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Optimizing Bed Width and Orifice Flow Rate for Wheat Crop Irrigation in The Nile Delta

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ABSTRACT

A field study was conducted at Gemmeiza Research Station, Gharbia Governorate, middle of Nile Delta, Egypt, having a clay textured soil during two winter seasons of 2017/2018 and 2018/2019. The aim of the current research was to investigate the impact of wheat planting method and flow rate on irrigation efficiency and grain yield under surface irrigation system. To achieve this purpose three planting methods (F: flat method, bed width of 120cm (W_{120}) and bed width of 80cm (W_{80}) under three orifice flow rates (Q_1 = 1.0 L/s, Q_2 = 1.5 L/s and Q_3 = 2.0 L/s) were applied to closed end long furrows of 50 m length without dikes. The main results cleared out that; the shortest advance time of 64 min was obtained at treatment of (W_{80}+Q_3). The lowest total applied water of 1407 m^3/fed. was obtained by the treatment (W_{120}+Q_3) which saved irrigation water by about 58.7% comparing with the highest treatment (F+Q_1=3403 m^3/fed). The highest water application efficiency, water uniformity coefficient (Cu), wheat grain yield and water productivity were 67.8%, 75.4%, 3100 kg/fed and 2.2 kg/m^3, respectively accomplished by the treatment (W_{120}+Q_3). The highest values of straw yield, number of spikes/m^2 and 1000 grain weight (g) were 6500 kg/fed, 418 spikes/m^2 and 54.1 g, respectively were achieved by treatment (W_{120} + Q_3).

Keywords: Irrigation efficiency, grain yield, surface irrigation, planting method, advance time, water uniformity

INTRODUCTION

Surface irrigation is the most commonly used irrigation method and indispensable in Egypt especially in Nile Delta region because it is easy in operation and maintenance but while having a serious defect that decreases irrigation efficiency ranged from 40 to 60% (Walker, 2003). Therefore it is necessary to develop new ways to apply irrigation water to enhance its efficiency.

Wheat is not only the staple food of the Egyptians but also the most important cereal crop in the world. In Egypt, wheat is planted in basins and irrigated by flooding method that leads to increased irrigation losses. Bed-planting is an innovative technique to save irrigation water and increase wheat grain yield and water productivity. El-Hadidi *et al*. (2015) pointed out that raised bed of 140 cm width saved applied water by about 16.7% and improved application efficiency by 14%. Also, wheat grain yield and water productivity increased by about 18% and 25%, respectively compared with flat planting method. Sorour *et al.* (2016) attributed saving irrigation water for bed-planting method comparing with the traditional one to increase irrigated area, irrigation time and irrigation losses "percolation, seepage and evaporation" for flat planting. Akbar *et al.* (2017) concluded that saving irrigation water and increasing crop yield for wheat planted on beds depends on convenient management of bed furrow sizes according to soil and field conditions, wider beds can lead to poor lateral infiltration in the bed middle. Jamali and Laghari (2019) resulted that water logging and salinity were controlled from raised bed irrigation so grain yield and water productivity were enhanced. Zohry *et al.* (2020) and Memon *et al.* (2020) mentioned that application of improved management practices package (cultivation on raised beds and irrigation scheduling) can be useful in reducing applied water losses. Larger bed width may result in less water reaching the center of the bed and consequently affect plant growth. Tewabe *et al.* (2020) said that irrigated area of furrows per hectare in the wider beds is lower than it in narrow beds resulting in received a lower amount of irrigation water.

The optimum bed width is defined as the width which leads to effective utilization of land by reducing the number of furrows and a good lateral movement of irrigation water. Ali (2011) referred to flow rate up to 0.5 L/s is suitable for furrows in clay soil that are not too long while flow rate larger than 3 L/s is not advisable to use. El-Sanat (2018) mentioned that higher flow rate in clay soil decreased seasonal applied water and improved surface irrigation efficiencies.

The overall aim of this research work was to improve traditional flooding irrigation for wheat crop in the Delta region using bed-planting method.

The specific objectives of this study were to:

1. Assess the impact of planting method and bed width on irrigation efficiency and wheat grain yield, and
2. Determine the optimum flow rate to enhance irrigation efficiency and wheat grain yield.

