Statement

Innovative Method for Rice Irrigation with High Potential of Water Saving

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Introduction:

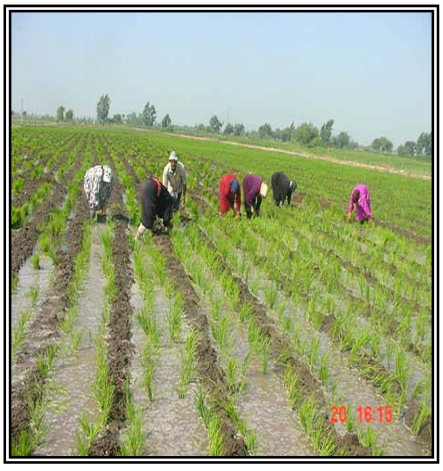
One of the main strategies to overcome this problem is to achieve better water management policy. Irrigation management under old lands conditions which irrigated by surface irrigation method is very important to improve production and water saving. For increasing water use efficiency of rice can be improved without additional costs to the farmers and consequently water save. So saving water is necessary to face the water shortage in the future. Such saving for irrigation water of rice is like to be achieved by using a new planting and irrigation method with high potential for water saving.

Scope of the Innovation Method:

The scope of this method was performed in order to seek a possibility of growing rice on strips in order to decrease the amount of irrigation water as well as increasing water productivity.

I. Description of the Innovation Method:

This method is depending on reducing irrigated area by land deviation into furrows. Top of furrow was named (border) and bottom of furrow was named (tape). Every border and tape named (strip). The seedlings were transplanted in bottom of furrow (tape) with using the same plant density as recommended into two rows of plants according to strip width. Planting irrigation was given with enough amount for reaching to puddiling then the next irrigation were given for taps



only with depth of 7 cm. Accordingly flooding area was less and consequently increased water saving by about 40% using this new method increased irrigation application efficiency and water productivity. In addition to, it decreased percolation losses and decreased evaporation.

The Innovative method of rice cultivation (on strips) was applied in farmers fields on five governorates under different soil and climate conditions in Egypt in 150 hectares, This method aimed to seek the possibility of growing rice in the bottom of furrows (strips) in order to increase water use efficiency of rice cultivar Sakha 104 with cropping period (135 days).

Planting methods (M):

Two planting methods were followed in the permanent field, they were:

M_1: Traditional transplanting:

Transplanting of seedlings rice on flat at the hills (4-5 plants) distance of 20 × 20 cm. to give the rate of (25 hills/m^2) and,

M_2: Transplanting in strips of furrows 80 cm wide:

(Top of furrow 45cm. and 35 cm. for bottom) Seedlings were transplanting in hills (4-5 plants) 10 cm. apart in the two rows on the bottoms of furrows (strips) keeping population the same as in the traditional method (25 hills/m^2) as recommended as shown in Fig. (1).

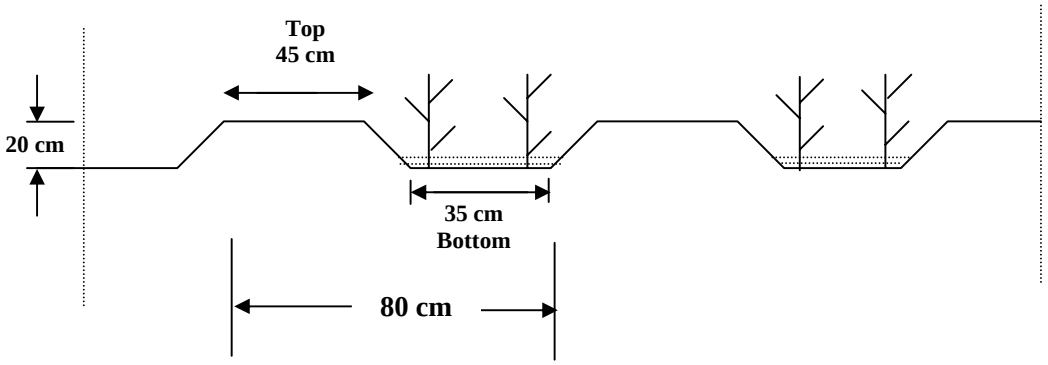


Fig (1) : Strips of Furrows Diagram (80 cm wide).

