELD, QUALITY AND ENERGY REQIREMENTS UNDER SPRINKLER IRRIGATION SYSTEM

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ABSTRACT

The aims of this investigation were to analyze pea crop yield and quality under different sprinkler atomization theories; estimate the crop reduction coefficient due to the examination point of view along sprinkler lateral lines and determine the energy requirements for seedbed preparation under newly reclaimed areas of Egypt. Therefore, two field experiments were carried out during two successful growing seasons (2006 and 2007) in the Desert Experimental Farm of Faculty of Agriculture, Ain Shams University at El-Bustan region, which represents sandy soil conditions in the western desert of Egypt.

Results revealed that rotating sprinkler had the highest vegetation growth factors "plant height and number of pods per plant" followed by small and large nozzles impact sprinkler respectively. However the vegetation growth factors: plant height and number of pods per plant had been increased with about 19and 23% with rotating sprinkler and about 13.7and 6.8% with small nozzle impact comparing with large nozzle impact sprinkler. With respect to the effect of the point of estimation along sprinkler lateral line, data revealed a non-homogeneity trend due to the effect of sprinkler atomization theories and corresponding nozzle sizes. However, data revealed that there is heterogeneity of the highest values with regard to the examination point along sprinkler lateral line under different sprinkler atomization theories.

Keywords: Crop reduction coefficient, Rotating sprinkler, Impact sprinkler, quality parameters.

INTRODUCTION

There is no doubt that the average crop yield is a function of the irrigation water application factors that depends upon the application of the appropriate irrigation method and corresponding systems under specified field conditions, as well as, the hydraulic variation of irrigation systems' distributors as well as the crop sensitivity to the soil moisture stress (Arafa *et al,* 2005 and Arafa, 2004). However, Irrigation application should increase until the marginal value of water equals the marginal value of the yield or until no yield reduction occurs in any part of the field (Demritas *et al*, 2008 and Crusciol *et al*, 2003).

Sprinkler irrigation is considered as a method which the irrigation water delivers to the plant simultaneously to rainfall based on pressure concepts through small orifices or nozzles. However, pressure forces the water through outlets and thus forms spraying sprinkling. Moreover, sprinkler irrigation systems are most suitable method under diverse field conditions. Therefore, sprinkler irrigation systems are widely used under arid ecosystems of Egypt, however, it nearly covered about 0.75% of the totally irrigated newly reclaimed areas. The challenges of sprinkler irrigation are that adjust the spatial distribution of soil moisture and application uniformity to avoid the attributed crop reduction coefficient due to in proper management and stresses along sprinkler lines (El-Zakaziky *et al*, 2009 and Arafa *et al,* 2008).

With the point of view of crop response to sprinkler irrigation systems, observed data by several researchers revealed that crop production is highly significant effect with sprinkler irrigation by about 15 up to 64.55% according to the crop type and variety (Patil *et al*, 2007; Haikel and El-Melegy, 2005 and Beck *et al*, 2003), moreover, irrigation water could be saved by about 17.81% (El-Yazel et al, 1998). On the other hand, data speculated that there is significant affect due to the application water level (Demritas *et al*, 2008), also, crop reduction do occur due to extend duration and severity of water stress (Unlu *et al*, 2006 and Yonts *et al*, 2003) and grain yield could not compensate for higher production costs (Rakowski, 2003).

With respect to the energy requirements of sprinkler irrigation systems, Deboer and Monnens (2001) found that, for single-leg irrigation sprinkler based on a ballistic computer simulation program, energy flux density patterns was maximum to average ratios of 6.0 or less can be expected to produce satisfactory irrigation water energy uniformity with a sprinkler spacing of 2 to 3 m, unsatisfactory energy uniformity can be expected with sprinkler spacing of 5 to 6 m. The proposed estimation procedure provides results that are adequate for practical field application.

Therefore, the aims of this investigation were to analyze pea crop yield and quality under different sprinkler atomization theories; estimate the crop reduction coefficient due to the examination point of view along sprinkler lateral lines and determine the energy requirements for seedbed preparation under newly reclaimed areas of Egypt.

