ECONOMIC EFFICIENCY OF LETTUCE CROP IRRIGATED THROUGH DIFFERENT METHODS

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Abstract. The research purpose of this paper, was to determine the economic efficiency of irrigation on lettuce cultivated in a protected area, while aiming to attain early crops of high quality, at low specific costs. From an economical point of view researches showed that micro-sprinklers irrigation is recommended. Though the yields are lower using this method, they are enough to determine a higher gain.

Keywords: lettuce, unit production cost, profit rate, production expenses in product equivalent

INTRODUCTION

Irrigation is very important for lettuce, because both the lack and water excess are harmful. Establishing an optimum irrigating regime, with an irrigation norm that corresponds to this crop in different vegetation phases has good effects on the plant as well; by reducing the disease and pests attack, a better production is obtained both qualitatively and quantitatively, which allows the obtaining of important economies, with a reduction of the producing cost. Calculating the water need and using the water rationally, correctly exploiting the irrigated terrains and especially the wetting technique are problems that every producer should know in order to obtain high yields at a low production cost. Irrigating method is an extremely important factor within the crop irrigating works assembly. Choosing and establishing the right assembly becomes important for the works to be successful during all phases: projecting, executing, exploiting and maintaining the irrigation systems. When high quality works are done while projecting and executing at a low cost per surface unit, the irrigation method should assure in the end the most important requirement, the uniform distribution of the water to plants (Budiu et al., 2008).

MATERIAL AND METHOD

The researches regarding irrigation regime and the economic efficiency at lettuce crop in green houses were conducted in two experimental cycles (spring and autumn) for three years, when two different wetting methods were studied.

Wettings were done through two modern irrigation methods: drip irrigation and micro-sprinklers, aiming to economize irrigation water, work force and to obtain high and stabile yields.

Wettings were done at three different norms, when humidity of the soil reached 60, 70 and 80% of the active humidity interval (AHI).

Mainly, drip irrigation technology resumes at wetting with controlled quantities of water correlated with absorption capacity of the soil and vapour-transpiration, distributed near the plants, mainly in the area where plant radixes develop. Drip irrigation is done

through a system with polyethylene tubes with drippers, where water is delivered towards the area of the radix system of the plant.

Up against the traditional methods, drip irrigation method determined a new view upon the water-soil system and influenced crop technologies. It is economical; it has great certainty in exploitation and determines an increase of the yield quality, being imposed in the vegetable-growth technology within green houses and solars.

Dripping wings used in the experiment, produced by Palaplast firm, with a 16mm diameter, were fitted with dripping devices, these being mounted in the interior of the wings. The debit of these drippers is 2 l/h.

Three aspects are of great interest for the local facilities, keeping in line with the fast technological progress happening in all countries using this irrigation method on a large scale: managing the wettings, improving their uniformity, fertilization and automation. In the vegetable case, the distance between drippers has low values, practically wetting a continuous strip of terrain alongside the conduct, which in transversal cutting has an approximately ellipsoidal form, and in sandy soils the form is approximately semi-circular.

Micro-sprinkler irrigation is a variant of the aspersion irrigation which should catch the attention of the vegetable growers because it may use low water resources and the equipments- micro-fixed or mobile aspersers fitted with fine nozzles-, may be efficiently installed, on small terrain surfaces in particular gardens, but on large parcels as well (VANNIERE MARIE and POLIDARI, 1992; KABASHIMA, 1996, cited by RUXANDRA CIOFU, 2003). Within this method, water is distributed to the plants as natural rain, with the aid of the pulverizing devices which work under pressure, and the specific technical elements include: intensity and type of the rain, uniformity of water distribution to plants and wetting time.

Up against drip irrigation, this irrigation allows an optimum level of moistening of the entire soil volume exploited by plants radixes, the reduction of water loses through percolation and moving of mineral elements, thus avoiding pollution of the soil and environment.

The micro-sprinklers used in the experiment, produced by Palaplast, were specially conceived for greenhouse and solar irrigation, being micro-sprinklers with jet breakers which disperse water in very fine pellicles under the form of a dense fog.

RESULTS AND DISCUSSION

Analyzing the lettuce crop from an economical point of view aimed to establish the efficacy of each variant by calculating the corresponding economical indices and comparing them: unit production cost, selling price, raw unit profit, profit rate, labor productivity and production expenses in product equivalent.

In order to get a general idea on the economical aspect of the crop, the calculation of expenses implied by each variant referred to the average production obtained by each of these in all three years and in each of the two crop starting season (spring and autumn). The same procedure was applied in the case of quantities of administrated water.