I. Irrigation Water Measurement:

2. Water Use Efficiency (WUE):

It was calculated according to Israelsen and Hansen (1962) as follows:

WUE = Rice grain yield (Kg/ha.) / Total water used (m^3/ha.)…….(1)

(B) Grain Yield (ton/ha.):

The central samples of each field were harvested to determine grain yield in ton/ha as adjusted at 14% moisture content. All data were subjected to analysis of variance according to Cochran and Cox (1957) then treatment means were compared by LSD test.

(C) Economic analysis

In order to identify the difference between the two methods, economic analysis will be applied. This analysis will depend on the following two indicators:

- Net return/m^3 of water: This indicator will be calculated by dividing the net return arising from each method by the total amount of water applied

  Net Return /Total water applied…….……(2)

- Benefit cost ratio (B/C): This ratio is calculated" by dividing the total net return for each method by its total costs. The higher ratio refer is the better economic efficiency.

  B /C = total net returns / total costs……..(3)

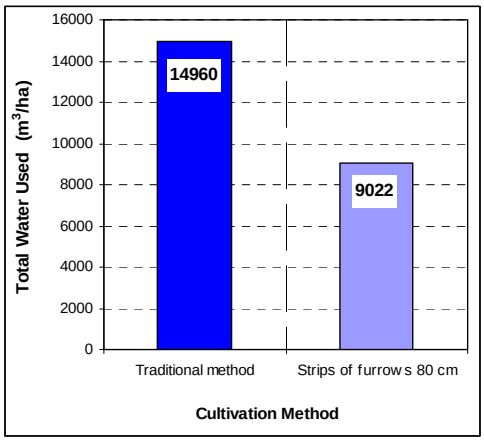
II. Contribution of the Innovative Method on Water Saving:

Data for grain yield collected and presented in Table (2). The obtained data showed that, the planting methods had a significant effect on grain yield/ ha. The highest grain yield/ha (9.275 t/ha.) was obtain from M_2 treatment, While the lowest value was recorded from M_1 treatment (8.789 t/ha.). Similar results were obtained by Atta (2005).

Water Relations:

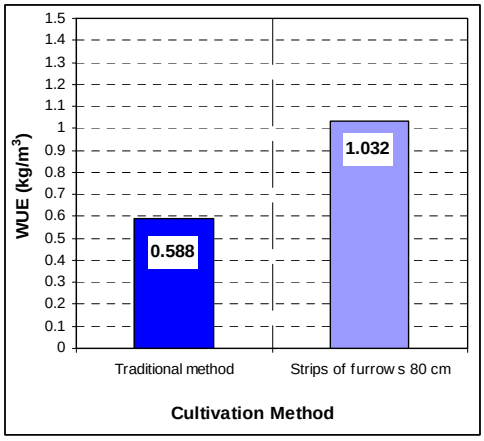
1) Water used before and through treatments:

The amount of water used for land preparation, for both nursery and permanent field, as well as raising for 30 days and through 7 days after transplanting and before treatments application were 4018.66 m^3/ha. as average. The nursery area was about one tenth of permanent field area. Water used through treatments application measured and was found to be 10941.28 and 5003.48 m^3/ ha. for M_1 and M_2 treatments as average respectively.



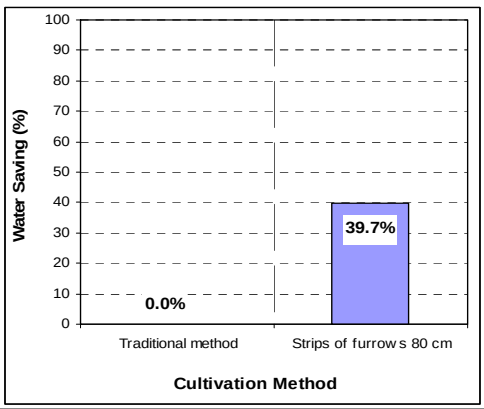
2) Total water used:

The results showed that total water used by rice according to the different planting methods, where 14959.94 and 9022.5 m^3/ha for M_1 and M_2 treatments respectively. From these results, it can be reported that water saved were about 5937.44 m^3/ha (39.69 %), and yield increasing by 5.86 % for M_2 treatment.



3) Water Use Efficiency (WUE):

The highest water use efficiency (WUE) was recorded for M_2 treatment (1.032



kg/m^3).While the lowest one was recorded for M_1 treatment (0.588 kg/m^3). This due to the marked reduction in the amount of water used with a significant increase in grain yield. Similar results were obtained by Atta (2005).

