FABA BEAN RESPONSE TO SURGE IRRIGATION IN CLAY SOIL
Eid, S.M.; M.A.M. Ibrahim and M.M. Kassab
Soil Water and Environment Res. Inst.; Agric. Res. Center

ABSTRACT

This study was conducted during the two seasons of 2001/2002 and 2002/2003 at Sakha Agric. Res. Station, Kafr El-Sheikh Governorate. The aim of this work was to study the effect of the relatively new surface irrigation technique (surge flow irrigation) on consumptive use (CU), water application efficiency (Ea), water use efficiency (WUE), water utilizations efficiency (WUE) and productivity of faba bean, under clay soil condition. Three water irrigations discharge (D): 4, 6 and 8 L/s as main treatments. Four irrigation treatments were used as a subtratements and were arranged in split plot design, as following: l_1 continuous irrigation, l_2 = 20 min. with cycle 10 min. On and 10 min. Off, l_3 = 25 min. with cycle 10 min. On and 15 min. Off and 30 min. with cycle 10 min. On and 20 min. Off. Data revealed that consumptive use is higher under continuous irrigation than the other surge irrigation treatments. The average values of CU were 41.8, 40.4, 37.5 and 33.4 for treatments l_1, l_2, l_3 and l_4, while it was 36.95, 38.31 and 40.25 for D_1, D_2 and D_3 irrigation discharges, respectively. Values of Ea, WUE, WUE and seed yield were increased in case of surge flow under similar conditions. The best results regarding to CU, Ea, WUE , WUE and seed yield were obtained from using l_4 treatment.

INTRODUCTION

Surge irrigation is a tool that can be used to improve the efficiency of water applied by furrow irrigation. In surge irrigation, water is applied to an irrigation furrow, intermittently, during irrigations set, whereas in continuous-flow (or conventional) irrigation, water is applied to the furrow during the entire irrigation set. Total water application can be reduced substantially, with the use of surge irrigation. Previous researches with faba bean, had demonstrated the effectiveness of surge irrigation in reducing water application and at the same time, maintaining crop yield and quality equivalent to conventional furrow irrigation. Surge flow creates series of on and off conditions of constant or variable time spans at furrow in let (Bishop et al., 1981). Zein El-Abedin (1988) stated that water application efficiency (Ea) was over 80% by surge flow, while it was about 40% under continuous flow. Guirgus (1988) found that Ea at inflow rate of 1.45 L/S was 43.9, 87.8, 90.1 and 88.3% for continuous flow and surge flow of 5/5, 5/10, 5/15 On/Off min., respectively. Kassab (2003) found that consumptive use for faba bean ranged from 38.9-45.8 and 33.5-39.9 during 1999-2000 and 2000-2001 growing seasons at North Nile Delta. Tawadros et al. (1988) reported ranges of seasonal CU for beans grown in Nile Delta, middle Egypt, and Upper Egypt, as follows 24.1-38.6 cm, 32.9-44.8 cm and 39.3-49.2 cm for each region respectively. Therefore, the main objective of the present work, is to show the effect of surge flow irrigation on consumptive use, water application efficiency water utilization efficiency, water use efficiency and productivity of faba bean.
and to compare it with the conventional continuous furrow irrigation in clayey soil at North Nile Delta.

**MATERIALS AND METHODS**

Two field experiments were conducted during 2001/2002 and 2002-2003 winter seasons, at Sakha Agricultural Research Station Farm, Kafr El-Sheikh Governorate, using faba bean crop. Table (1) shows some physical properties of the experimental soils. Dates of sowing (S) and harvesting (H) were as follow:


All cultural practices were done as recommended by the Egyptian Ministry of Agricultural and land Reclamation except for the two factors of study i.e. irrigation method and discharge. Area of plot was 3.5 x 80 = 280 m². The experimental design was a split plot design with four replicates as follows:

**A. Main treatments = discharge (L/S):**

- D₁ = 4 L/S
- D₂ = 6 L/S
- D₃ = 8 L/S

**B. Subtreatments (irrigation treatments):**

There were 4 treatments:

- I₁: Continuous flow.
- I₂: Surge 20 min. cycle with 10 min. On and 10 min. Off.
- I₃: Surge 25 min. cycle with 10 min. On and 15 min. Off.
- I₄: Surge 30 min. cycle with 10 min. On and 20 min. Off.