Within material expenses, the variants of the same wetting methods have the same values up to the level of the irrigating water, where different quantities used for each variant determine changes of the total cumuli of material means. Acquiring the drip irrigation system implied higher material expenses.

Differences between variants regarding live work expenses are due to different average yields that imply different numbers of man-working days necessary for harvesting, sorting, loading and unloading. As expected, at higher yields the expenses on live-work are more consistent.

The high cost of the drip irrigating system, but mainly the expenses with working force necessary for harvesting a higher yield determined greater expenses within the variants wetted through drips (table 1). Within these variants, the one of the wetting to 80% of AHI registered the maximum of expenses.

At variants wetted through micro-sprinklers, water loose and the reaching of the aimed level with a reduced speed determined the use of a higher quantity of water, thus increasing the irrigation expenses. Nevertheless, the reduced cost of the installation used at these variants, together with a lower necessary of working force for harvesting are sensed within total expenses. The highest total production expenses within the variants of micro-sprinklers (80% AHI: 20663.14 lei/ha) are very close to the lowest expenses registered for the variants of drop method (60% AHI: 20203.61 lei/ha). Total income depends on obtained yields, and income hierarchy is identical to production hierarchy.

Table 1

Costs and incomes for each variant, in correspondence with production and the amount of irrigation water

Variant		Average yield (t/ha)	The average applied water (m^3/ha)	Total costs Lei/ha	Total incomes Lei/ha
V1-60 % AHI	Drip	23,6	1026	20203,61	23600
V2-70 % AHI		28,1	1350	22121,30	28100
V3-80 % AHI		29,3	1593	22898,40	29300
V4-60 % AHI	Micro-sprinkler	22,8	1524,33	18331,87	22800
V5-70 % AHI		26,2	1784,33	19806,57	26200
V6-80 % AHI		27,8	2002,50	20663,14	27800

One of the calculated economical indices, the unit production cost is in a direct relation with total expenses and obtained yield. The variant of the minimal level of 60% from AHI assured through dripping registered the highest unit production cost (0.86 lei/kg), and the one of the minimal level of 80% from AHI, assured through micro-sprinklers registered the lowest one (0.74 lei/kg) (Figure 1).

In this sense the two variants represent the extremes; while the production costs had similar values, the difference was made by the obvious lower yield of the variant 60% from AHI x dripping.

Close to the maximum attained is the variant of micro-sprinklers x 60% from AHI with an average situated between the two costs (0.80 lei/kg). The other variants have relatively similar costs among them: 0.76 lei.kg- micro-sprinklers x 70% from AHI, 0.78 lei/kg- dripping x 80% from AHI and 0.79 lei/kg- dripping x 70% from AHI.

Yields of each variant were valorized at the same price: 1 leu/kg. After valorizing the yield, the unit raw profit was calculated for each variant. Naturally, values hierarchy of this economical index is inversed up against the one of the unit production cost (figure 1). Thus, the smallest unit raw profit was obtained for the variant dripping x 60% from AHI (0.14 lei/kg) and the highest for the variant micro-sprinklers x 80% from AHI (0.26 lei/kg).

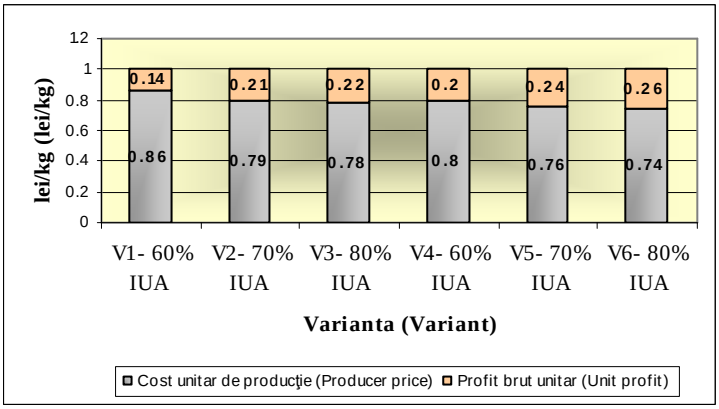

Fig. 1. Unit cost of production and unit raw profit for the six experimental variants

The next analyzed index, profit rate expressed in percentage, places on top the variant micro-sprinklers x 80% from AHI (34.54%), followed by the variant micro-sprinklers x 70% from AHI (32.28%) (Figure 2).

For this index, the hierarchy of the variants coincides with the one given by unit raw profit. Thus, the smallest profit rate corresponds to the variant dripping x 60% from AHI (16.81%), followed by the variants dripping x 70% from AHI (27.03%) and dripping x 80% from AHI (27.96%).