MATERIALES AND METHODS

Two sprinklers atomization theories (rotating and impact) had been investigated with different nozzle sizes (small and large), based on the hydraulic and operating test analyses under different conditions. Selection of the investigated sprinkler atomization theories and corresponding nozzle sizes was based on the spreading percentage of the sprinkler under Egyptian conditions, and the desired policies for providing Egyptian markets with new products which help in rationalizing irrigation water, improving irrigation efficiencies and maximizing irrigation water unit net return. Area of about 0.61 Feddan were divided into three parts (24 x 36 m^2 for each plot) for rotating sprinkler, small nozzle impact and large nozzle impact sprinkler, as shown in Fig. (1). Some initial soil physical, hydro-physical and chemical characteristics of the studied soil were determined and tabulated in Tables (1 and 2) as described by Baruah and Partaker (1997); Klute (1986) and Page (1982), however, chemical analysis of irrigation water at the studied area were conducted according to the standard procedures and presented in Table (3). The main components of sprinkler irrigation system network are:

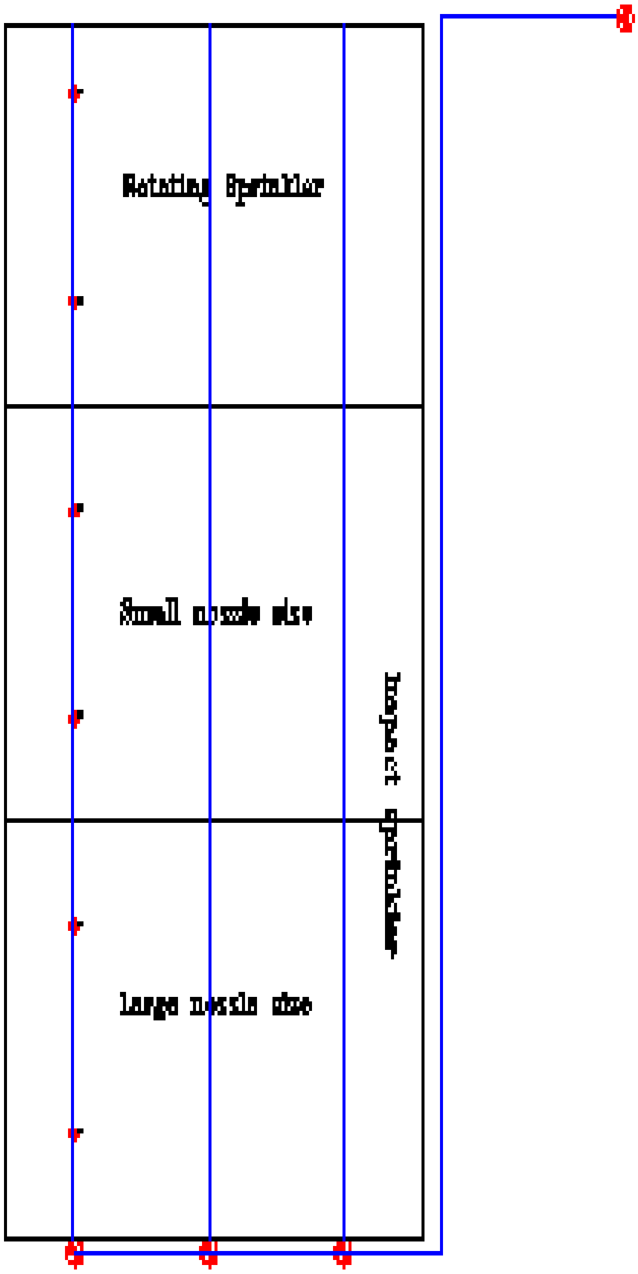

Fig. 1: Layouts of investigated sprinkler atomization theories (rotating and impact) and corresponding nozzle sizes (small and large).

Table 1: Some physical and hydro-physical properties of the investigated soil.

Sample Depth, cm	Particle Size Distribution, %				F.C., % (33 kPa)	P.W.P., % (15000 kPa)	B.D., g/cm^3	Texture Class
	C. Sand	F. Sand	Silt	Clay				
0-30	52.8	41.4	4.1	1.7	9.4	4.3	1.7	Sandy
30-60	50.0	43.5	5.0	1.5	8.5	4.4	1.6	Sandy

Table 2: Some chemical properties of the investigated soil.

Sample Depth, cm	pH (1.25) water	EC, dS/m	Soluble cations, meq/l				Soluble anions, meq/l			
			Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO_3^{--}	HCO_3^{-}	SO_4^{--}	Cl^{-}
0-30	8.2	1.27	2.9	2.8	5.1	0.6	0.0	3.6	2.0	6.1
30-60	8.3	1.22	2.9	2.1	5.2	0.7	0.0	3.7	2.1	6.3

Table 3: Chemical analysis of irrigation water.

pH	EC, dS/m	Soluble cations, meq/l				Soluble anions, meq/l			SAR
		Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^{-}	SO_4^{--}	Cl^{-}	
7.74	0.55	1.03	0.74	8.01	0.42	1.95	4.52	3.73	8.51

- **Pumping unit:** 30hp electric engine with centrifugal pumps is used to pump the irrigation water to the main line of the irrigation system network. The discharge of the pumping unit is 80 m^3/h with 40 m head.
- **Main line:** 125 mm in diameter UPVC pipe were used to carry water from the pumping unit to sub-mains . It is buried at 1 m under the ground surface.
- **Sub-main and manifold line** 110 mm and 90mm in diameter UPVC pipes were used for conveying the water to laterals lines.
- **Lateral lines:** 2" aluminum pipes with quick couplers were used for the hand move sprinkler laterals .
- **Sprinkler heads:** Three nozzle sizes of sprinklers had been used (4mm for rotating, 4.4mm for small nozzle impact and 9.6mm for large nozzle impact).

