PROFITABILITY ANALYSIS OF THE USE AUTO-CONTOUR HEDER IN SOY CROP HARVESTING

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Abstract

The purpose of the paper is to analyze the profitability of the use of the auto-contour heder (12 m long) compared with the conventionally one used for soya crop. The objectives were to determine the yield and productivity of soybean crop (plant average height, number of pods per plant, height of insertion of the first floor of pods). Also, it was determined the cutting height of the auto-contour heder compared to the conventional one. The profitability analysis consisted in determining the costs, incomes and returns compared with the use of the auto-contour heder versus the conventional one. The research was carried out under pedoclimatic conditions of the Făcăeni locality, Ialomiţa County, on a relatively flat land with a chernozem cambic soil, well supplied in N, P, K with a slightly alkaline pH. The determinations were carried out both in irrigated and not-irrigated systems. To obtain conclusive results, a number of 100 replications were performed on the 2 ha plot, the results being statistically processed by variance analysis and F test. Analysis of the results indicated that in case of soya crop the use of auto-contour heder is more profitability compared to the conventional one, especially in the case of irrigated crops, and yield was higher with 950 kg ha^{-1} of grain than with non-irrigated crops.

Key words: soybean, profitability, auto-contour heder, irrigated sistem

An important problem for mankind, emphasized in the second half of the 20th century and the beginning of the 21st century, is food security and the environment. At the Club in Rome in 1983, Eduard Saouma, as Director of this Club, said "Apart from nuclear disarmament, there is no more vital objective than food security, which is increasingly endangered by environmental pollution" (*Salontai Al. 2007*).

A perfect harvest begins with a perfect cut. This is especially true for legumes such as soy beans, peas and lentils, whose pods grow almost directly on the ground. To eliminate losses during harvesting, the plants must be mown as small as possible from the ground.

The combines are equipped with detachable headers, which change depending on the crop that needs to be harvested. The standard header is equipped with a rectilinear cutter bar and a ram that is designed to push the cuttings to the snail conveyor. Another type of header is the flexible one that has a similar construction to the classic one, distinguishing itself only by the fact that the cutter bar adapts to the contour and the ground unevenness. A flexible header can be used to harvest soybeans, which form pods close to the soil level, but can be used equally well for grain harvesting, while a rigid header is generally used only for harvesting cereals.

Due to flexible bar, header Auto-Contour adapts to the smallest unevenness of the ground, preventing dragging the earth and dirty knives. Combined with adjusting the cutting angle on the central conveyor, collecting losses can be prevented over the entire working width, even under difficult harvesting conditions. The chain sawers are mobile and can follow the contour of the soil. During operation, the heels below the header remain in constant contact with the ground to overcome the level differences and to maintain a constant working height over the entire working width (*figure 1*).

A sustainable agricultural holding must be economically viable, socially and environmentally acceptable, reproducible in time and transportable in perfect working order to future generations (*Ailincai, C., 2007*).

Soybean is a plant that has relatively high soil moisture requirements, with a specific consumption, ie a sweating coefficient of 300-700. To germinate, soybeans require 120-150% water relative to their dry weight. In the period of breeding, breeding and filling of the breeding organs, there are high demands on water. Calendar, this period is from June 10-15 to August 15-20.

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Insufficient water in the soil during this period causes the fall of flowers and pods, and the grains formed remain small. These aspects can lead to a decrease in yield by about 50% *(Muntean L. S. şi colab. 2003, Oancea I., 2003).* In this regard, additional measures will be taken to maintain soil moisture, as soybean coming from warmer areas is later sown, placing itself with the blooming and buildup of berry substances during the summer, when the risk of drought and high temperatures can cause flower abortion.

And excess moisture can be harmful to soybean crop, having the same negative effects as lack of water in all phases of vegetation.

The plant has a water consumption that varies throughout the growing stage depending on the degree of water supply to the soil, the variety or hybrid growth duration, the productive potential and the environmental conditions.

Figure 1 **Combine with auto-contour heder (Facaeni)**

MATERIALS AND METHODS

The purpose of the paper is to analyze the profitability of the use of the auto-contour header compared with the conventionally one used for soya crop. The objectives were to determine the yield and productivity of soybean crop (plant average height, number of pods per plant, height of insertion of the first floor of pods). Also, it was determined the cutting height of the auto-contour heder compared to the conventional one. The profitability analysis consisted in determining the costs, incomes and returnes compared with the use of the auto-contour heder versus the conventional one.

The profit rate was determined as a percentage ratio between gross profit and total expenditure (Ştefan G. *et al*, 2004*).*

The research was carried out under pedoclimatic conditions of the Făcăeni locality, Ialomiţa County, on a relatively flat land with a chernozem cambic soil (*figure 2*), well supplied in N, P, K with a slightly alkaline pH.

Figure 2 **Soil profile**

The determinations were carried out both in irrigated and not-irrigated systems. To obtain conclusive results, a number of 100 replication were performed on the 2 ha plot, the results being statistically processed by variance analysis and F test.