Because the selling price of one kg of lettuce was 1 leu, according to calculation, work productivity expressed in kg/man-working days is identical to the one expressed in lei/man (Figure 3).

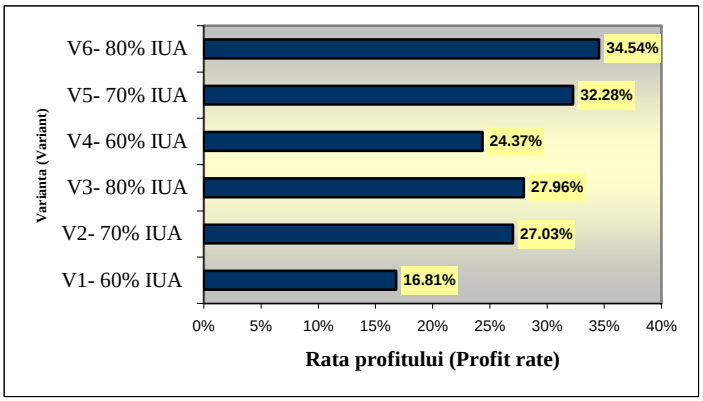

Fig. 2. The profit rate for the six experimental variants

Irrigating at 80% from AHI through dripping determines the realization of the highest value of this economical index (111.43 kg/man-working days or lei/man-working days). Closely following this variant is the one combining the dripping with 70% from AHI (110.84 kg/man-working days) and the one combining micro-sprinklers wetting with 80% from AHI (110,89 kg/man-working days of lei/man-working days). It must be mentioned the fact that labour productivity is manifested hierarchal identically to the yield. Hence, the highest work productivity is met at the variant micro-sprinklers x 60% from AHI (107.61 kg/man-working days or lei/man working days). The last analyzed index, production expenses in product equivalent, expressed in kg/ha registers after calculation, the same values as total production expenses, because of the selling price of 1 leu.

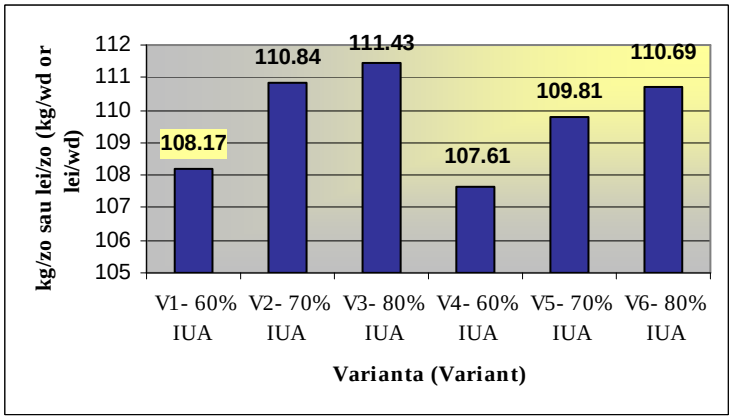

Fig. 3. Labour productivity for the six experimental variants (kg/md)

CONCLUSIONS

Because the selling price was the same for all variants, economical efficiency is dependent on the obtained yields and on the expenses within each crop.

Regarding the wetting method, though the dripping one was the one giving the highest yields the expenses involved in obtaining them were also bigger for the same irrigation level. Thus, unit raw profit and profit rate corresponding to dripping variants were smaller than the ones corresponding to micro-sprinklers variants. Only when regarding labor productivity, dependent on production value, the dripping method proves to be superior. When regarding the wetting levels, it is only expected that, within each method, the minimal input of 80% from AHI gives the best results form an economical point of view.

When regarding raw profit and profit rate, from all experimental variants, the one of micro-sprinklers x 80% from AHI is the most efficient, followed by the one wetted through the same method at 70% from AHI. On the third position is the variant of dripping x 80% from AHI. The less efficient variant was the combination of dripping x 60% from AHI. Labor productivity index determines a different hierarchy, placing the levels of 80% from AHI and 70% from AHI of the dropping on the first two positions followed by micro-sprinklers x 80% from AHI, the last position being occupied by micro-sprinklers x 60% from AHI.

Obtaining high yields by using the dripping irrigation system which implies water economy does not mean that maximum economical efficiency is obtained. The high cost of the system per say and the costs with working force are big enough to induce a lower profit than the one obtained through the micro-sprinklers method. The last one is economically justified as it gives lower but sufficient yields to determine a higher raw profit.

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