Each of the treatments consisted of three replicates. Statistical uniformity was calculated with the following equations for the tested sprinkler irrigation systems (ASAE standards 2004):

$$U_S = 1 - \frac{\sum_{i=1}^{n} |x_i - \bar{x}|}{n\,\bar{x}}$$

Where, x_i is the single observation of application rate as depth (mm) and x is the average of the individual observation of the i^{th} to n^{th}. To reduce experimental error and protect against the subjective assignment of treatment, a complete randomization procedure was used. As consequence of individual trials and combination of orders between the treatments and experimental units and subunits were randomly chosen.

Irrigation water requirements were scheduled based on the following equation:

$$IR = ET_c \ x \ I \ x \ (I + LR) \ x \ 4.2$$

Where, IR is irrigation requirements (m^3/fed), ET_c is actual evapotranspiration (mm), (crop coefficient values were used according to FAO 1984), meanwhile, the reference evapotranspiration was calculated based on climatic data of El-Bustan weather station.

1- Crop yield components, productivity and attributed quality indices

i- Plant measurements

At harvesting time, different plant samples of area about 1 x 1 m^2 from different points of examination (0-4, 4-8 and 8-12m) along sprinkler lateral line, had been collected in order to investigate the crop response parameters and indicated factors under different investigated sprinkler types and associated sprinkler nozzle sizes. Measurements include growth indicator parameters. However, the indicated parameters and attributed indices can be categorized as follows:

a- Vegetative growth parameters

* Plant height
* Number of pods per plant

b- Yield productivity parameters

* Economic yield (MGram/ha)

c- Crop yield reduction coefficient (k_y) was calculated according to **Stewart et al (1977)**

$$\left[1-\frac{y_a}{y_m}\right]=k_y\left[1-\frac{ET_a}{ET_m}\right]$$

where, y_a is the actual crop yield in MGram/ha; y_m is the maximum crop yield, in MGram/ha, under specified conditions (it referred to be 0.5 MGram/ha for economic pea crop yield "grain" under El-Bustan region conditions, according to Veg. Res. Inst., ARC, Egypt); ET_a is the actual evapotranspiration in mm and ET_m is the maximum crop evapotranspiration in mm.

ii - Engineering attributed quality parameters:

An analog caliper, with an accuracy of 0.01 mm, was used to measure three axial dimensions of the observed pea crop grains noted length (L), width (W) and thickness (T). One hundred and fifty pea grains of each treatment sample were analyzed. The geometric mean diameter (D_g, mm); the sphericity percentage (f, %) and the arithmetic mean diameter (D_a, mm) were calculated according to Rich and Teixeira (2005). The flat surface area (A_f, mm^2), thickness surface area (A_t, mm^2), surrounded surface area (A_s, mm^2) were calculated according to El-Raie *et al* (1996). Meanwhile, the shape index (SI, dimensionless) and the coefficient of contact surface (CC, %) were calculated according to Abd Alla *et al* (1995).

iii- Energy requirements and fuel consumption of different farming equipments

In order to determine the energy requirements of seedbed preparation practices a 65 hp tractor, Diesel engine had been used. Fuel consumption rate and operating time had been considered as indicators of energy requirements for each at stage of seedbed preparation (chiseling, turning and furrowing). Fuel consumption had been carried out by filling the tractor tank and after its finishing we refill the tank and calculate the added quantity of fuel. By the end of the season the same procedures had been done for every sprinkler zone through the three seedbed preparation practices (chiseling, turning and furrowing). Same measurements replicates had been conducted at different points of examination along sprinkler lateral line under different sprinkler atomization theories and associated nozzle sizes. The satisfactory match between tractor power and that required for soil preparation practices would be consider. The following formula used to estimate the engine power requirement for any operation:

$$\mathbf{E.P = Fc \times \rho_f \times LCV \times 4.27 \times \mu^{th} \times \mu_{mech}}$$

Where, E.P is the engine consumed power (kW), Fc is the fuel consumption (l/S), ρf is the fuel density (kg/l) (for diesel fuel = 0.85), LCV is the calorific value of fuel (kcal/kg) (average of LCV for diesel 10000 kcal/kg), 4.27 is the thermal-mechanical equivalent (k Joule/kg); μ^{th} is the thermal efficiency of the engine (considered to be 35% for diesel engine) and μ_{mech}: the mechanical efficiency of the engine (considered to be 80% for diesel engine). So, the energy requirement per area can be calculated as follows:

RESULTS AND DISCCUSSION

1- Crop response to sprinkler atomization theories and corresponding nozzle sizes

i- Attributed yield component

Results presented in Table (4) and revealed that rotating sprinkler had the highest values of the studied vegetation growth factors "plant height and number of pods per plant" followed by small and large nozzles-sizes impact sprinklers respectively. However the vegetation growth factors: plant height and number of pods per plant had been increased with about 19and 23% with rotating sprinkler and about 13.7and 6.8% with small nozzle impact comparing with large nozzle impact sprinkler.

With respect to the effect of the point of estimation along sprinkler lateral line, data revealed a non-homogeneity trend due to the effect of sprinkler atomization theories and corresponding nozzle sizes. However, the highest plant height was 56.16cm, obtained at the distance of 8-12m from sprinkler position with rotating sprinkler and it was 50.33cm obtained at distance of 4-8m from the small nozzle impact sprinkler, and it was 45cm obtained at distance of 0-4m with large nozzle impact sprinkler. However, same trend had been observed with respect to number of pods per plant. This may be due to the heterogeneity of both droplet sizes distribution and attributed change of soil characteristics along sprinkler lateral lines. These findings lead to the fact the vegetation parameters are resulted from the dynamic behavior of all environmental factors and applied techniques, so, it has not taken in an individual affairs.

ii- Economic pea yield

With respect to the effect of investigated sprinkler atomization theories on pea yield, results presented in Table (4) indicated that highly economic pea yield per hectare (seed yield) had been observed with rotating sprinkler followed by small nozzle and large nozzle impact one with an enhancement of about 62.8 and 25.19% respectively. With the point of view of crop yield productivity as affected by examination point, data revealed that there is heterogeneity of the highest values. However the highest values were 0.49 and 0.28 Mgram/ha obtained at distance 4-8m of rotating sprinkler and small nozzle impact sprinkler compared with 0.45 Mgram/ha obtained at distance of 0-4m from large nozzle impact sprinkler.

Generally it can be concluded that there is highly correlation between pea yield components and unit productivity and the investigated sprinkler types and corresponding nozzle sizes, this may be due to the sprinkler mode of action and attributed crop reduction coefficient, which had been ranged from 0.7 up to 0.88, and heterogenic difference along the examination point of view. However, rotating sprinkler observed a stable yield productivity moreover impact one with large nozzle size, then at the last order impact sprinkler with small nozzle sizes (which considered as control; however it is widely spreading under the studied area conditions).Meanwhile, with regard to the combined effect of sprinkler atomization theories and corresponding nozzle sizes and examination points along lateral lines, data revealed that the highest yield values were 0.486 Mgram/ha; and 0.282 M gram/ha at 4-8m along sprinkler lateral lines for rotating and impact with small nozzle sizes. Meanwhile, it was 0.446 at 0-4 m along sprinkler lateral lines for impact sprinkler with large nozzle sizes. This may be due to the effect of droplet distribution pattern and it's attributed accumulative water level patterns under the investigated sprinkler types and nozzle sizes.

Table 4: Pea yield component and productivity parameters as response to different sprinkler atomization theories and corresponding nozzle sizes

Sprinkler atomization theory	Nozzle Size	Examination Point (m)	Yield component parameter		Yield (Mgram/ha)	Crop reduction coefficient (fraction)
			Plant height (cm)	No. of pods per plant		
Rotating	Small (4mm)	0 - 4	49.833	9.170	0.380	0.85
		4 - 8	48.833	10.330	0.486	0.88
		8 - 12	56.167	6.500	0.300	0.83
Impact	Small (4.4mm)	0 - 4	48.667	6.500	0.196	0.75
		4 - 8	50.333	8.170	0.282	0.7
		8 - 12	43.667	6.500	0.241	0.77
	Large (9.6mm)	0 - 4	45.000	9.330	0.446	0.7
		4 - 8	42.500	5.170	0.222	0.68
		8 - 12	38.000	5.500	0.227	0.7

iii-Attributed pea grain quality indices

a- Geometrical dimensions

With respect to the geometrical dimensions characteristics, data presented in Fig. (2) revealed that sprinkler atomization theory and attributed nozzle sizes had a highly effect on both pod length, width and thickness, but it had a slightly differences in geometric mean diameters (Dg) and arithmetic mean diameters (Da). Regarding the examination point of view, data speculated that there is a heterogeneity effect with all sprinkler atomization theory, as well as, with each nozzle size. However the highly affected parameter is that pod width. Another observation is that the examination point of 0–4 m along sprinkler lateral line gave the highest pods geometrical dimensions under rotating and impact sprinkler comparing with small nozzle sizes, but it was observed at 4–8 m along impact sprinkler attributed with large nozzle size. These are in agreement with the observed analysis of droplet size and droplet distribution pattern, and its accumulated water in the effective root zone of pea plants.