RESULTS

Determined the cutting height, yield and productivity of soybean crop.

The results obtained showed that the yield obtained was directly influenced by the way it was harvested. Thus, in the case of the non-irrigated variant, harvested with auto-contour heder, 3534 kg ha^{-1} of beans were obtained, and harvest losses were 3.19 % and 117 kg ha^{-1} of grain (*table 1*). In the case of conventional heder harvesting, the losses were 11.66 %, which is 426 kg ha^{-1} of grain (*table 1*). In the case of irrigated variants, reduction in harvest losses was observed by 0.56 % for soybean crop with auto-contour heder and 1.58 % for crops harvested by conventional heder (*table 1*).

Table 1

Determined the yield and productivity of soybean crop

Variant	Sistems of harvest	Yield of grains with losses	Lost harvests		Yields of beans without loss
		(kg ha^{-1})	(kg ha^{-1})	(%)	(kg ha^{-1})
Non-irrigated	Conventional heder	3225	426	11,66	3650
	Auto-contour heder	3534	117	3,19	3650
Irrigated	Conventional heder	4137	464	10,08	4600
	Auto-contour heder	4479	121	2,63	4600

The statistical analysis of the obtained results showed a direct influence of the harvesting on yield. Thus, statistically ensured differences were obtained both for irrigated and non-irrigated crops with yields of 309 kg ha^{-1} (9.58%) in non-irrigated system and 342 kg ha^{-1} (8.26%) in the irrigated system (*table 2*).

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Table 2

The influence of the soybean crop harvesting the yield

Variant	Sistems of harvest	Yield of grains with losses		Difference (kg ha^{-1})	Significance
		(kg ha^{-1})	% of the control		
Non-irrigated	Conventional heder	3225	100.00	0	Control
	Auto-contour heder	3534	109.58	309	XX
LSD	LSD 5% = 118.1 kg ha^{-1}	LSD 1% = 167.0 kg ha^{-1}		LSD 0,1% = 241.0 kg ha^{-1}	
Irrigated	Conventional heder	4137	100.00	0	Control
	Auto-contour heder	4479	108.26	342	XX
LSD	LSD 5% = 121.3 kg ha^{-1}	LSD 1% = 171.2 kg ha^{-1}		LSD 0,1% = 289.0 kg ha^{-1}	

Note: xx – distinctly significant, LSD – Least significant diference.

For a conclusive analysis of harvest losses, we will analyze this in close correlation with the average height of plants (*figure 3*), the height of insertion of the first floor of the pods (*figure 4*) and the average heder cutting height (*figure 5*) . In irrigated crops, the average plant height was 4.4 cm greater than non-irrigated plants, which averaged 109.9 cm (*figure 3*).

The height of insertion of the first floor of the pod was 0.2 cm higher in the irrigated crop compared to the non-irrigated crop, which was 15.9 cm (*figure 4*). The difference of 0.2 cm is not exaggerated, but is sufficient to ultimately reduce harvest losses by 4 kg ha^{-1} in irrigated crops and 38 kg ha^{-1} in non-irrigated crops (*table 1*).