MATERIALS AND METHODS

1. Site description

A field experiment was undertaken during the winter growing seasons of 2017/2018 and 2018/2019 at El-

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Gemmeiza Agricultural Research Station, Gharbia Governorate, middle of the Nile Delta, Egypt, "31° 07´ longitude and 30° 43´ latitude" which is 20 m mean altitude above sea level. The location of the experiment is shown in Fig. 1.

Fig. 1. Location of El-Gemmeiza Agricultural Research Station, Gharbia Governorate

Mechanical analysis and some physical properties of the experimental soil were done at soils-water and environmental research institute laboratory, El-Gemmeiza Agricultural Research Station; as presented in Table 1.

2.Experimental layout

The experimental field was tilled two perpendicular passes by a chisel plow and leveled up traditionally. The recommended phosphor dose "100 kg/fed." was applied in the form of calcium super phosphate "16 % P_2O_5" to the field and mixed with the soil at plowing. Wheat "Misr 1 variety" was sown during November at a rate of 50 kg/fed. in rows by a seed drill "Tye model" at distance 15 cm between rows for the entire experimental field. The beds were raised after planting at 15 cm height; every treatment consists of 5 beds the distance between beds was accomplished according to suggested bed width under study as shown in Figs. 2 and 3. The recommended nitrogen dose "50 kg/fed." in the form of ammonium nitrate "33.5% Nitrogen" was applied manually in two equal doses before the second and third irrigation.

Table 1. Mechanical analysis and physical properties of the experimental site

Depth, cm	Particle size distribution, %			Bulk density, g/cm^3	Field capacity, %	Wilting point, %	Available water, %
	clay	sand	silt				
0-20	50.67	14.52	34.81	1.20	45.05	21.14	23.91
20-40	53.09	11.00	35.9	1.26	43.78	19.75	24.03
40-60	52.76	10.63	36.61	1.30	41.92	19.91	22.01

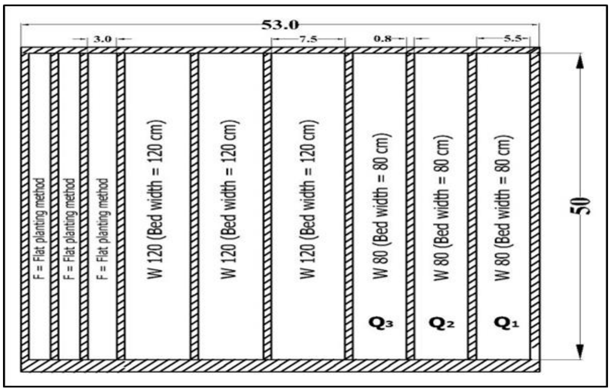

Fig. 2. A schematic diagram showing the experimental design

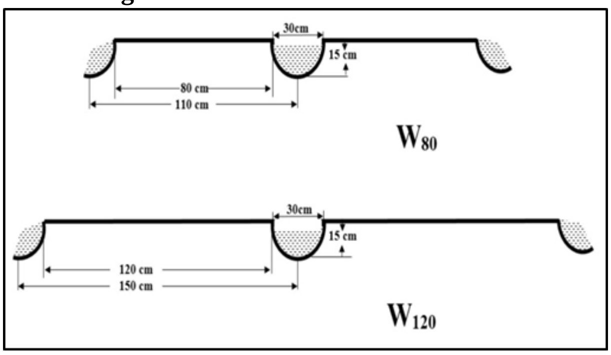

Fig. 3. A schematic diagram showing beds dimensions

3.Irrigation system components

Surface irrigation was applied using perforated pipes. The system consisted of a centrifugal pump which had 3 inch inlet and outlet diameters powered by a 3.75 kW gasoline internal combustion engine. 6 m length aluminum pipes of 75 mm outer diameter were perforated into circular orifices of 32 mm diameter distributed at a distance equals to the width of the beds; the flow rate of every orifice was controlled by a 32 mm PVC control valve which jointed with the orifice by PVC saddle (75 x 32 mm).

4.Surface irrigation scheduling

Irrigation was scheduled according to growing stage (irrigation for every growing stage) as recommended by El-Sayed (2015) as listed in Table 2.