4) Economic analysis:

The net return for rice cultivated under strip method (M_2) were calculated at 0.182 \$ /m^3 of water compared to 0.089 \$/m^3 of water for rice cultivated under the normal method (M_1). On the other hand, Benifit cost ratio (B/C) for rice (M_2) is higher than that for rice (M_1). This due to the less amount of water used with rice planted under strip method.

Generally in this method the new planting method for rice (strip of furrow 80 cm) was always better than traditional method in reduction of irrigation water applied and costs while it increase water productivity, green yield because planting rice on strips perhaps made a good advantages and important proprieties such as:

- Good distribution of plant density.
- Less flooded area.
- Water saving about 40%.
- Raising water productivity.
- Increasing fertilizers use efficiency.

III. Introducing and Spreading the Innovation Method:

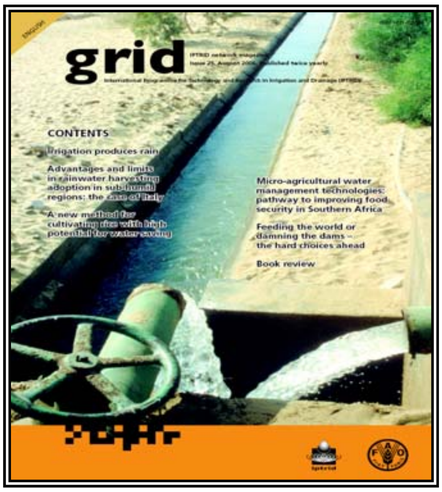
This innovative method has been conducted in 2002 on small research area as an experimental work. After that, through years of 2003 till 2005, whereas the experiments showed good achievement, the Ministry of Water Resources and Irrigation co-operated with Water Management Research Institute for extend this innovative method on different governorates covering all climate and soil conditions in Egypt. These governorates were located on different regions (North Delta, Middle Delta, West Delta and East Delta). This extension works aimed to convince the farmers by using this new method in order to save water. During theses extension years we achieved a very good results on water saving by convincing many farmers by this method. The cultivated areas were 50 hectares distributed on different sites.

After this extension work, The Minster of Water Resources and Irrigation allowed to forbidden rice cultivation areas (such Fayoum Governorate) to cultivate rice but under using this Innovative method which save the applied water by 40%. The Minster announced this through the media. In addition to the Minster gave his instructions to irrigation districts to use this new method and to be wide used all over Egypt. Then this method through years 2006 and 2007 has been used on large scale on five regions including Fayoum Governorate, Middle Egypt on cultivation area about 150 hectares.


تجربة جديدة لزراعة الأرز بالشرائح.. توفر ٥٥٪ من المياه.. وترفع إنتاجية الفدان

نقص المياه يهدد زراعات الأرز في كفر الشيخ

Some piece information about this innovative method have been published in Grid (FAO Journal) Volume 25, 2006, Arabic and English versions. And Water Management Project in Fayoum recommended this method to be world wide used. And currently Irrigation Improvement Projects applying this new method on the command areas.



WUAs now using this method and they doing extension for this innovative method.

IV. Scope Further Expansion of the Innovative Method:

Rice is one of the most inefficient in water use because it grown generally under submerged condition in Egypt. It is means stable food for majority of the population and has become exportable crop in Egyptian agricultural system after the free cropping pattern policy. For these reasons, the areas cultivated with rice have been increased. The authorities in Egypt limit the area devoted to rice to be about 46000 hectares every year but the farmers cross this area to almost the double because rice is more profitable crop than other summer crops namely maize and cotton. Consequently the pressure increase on the limited area resources in the country and sometimes causes irrigation water shortage during the peak summer season.

This method is a pioneer one. And this method is highly recommended to be used by farmers and policy makers. Further works are recommended to cultivate rice using this new method in very large area all over Egypt.

As a notional goal, by applying this innovative method allover Egypt for the rice cropped area it means that we can **save about 3.7 Millard Cubic Meter of irrigation water**, this amount of water can serve for horizontal extension and cultivate new lands.

V. Roles of the Individual Nominees:

This innovative method has been developed and evaluated by Prof. Dr. Yousry Atta, Professor of water management, in Water Management Research Institute, National Water Research Center, Ministry of Water Resource and Irrigation. Dr. Atta is a Director of Research Stations on Delta Region.