Irrigation water was applied to furrows, whatever number of surges was needed, until the end of the furrow, for each irrigation treatment through a plastic pipe of 5 cm inner diameter and 70 cm length submerged in the irrigation channel. Two, four and six pipes were used per plot. The average effective water head above each pipe was determined during the On time.

**Table (1): Some physical analyses of experimental site.**

<table>
<thead>
<tr>
<th>Soil depth</th>
<th>Particle size distribution</th>
<th>Texture</th>
<th>Bulk density mg/m³</th>
<th>FC w%</th>
<th>PWP w%</th>
<th>Available water w%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sand</td>
<td>Silt</td>
<td>Clay</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-15</td>
<td>15.18</td>
<td>18.85</td>
<td>65.97</td>
<td>1.12</td>
<td>47.2</td>
<td>25.28</td>
</tr>
<tr>
<td>15-30</td>
<td>19.90</td>
<td>13.80</td>
<td>66.30</td>
<td>1.15</td>
<td>40.5</td>
<td>21.85</td>
</tr>
<tr>
<td>30-45</td>
<td>16.59</td>
<td>16.47</td>
<td>66.94</td>
<td>1.24</td>
<td>39.0</td>
<td>21.19</td>
</tr>
<tr>
<td>45-60</td>
<td>17.65</td>
<td>15.24</td>
<td>67.11</td>
<td>1.26</td>
<td>38.5</td>
<td>20.81</td>
</tr>
</tbody>
</table>

1. **Consumptive use (CU):**

To compute the actual consumed water of the growing plants, soil moisture percentage was determined gravimetrically, on over dry basis before and after each irrigation as well as at harvesting. Soil samples were taken from the successive layers of the effective root zone, 0-15, 15-30, 30-45 and 45-60 cm. This method of computation is considered as one of the direct
methods of consumptive use which based on soil moisture depletion (S.M.D) or so called crop-water consumed (ETc) as stated by Hansen et al. (1979).

\[
SMD = CU = \frac{\theta_2 - \theta_1}{100} \times Db \times d \times A \text{ m}^3/\text{fed.}
\]

Where:
- SMD = Soil moisture depletion in the effective root zone = 60 cm
- CU = Consumptive use of the growing plants.
- \(\theta_1\) = Mean soil moisture percentage (w/w), before irrigation for the 60 cm soil depth.
- \(\theta_2\) = Mean soil moisture percentage (w/w) for the 60 cm soil depth, 48 hrs after irrigation (field capacity).
- Db = Mean soil bulk density, gm/cm\(^3\) for the 60 cm soil depth.
- d = Soil wetting depth i.e. effective root zone of 60 cm.
- A = Irrigated area, m\(^2\) (4200 m\(^2\) i.e. area of 1 feddans).

2. Crop yield:
   Yield of the inner furrows of each field plot was recorded at harvest.

3. Water application efficiency:
   Water application efficiency (Ea) in percent were obtained by dividing the seasonal consumptive use by the irrigation water applied to the field as follows:
   \[
   Ea = \frac{CU}{IW} \times 100 \tag{3}
   \]
   (ICID) Bulletin (1978)

   Where:
   - Ea = Water application efficiency %,
   - CU = Total consumptive use, and
   - IW = Irrigation water applied.

4. Water use efficiency (WUE):
   \[
   WUE = \frac{Yield \text{ (kg/fed.)}}{\text{Amount of water consumed by crop i.e. consumptive use (m}^3/\text{fed.)}}
   \]

5. Water utilization efficiency (WUtE):
   The water utilization efficiency, as a measure to clarify variations in yield due to irrigation water was calculated as follows:
   \[
   WUtE = \frac{Yt}{I.W.}
   \]

   Where:
   - WUtE = Water utilization efficiency kg/m\(^3\)
   - Yt = Total yield produced kg/fed. and
   - I.W. = Applied water m\(^3\)/fed.