b- Grain shape index

Data presented in Fig. (3) indicated that rotating sprinkler had no effect on the homogeneity of shape index compared with impact one. Moreover, rotating sprinkler has the highest values allover the examination points along sprinkler lateral lines. On the other hand, data revealed that there are heterogeneity effect with the both investigated nozzle sizes of impact sprinkler individually or with respect to the examination points of view along sprinkler lateral lines. This may be due to the small variations of correct and deformed droplet sizes percentages and its attributed accumulative water content under rotating sprinkler comparing with impact one.

c- Engineering quality indices

Figures (4 and 5) represent the effect of investigated sprinkler atomization theory (rotating and impact) and attributed nozzle sizes (small and large) on the engineering quality indices of pea grains. However, data in Fig. (4) indicated that the effect of sprinkler atomization theory can be ordered ascendingly: rotating and impact. On the other hand, there is a steep effect on flat surface area due to the atomization theory and attributed nozzle sizes, allover the examination points of view along sprinkler lateral lines. Meanwhile, it is clearly to observe that there is a highly heterogeneity effect with respect to the thickness surface area, individually for the investigated sprinkler atomization theory or regarding to the investigated points of view. These observations are in agreement with the data analyses of geometrical dimensions, as well as, the economic pea yield productivity. With regard to the coefficient of contact surface, data presented in Fig. (5) indicated that sprinkler atomization theory may be ordered ascend as: rotating and impact sprinkler with small nozzle size and impact sprinkler with large nozzle size. These are in agreement with data analysis of shape index, as well as, thickness and flat surface areas. Regarding the investigated points of view, rotating and impact sprinkler with large nozzle sizes gained the highest values of the coefficient of contact surface at 0–4 m along sprinkler lateral lines compared with 4-8 m at impact sprinkler with small nozzle size. Generally, it can be noticed that there are a heterogeneous effect with the examination points of view under the investigated sprinkler types and nozzle sizes. These findings are in agreement with the above mentioned quality indices and economic yield productivity.