Table 2. Irrigation scheduling according to wheat growing stage

Growing stage	Irrigation No.	Irrigation scheduling
Sowing	1st irrigation	--
Tillering	2nd irrigation	40
Heading	3rd irrigation	30
Grain filling	4th irrigation	30

5. Study parameters

The present research work included two variables as follows:

a) **Planting method**: three planting methods were applied; F: flat planting method, W_{120}: bed-planting with net bed width of 120 cm and W_{80}: bed- planting with net bed width of 80 cm.

b) **Orifice flow rate:** three orifice flow rates (Q) were applied; Q_1 = 1.0 L/s., Q_2 = 1.5 L/s and Q_3 = 2.0 L/s.

6.Field data measurements

a) **Advance time**

Water stream (furrow or basin) was divided into five equal stations; the distance between every two stations was 10 m. The time needed by the water head to reach every station was recorded by a stop watch. The total advance time was recorded when the water head reached the furrow end.

b) Applied irrigation water

Orifices flow rate were calibrated using volumetric method as described by James (1988). The total applied water at the end of each furrow was calculated.

c) Stored water

Soil samples were collected just 24 h before and after irrigation at field capacity to calculate soil water content according to Horst *et al.* (2005). Stored water in the root zone during irrigation event was calculated using Eq. 1 by James (1988).

$$Z_{avg} = \sum_{i=1}^{n} \frac{\theta_{Ai} - \theta_{Bi}}{100} * D_i B_i \qquad [1]$$

Whereas: **"Z_{avg}" is the stored water (cm); "i" is the number of soil layer; "θ_{Ai}" is the soil moisture content after irrigation for the specified soil layer (%); "θ_{Bi}" is the soil moisture content before irrigation for the specified soil layer (%); "D_i" is the depth of the soil layer within the root zone and "B_i" is the bulk density of the specified soil layer (g/cm^3).**

d) Application efficiency

Water application efficiency was estimated using Eq. 2 James (1988).

$$Ea = \frac{Zavg}{D} x100 \qquad [2]$$

Whereas: "E_a" is the water application efficiency (%); "Z_{avg}" is the average depth of water stored in the root zone (mm), and "D" is the average depth of applied water (mm).

e) Distribution efficiency

The uniformity of application along water stream was expressed by Christiansen uniformity coefficient. The uniformity coefficient was computed according to James (1988) using Eq. 3 as follows:

$$CU = 100\ X\ (1.0 - \frac{\sum_{i=1}^{n}|x_i - x^\backslash|}{n\, x^\backslash}) \qquad [3]$$

Whereas: **"CU" is the Christiansen uniformity coefficient; "x_i" is the depth of water stored at soil layer *i*; $x^\backslash$ is the average depth of water stored along the furrow during the irrigation and "n" is the number of observations.**

f) Wheat grain yield

At harvesting time, wheat grain yield (kg/fed.) was recorded for different treatments and adjusted to 14 % moisture basis.

g) Straw yield and some yield components

Three random samples of one square meter were taken from each treatment to determine straw yield, number of spikes/m^2 and 1000 grain weight (g).

h) Water productivity (WP)

Water productivity (WP, kg/m^3) clarifies the variations in yield because of irrigation water applied; it calculated according to Michael (1978) as follows:

$$\mathrm{WP} = \frac{\text{Total grain yield,(kg /fed)}}{\text{Total applied irrigation water,}(m^3/\text{fed })} \qquad [4]$$

Statistical analysis

Statistical analysis was performed by CoStat Statistical Software. The experimental design was a split-plot design with three replications "planting method in main plot and flow rate in sub-plot". Analysis of variance and significant differences between means was analyzed at 5% level.

RESULTS AND DISCUSSION

1. Advance time

The advance time was recorded at five stations along the furrow. The averages of advance time for different treatments are shown in Fig. 4. High flow rate decreased advance time for different treatments as a result of increasing stream size. These results have the same trend to those obtained in many research studies **(Amer and Attafy, 2017 and El-Sanat, 2018)**. Bed-planting accelerated the advance time compared with flat planting, where in flat method the soil surface is completely submerged by water while in bed method just a part of the soil surface (furrows) is submerged. The W_{80} accomplished faster advance time compared with W_{120}; which may be due to increased lateral movement of irrigation water under W_{120} more than W_{80} since the bed is wider which led to slowing in water advance. The longest advance time of 160 min was obtained at (F + Q_1) treatment, while the shortest record 64 min obtained at (W_{80} + Q_3) treatment, which means that the shortest advance time decreased by about 60% less than the longest one. The W_{80} decreased advance time compared with F by about 17.5, 17.4 and 21.6 % under the flow rates Q_1, Q_2 and Q_3, respectively. The statistical analysis demonstrated high significant effects of both investigated factors and their interaction on the advance time (R^2 = 0.99) at 0.05 probability level. Comparing means showed that (F + Q_1) treatment had the highest effect on advance time, while (W_{80} + Q_3) treatment had the lowest effect. LSD at 5% level was 1.18, 0.91 and 3.54 for flow rate, planting method and the interaction, respectively.