6703
RESULTS AND DISCUSSION

Crop water consumptive use (CU):

Tabulated data in Table (2) and the illustrated Fig. 1 reveal that the increase in water discharge was associated with the increase in CU. Mean values on the two seasons of CU for the 3 water discharges are: 36.95, 38.31 and 40.25 for the D₁, D₂ and D₃ water discharge respectively. The increase for D₂ and D₃ discharges over the D₁ discharge are, 5.0 and 9.0%, respectively. The greater CU for D₂ or D₃ over D₁ was occurred with all irrigation treatments. Under continuous irrigation mean CU values over the two seasons are 39.5, 42.5 and 43.5 cm for the D₁, D₂ and D₃ respectively for I₂ surge irrigation with cycle ratio 0.5 i.e. 10 min. On-10 min. Off the comparable values are 38.3, 40.5 and 42.5 cm respectively. With the I₃ treatments values are 36.5, 37.5 and 38.5 cm respectively. In addition the I₄ treatment comparable values are 32.0, 32.75 and 35.5 cm, respectively.

Using surge irrigation was associated with lower values of CU. Mean values of CU for the I₂, I₃ and I₄ treatments are 40.4, 37.5 and 33.4 cm, respectively. The average decrease of CU using the I₂, I₃ and I₄ compared with I₁ (continuous) are 1.4, 4.3 and 7.4 cm, respectively. Surge treatment (I₄) recorded the lowest values of CU, it was 32.0, 32.75 and 35.5 for the D₁, D₂ and D₃, respectively.

Such finding might be attributed to the increase of evaporation component at high moisture content, under continuous treatment. These results are similar to that found by many workers Badawi (1970); El-Maghraby (1980) and Serry et al. (1980) who reported such increased CU with increasing application of irrigation water.

![Graph showing consumptive use (CU) cm for faba bean crop as affected by irrigation treatments and discharge in the two growing seasons.](image-url)

Fig. (1): Seasonal consumptive use (CU) cm for faba bean crop as affected by irrigation treatments and discharge in the two growing seasons.
Table (2): Seasonal consumptive use (CU) cm for faba bean crop as affected by irrigation treatments and discharges in the two growing seasons.

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<tbody>
<tr>
<td></td>
<td></td>
<td>Discharge L/S</td>
<td>Discharge L/S</td>
<td>Discharge L/S</td>
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<tr>
<td></td>
<td>On</td>
<td>4 6 8</td>
<td>4 6 8</td>
<td>4 6 8</td>
</tr>
<tr>
<td>I₁</td>
<td>Cont.</td>
<td>40.0 43.0 44.0</td>
<td>39.0 42.0 43.0</td>
<td>39.5 42.5 43.5</td>
</tr>
<tr>
<td>I₂</td>
<td>10</td>
<td>38.2 40.0 42.0</td>
<td>38.5 41.6 43.0</td>
<td>38.3 40.5 42.5</td>
</tr>
<tr>
<td>I₃</td>
<td>10</td>
<td>36.0 37.0 38.0</td>
<td>37.0 38.0 39.0</td>
<td>36.5 37.5 38.5</td>
</tr>
<tr>
<td>I₄</td>
<td>10</td>
<td>33.0 34.0 36.0</td>
<td>31.0 31.5 35.0</td>
<td>32.0 32.75 35.5</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>36.8 38.5 40.0</td>
<td>36.4 38.3 40.0</td>
<td>36.95 38.31 40.25</td>
</tr>
</tbody>
</table>

Seed yield kg/fed.:

Data presented in Table (3) and illustrated in Fig. (2) showed that the increase in water discharge has a slight increase in seed yield, but not to the significance level. Average values of seed yield for the 3 water discharges are: 1305, 1346 and 1375 kg/fed., respectively. Regarding the effect of surge irrigation, seed yield was highest than the continuous irrigation. I₄ treatment recorded the highest value of seed yield during the two seasons. Mean yields for the 2 seasons due to I₁, I₂, I₃ and I₄ were 1186, 1253, 1373 and 1560 kg/fed., respectively. Thus the I₄ (i.e. 10 min. On and 20 min. Off) gave the highest yield. The mean of surge irrigation treatments I₂, I₃ and I₄ is 1388 kg/fed., it was higher by 17% as compared with I₁ the continuous irrigation. The highest seed yield was obtained using "I₄ D₃ treatment" which gave 1625 kg/fed. The lowest yield was obtained by I₁ D₁ treatment which gave 1155 kg/fed. Therefore, using the surge irrigation I₄ i.e. 10 min. On 20 min. Off, with discharge 8 L/S is the most suitable to get the maximum production of faba bean in north Nile Delta.