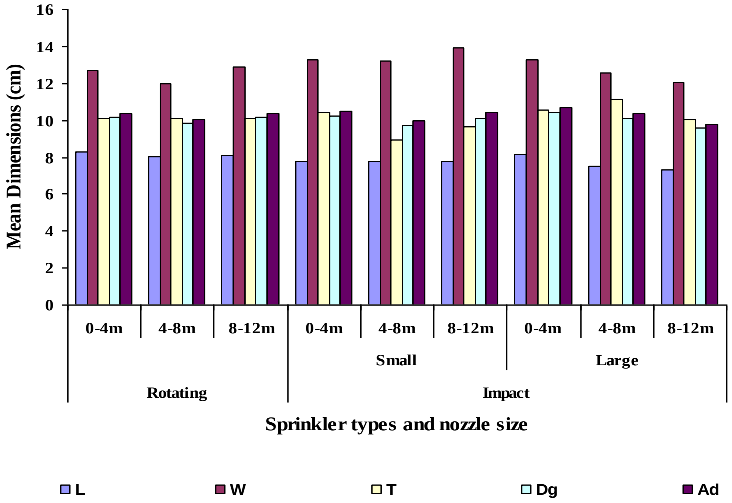

Fig. 2: Peas geometrical dimension along sprinkler lateral line

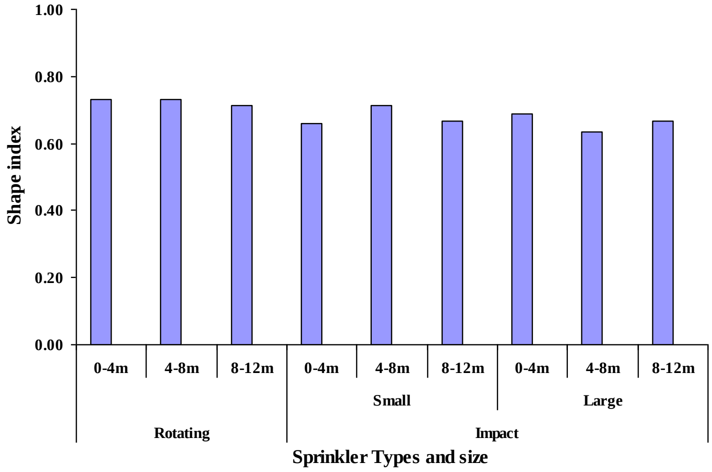

Fig. 3: Shape index of pea grains along sprinkler lateral line

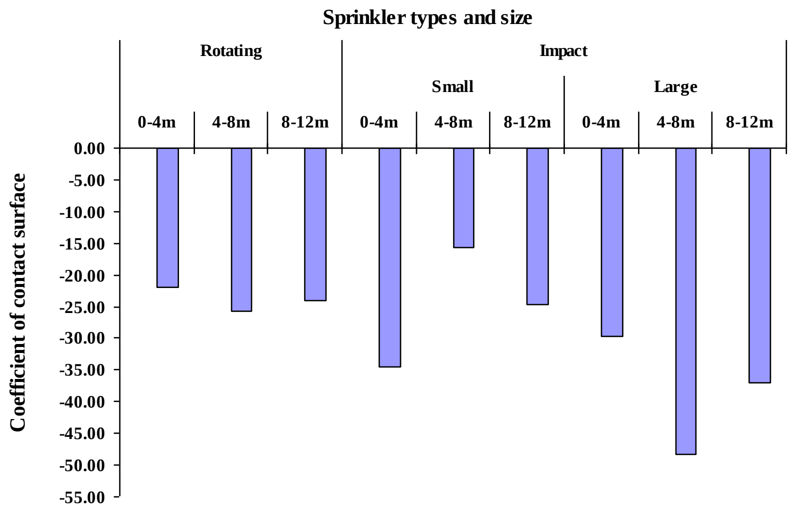

Fig. 4: Coefficient of contact surface of pea grains along sprinkler lateral line

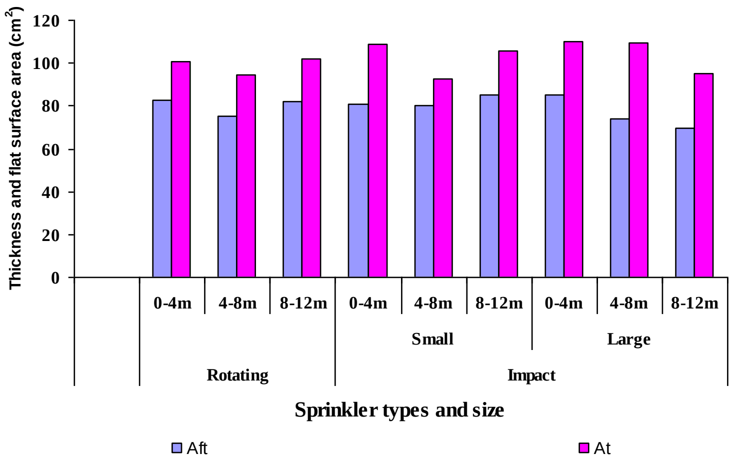

Fig. 5: Peas thickness and flat surface area along lateral line as affected by different sprinkler

2- Energy requirements for seedbed preparation practices

i-Fuel consumption rate

With respect to the fuel consumption rate for the seedbed preparation practices, data presented in **Fig. (6)** revealed that sprinkler atomization theory and attributed nozzle sizes had a highly effect on fuel consumption. Regardless the examination point of view of turning practices, data speculated that the examination point of 4–8 m along sprinkler lateral line gave the highest fuel consumption under impact sprinkler with small nozzle size, rotating and large nozzle sizes impact sprinkler respectively. Moreover for chiseling practices, data revealed that the examination point of 4–8 m along sprinkler lateral line gave the highest fuel consumption for impact sprinkler with large nozzle size, rotating and impact sprinkler with small nozzle sizes respectively. On the other hand for furrowing process, data revealed that the examination point of 4–8 m along sprinkler lateral line gave the highest fuel consumption for impact sprinkler with large nozzle size, impact sprinkler with small nozzle sizes and rotating sprinkler respectively.

ii- Required time

Figure (7) revealed that sprinkler atomization theory and attributed nozzle sizes had a highly effect on time requirement for seedbed preparation practices. Regardless to the examination point of view, for turning process data speculated that the examination point of 4 – 8m along sprinkler lateral line gave the highest time requirement for rotating sprinkler, impact sprinkler with large nozzle size and impact sprinkler with small nozzle sizes respectively. Moreover for chiseling operation, data revealed that the examination point of 4 – 8m along sprinkler lateral line gave the highest time requirement for rotating sprinkler, impact sprinkler with small nozzle size, and impact sprinkler with large nozzle sizes respectively. On the other hand for furrowing process, data revealed that the examination point of 4 – 8m along sprinkler lateral line gave the highest time requirement for rotating sprinkler, impact sprinkler with large nozzle size and impact sprinkler with small nozzle sizes respectively.