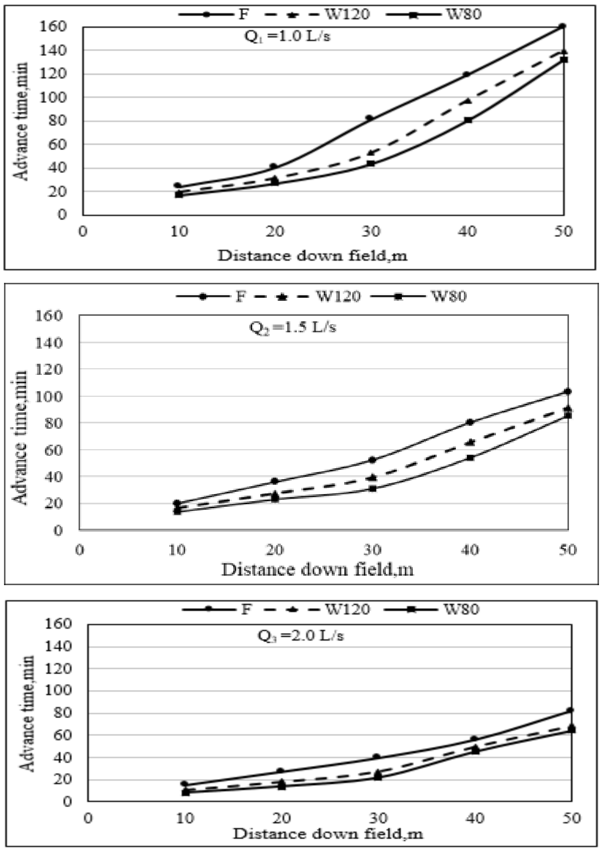

Fig. 4. Advance time for different planting methods and orifice flow rates

2. Total applied water

The average total applied water (m^3/fed) in relation to orifice flow rate under different planting methods is described in Fig. 5. Generally increasing flow rate from 1 to 2 L/s decreased the total applied water for different planting methods as (F = 46.6 %), (W_{120} = 36.7 %) and (W_{80} = 33.7 %) where advance time decreased. Broadly, bed-planting decreased the total applied water compared with flat planting. In bed-planting soil surface irrigated partially (in furrows only) while in flat planting soil surface of the entire field is fully irrigated. When decreasing bed width from 120 cm to 80 cm. This led to higher total applied water per unit area, which may be interpreted as the number of water streams (furrows) at 120 cm bed width were less than the number of water streams for 80 cm bed width. That causes increase advance time; then decrease applied water per unit area. These results are agreement with those found by Mollah *et al.* (2009). The lowest total applied water of 1407 m^3/fed. obtained at treatment (W_{120} + Q_3) which saved irrigation water by about 58.7% compared with the highest treatment (F + Q_1). The statistical analysis referred to a high significant effects of both factors and their interaction on total applied water (R^2 = 0.94) at 0.05 probability. The (F + Q_1) treatment had the highest effect on total applied water, while (W_{120} + Q_3) treatment had the lowest effect. LSD at 5% level was 49.5, 241 and 142 for flow rate, planting method and the interaction, respectively.