These findings are in good agreement with those obtained by El-Zaher et al. (1996) and Ghalleb (1997).

Table (3): Faba bean seed yield (kg/fed.) under different irrigation treatments.

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<tr>
<td></td>
<td></td>
<td>D₁ D₂ D₃</td>
<td>D₁ D₂ D₃</td>
<td>D₁ D₂ D₃</td>
</tr>
<tr>
<td>I₁</td>
<td>Cont.</td>
<td>1150 1200 1220</td>
<td>1120 1190 1200</td>
<td>1155 1195 1210</td>
</tr>
<tr>
<td>I₂</td>
<td>10</td>
<td>1230 1280 1260</td>
<td>1220 1250 1280</td>
<td>1225 1265 1270</td>
</tr>
<tr>
<td>I₃</td>
<td>10</td>
<td>1360 1360 1390</td>
<td>1340 1390 1400</td>
<td>1350 1375 1395</td>
</tr>
<tr>
<td>I₄</td>
<td>10</td>
<td>1520 1550 1610</td>
<td>1500 1550 1640</td>
<td>1510 1550 1625</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>1315 1347 1370</td>
<td>1295 1345 1380</td>
<td>1310 1346 1375</td>
</tr>
</tbody>
</table>

6705
Eid, S.M. et al.

Fig. (2): Effect of surge flow irrigation treatments and discharges on faba bean seed yield (kg/fed) in the two growing seasons.

**Water application efficiency (Ea):**

Table 4 shows that all tested numbers of surge flow gave high Ea than in continuous one. The highest Ea was obtained by I₄D₂ treatment (which gave 88, 94% during 1ˢᵗ and 2ⁿᵈ season, respectively) and the lowest was obtained by I₁ D₁ which gave 69 and 70.6% during 1ˢᵗ and 2ⁿᵈ season, respectively. The I₄D₂ treatment, was the best treatment due to the doses values of both CU comparing with all other treatments. These results are more or less in close agreement with the results of many workers, Guirgues (1988) found that Ea at inflow rate of 1.4545 was 43.9, 87.8, 90.1 and 88.8 for continuous flow and fore surge flow of 5/5, 5/10 and 5/15 On/Off min., respectively.

Zein El-Abedin (1988) stated that Ea was over 80 percent by surge flow, while it was about 40% for continuous flow.

**Water use efficiency WUE:**

As water is limiting factor in the expansion of cultivated area in Egypt, the primary management objective in the development of water use program that will provide maximum yield/m³ of applied water. Values of water use efficiency (kg seed/m³ of water consumed) for different treatments are presented in Table (5).

It is clear that the highest values of WUE were obtained from surge flow irrigation treatment I₄, under different discharges it was 1.13 kg/m³ i.e. surge irrigation with cycle ratio 0.33 (10 min. On and 20 min. Off. While the lowest one (0.66 kg seed/m³) from treatment I₁ (continuous irrigation).

**Water utilization efficiency WUTE:**

Water utilization efficiency values WUTE for faba bean seed yield for each treatment for total water applied (1W + RF) are shown in Table (6). Data revealed that all tested numbers of surges flow gave high WUTE than in continuos one. The highest values of WUTE were scored from I₄ treatment as
mentioned before (0.97 kg seed/m³). While the lowest one (0.48 kg seed/m³) from treatment I₁ (continuous).

Table (4): Water application efficiency values (Ea) as affected by irrigation treatments.

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<tbody>
<tr>
<td></td>
<td>On</td>
<td>Off</td>
<td>D₁</td>
<td>D₂</td>
</tr>
<tr>
<td>I₁</td>
<td>Cont.</td>
<td>Cont.</td>
<td>69</td>
<td>71</td>
</tr>
<tr>
<td>I₂</td>
<td>10</td>
<td>10</td>
<td>73</td>
<td>74</td>
</tr>
<tr>
<td>I₃</td>
<td>10</td>
<td>15</td>
<td>79</td>
<td>77</td>
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<tr>
<td>I₄</td>
<td>10</td>
<td>20</td>
<td>64</td>
<td>88</td>
</tr>
<tr>
<td>Mean</td>
<td>71.3</td>
<td>77.5</td>
<td>78.3</td>
<td>85.5</td>
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</table>

Table (5): Water use efficiency values (WUsE kg/m³) of faba bean as affected by irrigation treatments.