Conclusions

An integrated management of irrigation systems composed was implemented to achieve successfully the maximizing irrigation water unit based on a performance analysis of different sprinkler atomization theories and corresponding nozzle size. Several tests are being conduced to achieve the study objectives, as well to conclude about the sprinkler irrigation system efficiency. However, data analysis revealed that rotating sprinkler had the majority of the highest observed indices outputs comparing with impact sprinkler. Moreover, data analysis revealed that the examination point of estimation along sprinkler lateral line had a highly significant effect on the all investigated parameters, however, data revealed a non-homogeneity trend due to the effect of sprinkler atomization theories and corresponding nozzle sizes.

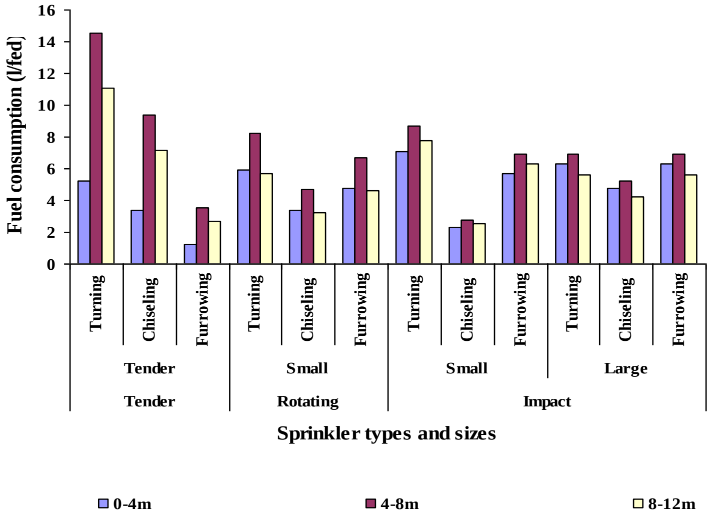

Fig. 6. Fuel consumption rate along sprinkler lateral line as response to sprinkler atomization theory and corresponding nozzle sizes

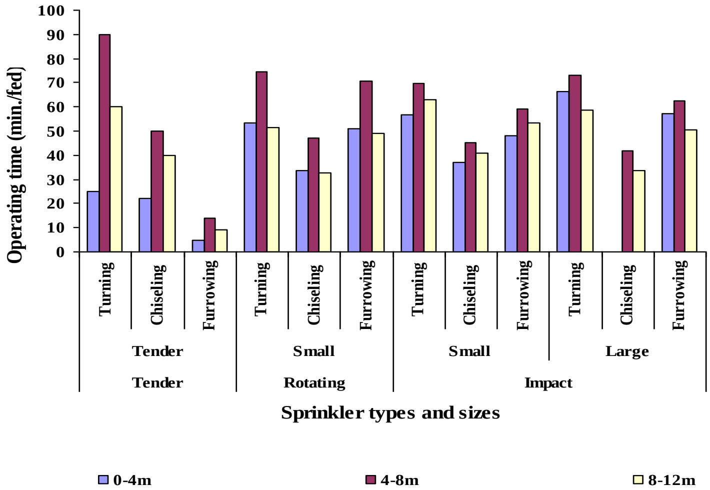

Fig. 7: Required operating time along sprinkler lateral line as response to sprinkler atomization theory and corresponding nozzle sizes

REFERENCES

Abd Alla, H. E.; S. M. Radwan and E. H. Hanafy, 1995, Effect of some properties on ricebgarins on milling quality. Misr J. Agric. Eng., 12(1):143-155.

Arafa, Y. E., 2004, Selection and design of localized irrigation systems based on expert systems. Ph. D. Dissert., Faculty of Agriculture, Ain Shams University, 98-101pp.

Arafa, Y. E.; E. A. El-Sahhar; A. M. El-Gindy and A. A. Rafae, 2005, Design of localized irrigation systems based on expert systems. 13th Annal. Conf. of MSAE, Misr J. Agric. Eng., special issue, 22(4):150-170.

ASAE Standards, 2004. Agricultural engineering standards: S352.2. ASAE St. Joseph, Michigan, USA.

Beck, M.; V. Henning; T. Jaksch; K. Kell and P. Fischer, 2003, Quality and yield improvement in chive production. Gemuse (Munchen). BLV Verlagsgesellschaft mbH, Munchen, Germany, 39 (1): 15-18.

Baruah, T. C. and H. P. Barthakur. 1997, A text book of soil analysis. 1st Ed., 56-76,Vikas Pub. House PVT Ltd., Delhi, India.

Crusciol, C. A.; O. Arf; R. P. Soratto; M. Andreotti and R. Rodrigues, 2003, Yield and grain quality of upland rice in function of sprinkler irrigation levels. Acta, 25(1): 125-130.