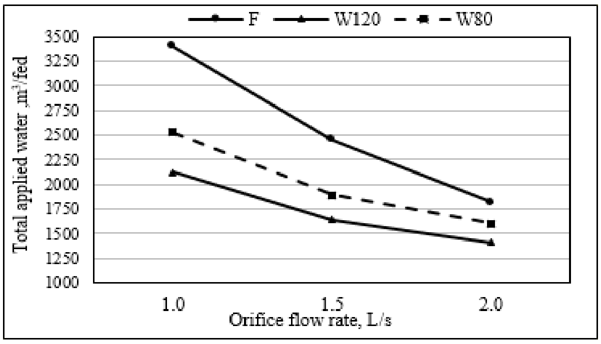

Fig. 5. Total applied water in relation to orifice flow rate under different planting methods

3. Application efficiency

Application efficiency (E_a, %) in relation to orifice flow rate under different planting methods is presented in Fig. 6. Increasing flow rate from 1.0 to 2.0 L/s increased application efficiency for different planting methods as (F = 16.0 %), (W_{120} = 24.4 %) and (W_{80} =28.2 %) associated with less seasonal applied water. Bed-planting increased application efficiency compared with flat planting and increasing bed width from 80 to 120 cm increased application efficiency. This can be attributed to decrease seasonal applied water and/or increase stored water. The greatest application efficiency of 67.8 % was accomplished by the treatment (W_{120} + Q_3), while the lowest value of 45.1% was obtained with (F + Q_1) treatment. The highest treatment (W_{120} + Q_3) increased application efficiency by 50.3 % compared with the lowest one (F+Q_1). The statistical analysis showed high significant effects of both tested factors and their interaction (R^2=0.98) on application efficiency at 0.05 probability. Comparing means showed that (F+Q_1) treatment had remarkable significant effects on total applied water, while (W_{120} + Q_3) treatment had the lowest effect. LSD at 5% level was 1.6, 5.0 and 4.8 for flow rate, planting method and the interaction, respectively.

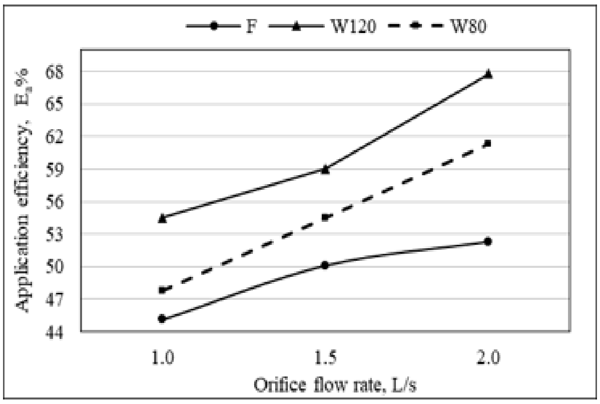

Fig. 6. Application efficiency in relation to orifice flow rate under different planting methods

4. Water distribution efficiency

Water distribution efficiency (E_d, %) in relation to orifice flow rate under different planting methods is presented in. Generally results in Fig. 7 demonstrated the higher flow rate achieved the greater distribution efficiency. The variation in water stored along the field length is a limiting factor in distribution efficiency. Increasing flow rate from 1.0 to 2 L/s increased water distribution efficiency for different planting methods as (F = 4.8 %), (W_{120} = 9.9 %) and (W_{80} =6.6 %). Bed-planting leads to increase distribution efficiency compared to flat planting. Increasing bed width from 80 to 120 cm leads to higher distribution efficiency. The highest value of distribution efficiency (E_d) of 75.4 % was achieved at treatment (W_{120}+ Q_3) which increased by 17.1% compared to the lowest treatment (F + Q_1 = 64.4 %). The statistical analysis showed high significant effects of flow rate and the interaction on water distribution efficiency at 0.05 probability. On the other hand, planting method hadn't significant effects on water distribution efficiency. Comparing means showed that (W_{120} + Q_3) treatment had remarkable significant effects on water distribution efficiency, while (F + Q_1) treatment had the lowest one. LSD at 5% level was 0.41, 30.9 and 1.23 for flow rate, planting method and the interaction, respectively.

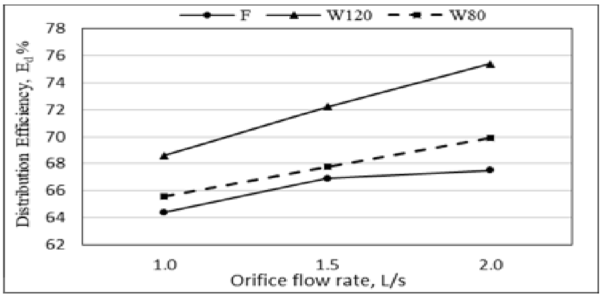

Fig .7. Water distribution efficiency in relation to orifice flow rate under different planting methods

5. Wheat grain yield

Wheat grain yield (kg/fed.) in relation to orifice flow rate at different planting methods is shown in Fig 8. The results indicated that, the higher flow rate achieved the greater grain yield for different planting methods.