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<tbody>
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<td></td>
<td>On</td>
<td>Off</td>
<td>D₁</td>
<td>D₂</td>
</tr>
<tr>
<td>I₁</td>
<td>Cont.</td>
<td>Cont.</td>
<td>0.68</td>
<td>0.66</td>
</tr>
<tr>
<td>I₂</td>
<td>10</td>
<td>10</td>
<td>0.76</td>
<td>0.76</td>
</tr>
<tr>
<td>I₃</td>
<td>10</td>
<td>15</td>
<td>0.89</td>
<td>0.88</td>
</tr>
<tr>
<td>I₄</td>
<td>10</td>
<td>20</td>
<td>1.09</td>
<td>1.11</td>
</tr>
<tr>
<td>Mean</td>
<td>0.86</td>
<td>0.85</td>
<td>0.83</td>
<td>0.86</td>
</tr>
</tbody>
</table>

Table (6): Water utilization efficiency values (WUte kg/m³) of faba bean as affected by irrigation treatments.

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<tbody>
<tr>
<td></td>
<td>On</td>
<td>Off</td>
<td>D₁</td>
<td>D₂</td>
</tr>
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<td>I₁</td>
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<td>Cont.</td>
<td>0.47</td>
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<td>0.57</td>
</tr>
<tr>
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<td>15</td>
<td>0.71</td>
<td>0.67</td>
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<td>I₄</td>
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<td>0.92</td>
<td>0.97</td>
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<tr>
<td>Mean</td>
<td>0.67</td>
<td>0.67</td>
<td>0.66</td>
<td>0.73</td>
</tr>
</tbody>
</table>

REFERENCES


ICID Bulletin Committee on “Assembling irrigation Efficiency Date” Standards for the calculation of irrigation efficiencies ICID Bulletin, 27(1).


استجابة الفول البلدي للري النبضي في الأراضي الطينية

صبحى محمد عبد الفتاح محمد إبراهيم - ماهر حمداك

معهد بحوث الأراضي والمياه والبيئية - مركز البحوث الزراعية - كفر الشيخ - مصر

أجريت هذه الدراسة خلال موسم 1994/1995 في محلة البحوث الزراعية بسخا محافظة كفر الشيخ - مصر وكان الهدف من هذه الدراسة تأثير النبضة على كل من الاستهلاك المائي وكفاءة الري وكفاءة الاستهلاك المائي وكفاءة الاستهلاك المائي والتكلفة الاستعمارية لوحدة المياه. وتم استخدام الفول البلدي حيث طبق ثلاث تصرفات للمياه: D1, D2, D3.$\delta$

وأجريت هذه الدراسة في محلة البحوث الزراعية بسخا محافظة كفر الشيخ - مصر وكان الهدف من هذه الدراسة تأثير النبضة على كل من الاستهلاك المائي وكفاءة الري وكفاءة الاستهلاك المائي وكفاءة الاستهلاك المائي والتكلفة الاستعمارية لوحدة المياه. وتم استخدام الفول البلدي حيث طبق ثلاث تصرفات للمياه: D1, D2, D3.

1- أجريت هذه الدراسة في محلة البحوث الزراعية بسخا محافظة كفر الشيخ - مصر وكان الهدف من هذه الدراسة تأثير النبضة على كل من الاستهلاك المائي وكفاءة الري وكفاءة الاستهلاك المائي وكفاءة الاستهلاك المائي والتكلفة الاستعمارية لوحدة المياه. وتم استخدام الفول البلدي حيث طبق ثلاث تصرفات للمياه: D1, D2, D3.

2- أجريت هذه الدراسة في محلة البحوث الزراعية بسخا محافظة كفر الشيخ - مصر وكان الهدف من هذه الدراسة تأثير النبضة على كل من الاستهلاك المائي وكفاءة الري وكفاءة الاستهلاك المائي وكفاءة الاستهلاك المائي والتكلفة الاستعمارية لوحدة المياه. وتم استخدام الفول البلدي حيث طبق ثلاث تصرفات للمياه: D1, D2, D3.