DeBoer, D. W. andM. J. Monnens, 2001, Estimation of drop size and kinetic energy from a rotating spray-plate sprinkler. Trans. ASAE, 44(6):1571-1580.

Demirtas, C.; U. Erturk; S. Yazgan; B. N. Candogan and A. Soylu, 2008, Effects of different irrigation levels on the vegetative growth, flower bud formation and fruit quality of sweet cherry in western part of Turkey. J. of Food, Agric. and Environment, 6(2): 173-177. 27.

El-Raie, A. E.; N. A. Hendawy and A. Z. Taib, 1996. Study of physical and engineering properties for some agricultural products. Misr J. Agric. Eng., 13(1):211-226.

El-Yazal, M. N.; H. E. Osman and S. El-Kady, 1998, Cotton crop response to sprinkler irrigation system in Egyptian old land. Egyptian J. of Agric. Res.76(3): 1347-1360.

El-Zakizky, M. O.; A. M. El-Araby; E. A. El-Sahhar and Y. E. Arafa, 2009, Changes of some soil physical and hydrophsyical characteristics in response to different sprinkler types and nozzle sizes. J. of Arabian Univ. Union, 17(1) (under press).

Haikel, M. A. and A. M. El-Melegy, 2005, Effect of irrigation requirements, seeding rates and bio-mineral fertilizer on wheat productivity in newly reclaimed soil under sprinkler irrigation system. J. of Productivity and Development, Zagazig University, 10(1): 113-134.

Klute, A. (ed.), 1986, Methods of soil analysis, Part 1: Physical and mineralogical properties, Amer. Society of Agronomy, Monograph 9, 2nd Ed., pp: 12-15, Madison, Wisconsin., USA.

Page, A. L. 1982 Methods of soil analysis, Part 2: Chemical and Microbiological Properties. Amer. Society of Agronomy, Monograph 9, 2nd Ed., pp: 35-48, Madison, Wisconsin., USA.

Patil, H. A.; A. V. Patil; H. M. Patil;B. T. Shete and S. S. Ilhe, 2007, Response of potato to different depths and methods. Int. J. of Agric. Sciences, 3(2): 179-182.

Rakowski, D., 2003, Effect of sprinkling irrigation and mineral fertilisation on yielding of some spring wheat and spring triticale cultivars on light soil.

Part III. Biological value of protein and technological value of grain. Acta ,2(2): 43-50.
Rich, E. C. and A. A. Taxeira, 2005. Physical properties of mucuna (valvet) bean. Applied Eng. In Agric., 21(3):437-443.
Unlu, M.; R. Kanber; U. Senyigit; H. Onaran and K. Diker, 2006, Trickle and sprinkler irrigation of potato (*Solanum tuberosum* L.) in the Middle Anatolian Region in Turkey. Agricultural Water Management, 79 (1): 43-71.
Yonts, C. D.; F. Lamm; B. Kranz; J. Payero and D. Martin, 2003, Impact of nozzle spacing on sprinkler performance and crop yield. Int. J. Water and Irrigation, 23(4): 36-38.

إنتاجية وجودة محصول البسلة ومتطلبات الطاقة تحت نظام الري بالرش

ياسر عزت عرفه ، عصام أحمد السحار و مدحت عمر الزقازيقي
قسم الهندسة الزراعية – كلية الزراعة – جامعة عين شمس – القاهرة - مصر

تهدف الدراسة الى تحليل انتاجية وجودة محصول البسلة تحت مختلف نظريات الترذيذ لفوهات الري بالرش ومعامل انخفاض المحصول المصاحب تحت مختلف المسافات على فرعيات الرشاشات، بالاضافة الى تقدية متطلبات الطاقة لاعداد مرقد البذرة. وبناءا عليه فقد أجريت التجارب الحقلية تحت ظروف المزرعة الصحراوية والتابعة لكلية الزراعة – جامعة عين شمس بمنطقة البستان- محافظة البحيرة خلال عامين زراعيين ناجحين 2006 و 2007 .

أوضحت التحليلات للنتائج المتحصل عليها من التجارب الحقلية أن فوهات الرش الدورانية ذات تأثير معنوي عن تللك التصادمية حيث كانت نسبة الزيادة تتراوح مابين 19 الى 23%. بينما كانت الزيادة مابين 13.7 الى 6.8 عند مقارنة قطر الفونيات التصادمية الصغيرة والكبيرة. كما اوضحت النتائج وجود عدم التجانس بين قيم عوامل الدراسة بالنسبة الى أماكن الدراسة على طول خط فرعيات الري بالرش تحت مختلف نظريات الترذيذ والأقطار المصاحبة للفوهات

الكلمات المفتاحية : معامل انخفاض المحصول- الرشاشات التصادمية – الرشاشات الدورانية- دلائل الجودة.