Increasing flow rate from 1.0 to 2.0 L/s increased wheat grain yield for different planting methods as (F = 11.6 %), (W_{120} = 9.5 %) and (W_{80} = 12.1 %).

Bed-planting increased wheat grain yield compared with flat planting, which may be due to avoiding submergence under bed-planting. In general increasing bed width from 80 to 120cm increased wheat grain yield, which is in broad agreement with the findings of Jin (2007) and Akbar (2013) who concluded that wider beds are better than narrow ones. Because they minimize deep drainage losses, reduce irrigation water applied and enhance grain productivity. The highest wheat grain yield of 3100 kg/fed. was obtained by the treatment (W_{120} + Q_3) which increased by 24 % compared with the lowest treatment (F + Q1 = 2510 kg/fed). The statistical analysis demonstrated significant effects of planting method and high significant effect of flow rate (R^2 = 0.98) on wheat grain yield at 0.05 probability. There is no significant effect in grain yield between wide and narrow beds. Comparing means showed that (W_{120} + Q_3) treatment had the highest effect on grain yield while (F + Q_1) treatment had the lowest effect. LSD at 5% level was 35.8, 163.4 and 107.5 for flow rate, planting method and the interaction, respectively.

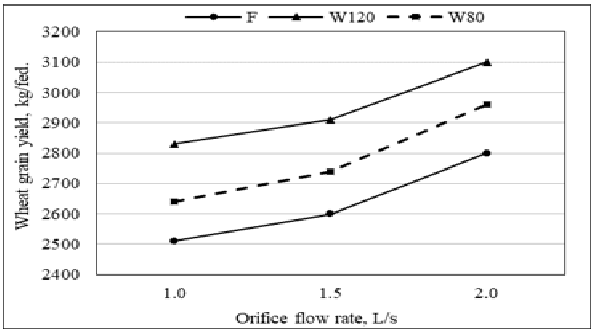

Fig. 8. Wheat grain yield in relation to orifice flow rate under different planting methods

6. Straw yield and some yield components

Straw yield, number of spikes/m^2 and 1000 grain weight (g) for different treatments are evaluated and listed in Table 3. Bed-planting increased straw yield, number of spikes/m^2 and 1000 grain weight (g) comparing to flat planting. Under bed-planting in general increasing bed width from 80 to 120 cm increased straw yield, number of spikes/m^2 and 1000 grain weight (g). Also increasing flow rate from one to 2 L/s had the same trend. The highest values were 6500 kg $_{straw}$/fed, 418 spikes/m^2 and 54.1 g/1000 grain which achieved by (W_{120} + Q_3) treatment. The lowest values were 4830 kg $_{straw}$/fed, 297 spikes/m^2 and 42.7 g/1000 grain obtained by (F + Q1) treatment.

Table 3. Straw yield, number of spikes/m^2 and 1000 grain weight, g in relation to orifice flow rate at different planting methods

Planting method	Yield components	Flow rate, L/s		
		1.0	1.5	2.0
F	Straw yield, kg/fed.	4830	5000	5086
	Number of spikes/m^2	297	315	326
	1000 grain weight, g	42.7	44.1	48.3
W_{80}	Straw yield, kg/fed.	4995	5140	5900
	Number of spikes/m^2	345	377	390
	1000 grain weight, g	43.4	46.8	50.7
W_{120}	Straw yield, kg/fed.	5130	5720	6500
	Number of spikes/m^2	355	400	418
	1000 grain weight, g	44.8	49.9	54.1

7. Water productivity

Water productivity in relation to orifice flow rate at different planting methods is shown in Fig. 9. The results indicated that, water productivity had the same trend as grain yield. The higher flow rate achieved the greater water productivity for different planting methods. Increasing flow rate from one to 2 L/s increased water productivity for different planting methods as (F = 108.9 %), (W_{120} = 65.3 %) and (W_{80} = 77.2 %). Bed-planting increased water productivity compared to flat-planting, which may be due to less applied water and higher grain yield at bed-planting. Increasing bed width from 80cm to 120cm leads to increase water productivity. Because of saving irrigation water and increase grain yield at 120 cm bed width. The highest water productivity of 2.2 kg/m^3 was obtained by the treatment (W_{120} + Q_3) which increased by about 197.3 % compared to the lowest treatment (F + Q_1 = 0.74 kg/m^3).