3- أجريت هذه الدراسة في محلة البحوث الزراعية بسخا محافظة كفر الشيخ - مصر وكان الهدف من هذه الدراسة تأثير النبضة على كل من الاستهلاك المائي وكفاءة الري وكفاءة الاستهلاك المائي وكفاءة الاستهلاك المائي والتكلفة الاستعمارية لوحدة المياه. وتم استخدام الفول البلدي حيث طبق ثلاث تصرفات للمياه: D1, D2, D3.

4- أجريت هذه الدراسة في محلة البحوث الزراعية بسخا محافظة كفر الشيخ - مصر وكان الهدف من هذه الدراسة تأثير النبضة على كل من الاستهلاك المائي وكفاءة الري وكفاءة الاستهلاك المائي وكفاءة الاستهلاك المائي والتكلفة الاستعمارية لوحدة المياه. وتم استخدام الفول البلدي حيث طبق ثلاث تصرفات للمياه: D1, D2, D3.

5- أجريت هذه الدراسة في محلة البحوث الزراعية بسخا محافظة كفر الشيخ - مصر وكان الهدف من هذه الدراسة تأثير النبضة على كل من الاستهلاك المائي وكفاءة الري وكفاءة الاستهلاك المائي وكفاءة الاستهلاك المائي والتكلفة الاستعمارية لوحدة المياه. وتم استخدام الفول البلدي حيث طبق ثلاث تصرفات للمياه: D1, D2, D3.

6- أجريت هذه الدراسة في محلة البحوث الزراعية بسخا محافظة كفر الشيخ - مصر وكان الهدف من هذه الدراسة تأثير النبضة على كل من الاستهلاك المائي وكفاءة الري وكفاءة الاستهلاك المائي وكفاءة الاستهلاك المائي والتكلفة الاستعمارية لوحدة المياه. وتم استخدام الفول البلدي حيث طبق ثلاث تصرفات للمياه: D1, D2, D3.

7- أجريت هذه الدراسة في محلة البحوث الزراعية بسخا محافظة كفر الشيخ - مصر وكان الهدف من هذه الدراسة تأثير النبضة على كل من الاستهلاك المائي وكفاءة الري وكفاءة الاستهلاك المائي وكفاءة الاستهلاك المائي والتكلفة الاستعمارية لوحدة المياه. وتم استخدام الفول البلدي حيث طبق ثلاث تصرفات للمياه: D1, D2, D3.

8- أجريت هذه الدراسة في محلة البحوث الزراعية بسخا محافظة كفر الشيخ - مصر وكان الهدف من هذه الدراسة تأثير النبضة على كل من الاستهلاك المائي وكفاءة الري وكفاءة الاستهلاك المائي وكفاءة الاستهلاك المائي والتكلفة الاستعمارية لوحدة المياه. وتم استخدام الفول البلدي حيث طبق ثلاث تصرفات للمياه: D1, D2, D3.

9- أجريت هذه الدراسة في محلة البحوث الزراعية بسخا محافظة كفر الشيخ - مصر وكان الهدف من هذه الدراسة تأثير النبضة على كل من الاستهلاك المائي وكفاءة الري وكفاءة الاستهلاك المائي وكفاءة الاستهلاك المائي والتكلفة الاستعمارية لوحدة المياه. وتم استخدام الفول البلدي حيث طبق ثلاث تصرفات للمياه: D1, D2, D3.

10- أجريت هذه الدراسة في محلة البحوث الزراعية بسخا محافظة كفر الشيخ - مصر وكان الهدف من هذه الدراسة تأثير النبضة على كل من الاستهلاك المائي وكفاءة الري وكفاءة الاستهلاك المائي وكفاءة الاستهلاك المائي والتكلفة الاستعمارية لوحدة المياه. وتم استخدام الفول البلدي حيث طبق ثلاث تصرفات للمياه: D1, D2, D3.

11- أجريت هذه الدراسة في محلة البحوث الزراعية بسخا محافظة كفر الشيخ - مصر وكان الهدف من هذه الدراسة تأثير النبضة على كل من الاستهلاك المائي وكفاءة الري وكفاءة الاستهلاك المائي وكفاءة الاستهلاك المائي والتكلفة الاستعمارية لوحدة المياه. وتم استخدام الفول البلدي حيث طبق ثلاث تصرفات للمياه: D1, D2, D3.