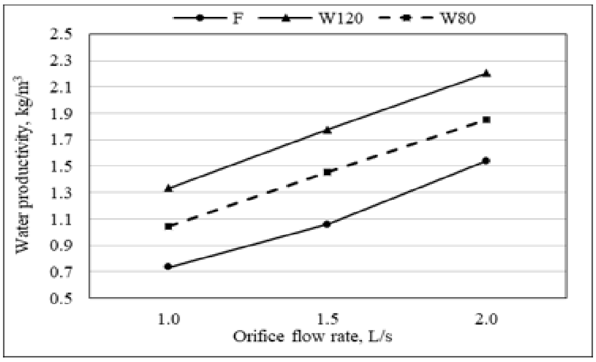

Fig. 9. Water productivity in relation to orifice flow rate at different planting methods

CONCLUSION

The present research study assessed the potential of enhancing the efficiency of surface flood irrigation of wheat crop in the Nile Delta region. The research was based on the hypothesis that bed-planting method could improve irrigation efficiency, growth and yield of wheat crop. From the obtained results it was revealed that, different irrigation efficiencies, wheat grain yield and water productivity were all greatly influenced by planting method and orifice flow rate. Irrigating wheat crop using the optimum bed size and water flow rate can lead to a better irrigation performance for saving water and consequently extend the cultivated area in the Nile Valley and Delta which is fundamentally crucial to face the current challenges.

REFERENCES

Akbar, G. (2013). Identifying Strategies for Improving Water Productivity of Permanent Raised Beds. National Centre for Engineering in Agriculture, University of Southern Queensland (USQ): Australia.

Akbar, G.; M. M. Ahmad; M. Khan and M. Asif (2017). Furrow lateral wetting potential for optimizing bed width in silty clay. Irrig. and Drain., 66: 218–226.

Ali, M. H. (2011). Practices of irrigation and on-farm water management: Volume 2. Springer New York Dordrecht Heidelberg London. ISBN 978-1-4419-7636-9:571.

Amer, M. H. and T. M. Attafy (2017). Effect of surge flow on some irrigation indices of furrow irrigation system. J. Soil Sci. and Agric. Eng., Mansoura Univ., Vol. 8 (12): 703 – 708.

El-Hadidi, E. M.; M. M. Ibrahim; S. A. Abdel-hafez and M. S. M. Eid (2015). Effect of deficit irrigation and raised bed on wheat yield, water productivity and water saving in North Nile Delta, Egypt. J. Soil Sci. and Agric. Eng., Mansoura Univ., Vol. 6 (7): 845 – 862.

El-Sanat, G. M. A. (2018).Improving irrigation efficiencies through different methods of land leveling and irrigation discharge under using gated pipes at North Delta.J. Soil Sci. and Agric. Eng., Mansoura Univ., 9 (4): 191 – 196.

El-Sayed, M. O (2015). Performance of some new wheat cultivars under different irrigation regimes and sowing methods. Ph. D. Thesis, Fac. of Agric., Tanta Univ., Egypt.

Horst, M. G.; Sh. S. Shamutalov; L. S. Pereira and J. M. Goncalves (2005). Field assessment of the water saving potential with furrow irrigation in Fergana, Aral Sea Basin. Agricultural Water Management 77: 210–231.

Jamali, M. H and K. Q. Laghari (2019).Comparison of flooding and raised bed irrigation systems for wheat crop at Samoo (Village Bilawal Khan Jamali) District JaffarabadBalochistan Pakistan.Irrigation and Drain. System Eng. 8: 228.

James, L. G. (1988). Principles of farm irrigation system design. John Willey/Sons (ed.), New York, pp. 543.

Jin, H. ; L. Hongwen; N. Kuhn; Z. Xuemin and L. Wenying (2007). Soil loosening on permanent raised-beds in arid northwest China. Soil and Tillage Research 97: 172–183.

Memon, M. S.; KhadimUllah; A. A. Siyal; N. Leghari; A. A. Tagar; K. A. Ibupoto; S. T. Ata-ul-karim; M. Tahir and N. Memon (2020).The effect of different raised bed sizes under furrow irrigation method on salt distribution in soil profile and yield by Hydrus (2/3D). Pakistan Journal of Agricultural Research, 33(1): 113-125.

Michael, A. M. (1978).Irrigation theory and practice. Vikas publishing House PVT. Ltd.

Mollah, M. I. U.; M. S. U. Bhuiya and M. H. Kabir (2009). Bed planting -a new crop establishment method for wheat in rice-wheat cropping system. Journal of Agriculture and Rural Development, 7 (1 and 2) 23-31.

Sorour, S. GH. R.; A. Y. Ragab; H. A. Abdel-Raheem and A. M. I. Meleha (2016). Effect of irrigation water management on wheat yield. J. Soil Sci. and Agric. Eng., Mansoura Univ., 7 (5): 375 – 382.

Tewabe, D.; A. Abebe; A. Enyew and A. Tsige (2020). Determination of bed width on raised bed irrigation technique of wheat at Koga and Rib IrrigationProjects, North West, Ethiopia, Cogent Food and Agriculture, 6:1, 1712767. To link to this article:
https://doi.org/10.1080/23311932.2020.1712767

Walker, W. R. (2003). SIRMOD III Surface Irrigation Simulation, evaluation and design. Utah State University. USA.

Zohry, A.; S. Ouda and T. Abd El-Wahab (2020). Sustainable intensive cropping to reduce irrigation-induced erosion: Intercropping systems under surface irrigation practice. Moroccan Journal of Agricultural Sciences, 1(2): 63-71.

عرض المصاطب ومعدل تدفق الفتحات الامثل لري محصول القمح في دلتا النيل

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يستخدم الري السطحي بشكل اساسي لري القمح في الدلتا وهذا يعني فقد كمية كبيرة من ماء الري. مؤخرًا بدأ المزارعون في الدلتا باستخدام المصاطب لزراعة القمح وهو في الحقيقة يمثل فرصة لتحسين إنتاجية القمح وتقليل الفاقد في مياه الري. أجريت دراسة حقلية بمحطة البحوث الزراعية بالجميزه محافظة الغربية – وسط الدلتا – مصر خلال مواسم شتاء2017/2018 و2018/ 2019 حيث التربة ذات قوام طيني. تهدف الدراسة الي معرفة تأثير طريقة الزراعة ومعدل السريان على مؤشرات الري السطحي وإنتاجية الحبوب ولهذا الغرض تم استخدم ثلاثة طرق للزراعة: الزراعة علي ارض مستوية (أحواض)، الزراعة على مصاطب بصافي عرض 120 سنتيمتر (مصاطب 120سم) الزراعة على مصاطب بصافي عرض 80 سنتيمتر (مصاطب 80 سم) وإستخدم ثلاثة مستويات من معدل السريان للأنابيب المثقبة بمعدل فتحة لكل خط (معدل سريان 1.0 لتر/ثانيه، معدل سريان 1.5 لتر/ثانيه، معدل سريان 2.0 لتر/ثانيه) والتي تم تطبيقها في خطوط ذات نهايات مغلقه بطول 50متر بدون بتون. أوضحت النتائج الرئيسية أن أقل زمن تقدم كان 64 دقيقة والذي تحقق في المعاملة (مصاطب80سم + معدل سريان 2.0 لتر/ ثانيه). أقل كمية ماء ري مضافة كانت 1407م^3/فدان والتي تحققت في المعاملة (مصاطب120سم + معدل سريان 2.0 لتر/ ثانيه) والتي وفرت في مياه الري بحوالي 58.7٪ مقارنة بأكبر كمية ماء ري مضافة في المعاملة (أحواض + معدل سريان 1.0 لتر/ ثانيه = 3403م^3/فدان). أعلى قيم لكفاءة الإضافة ومعامل الإنتظامية وإنتاجية الحبوب وإنتاجية ماء الري كانت 67.8٪ و 75.4٪ و 3100 كجم/فدان و 2.2 كجم/م^3 على التوالي والتي تحققت مع المعاملة (مصاطب 120 سم + معدل سريان 2.0 لتر/ ثانيه)، نفس المعاملة حققت اعلى قيم لإنتاجية التبن وعدد السنابل في المتر المربع ووزن 1000 حبة حيث كانت 6500 كجم/فدان و 418 سنبلة/م^2 و 54.1 جم على التوالي.