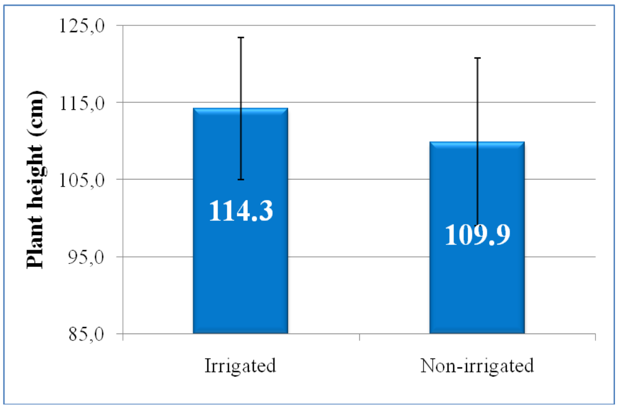

Figure 3 **Plant height**

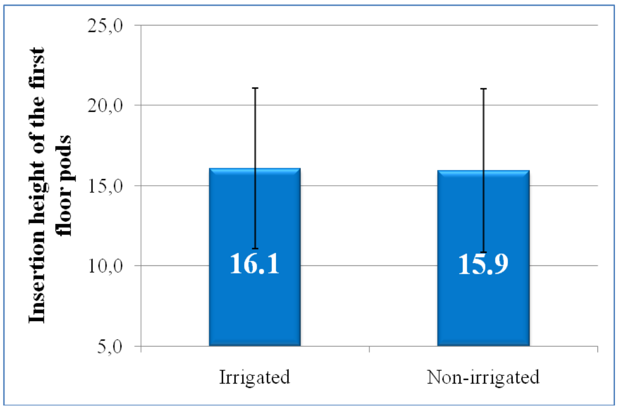

Figure 4 **Insertion height of the first floor pods**

The main indicator that directly contributes to reducing harvest losses (average cutting height of plants) has contributed to reducing harvest losses with statistically significant differences. Thus, in the case of conventional heder harvesting, the plants were cut at 18.62 cm high and with Auto-contour heder at 8.98 cm. An analysis of the height of the cutting plant in close correlation with the average height of the first stage flooring highlights that in the case of irrigated crops the "range of interest" was between 18.62 cm and 16.1 cm for Conventional heder harvesting and between 8.98 cm and 16.1 cm for Auto-contour heder harvesting (*figure 4*, *figure 5*). For crops sown in a non-irrigated system, the " range of interest" was between 18.62 cm and 15.9 cm for conventional heder harvesting and between 8.98 cm and 15.9 cm for auto-contour heder harvesting (*figure 4*, *figure 5*). These differences between the average height of insertion of the first floor of the pods and the average cutting height of the plants justify the occurrence of those differences in production at harvesting, since at that time the plant can develop another layer of pods.

An overall analysis of plant cutting height at harvest shows that the interest rate range is 18.62 cm and 8.98 cm, being 9.64 cm (*figure 5*).

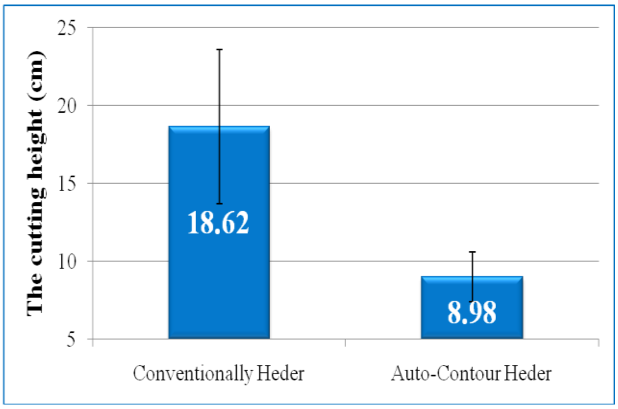

Figure 5 **The cutting height**

An analysis of the number of pods per plant shows that there were differences between the two analyzed systems. Thus, in the case of irrigated crops an average number of 60.7 pods was obtained per plant, and in the non-irrigated culture only 58.2 pods per plant (*figure 6*).

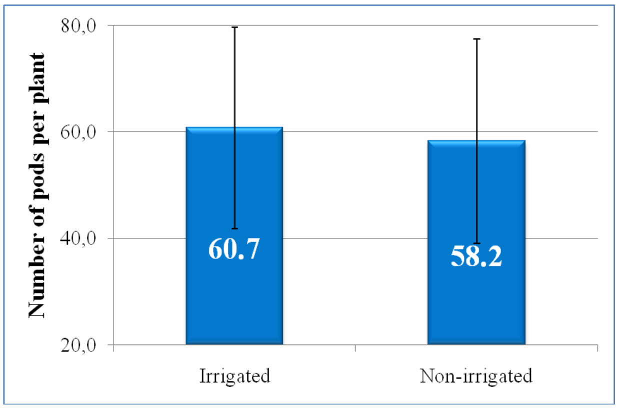

Figure 6 **Number of pods per plant**

Water has had an important role and also a direct influence on the number of floor per plant. Thus, in the case of irrigated crops, the plants had an average number of 17 floors per plant, while in non-irrigated crops the plants had 16 floors of pods per plant (*figure 7*).

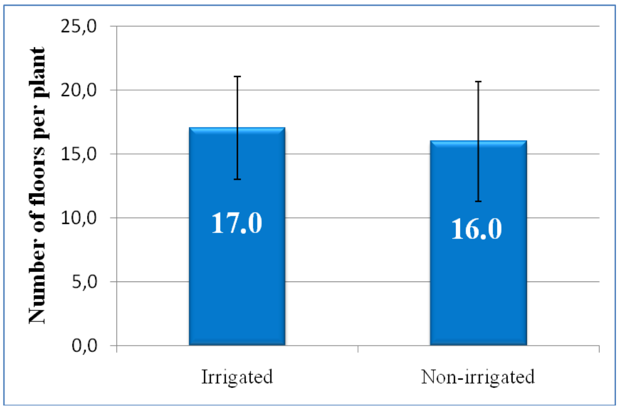

Figure 7 **Number of flors per plant**

Due to the competition that exists between plant and soil with regard to water, the amount and frequency of water intake and its movement in soil under the influence of temperature and texture, determine special conditions that can greatly influence soil productivity.

In soils with a favorable hydrological regime, as is the case with the cambic chernozem on which these experiments have been carried out, deficiency or excess water are not chronic phenomena, but they may appear as acute conditions for a limited time. Thus, in periods of high dryness, water accessible to plants may fall to the critical points of temporary or even permanent pollution. Under conditions of excess water in the soil, conditions of anaerobiosis and asphyxia can be created, so that plants can suffer unwanted consequences.

The profitability analysis

Additional expenses due to the use of the auto-contour hederul are represented by the depreciation, maintenance and repair of the heder. Depreciation and maintenance costs are independent of usage, but repair costs are variable. The latter are determined by the cultivated area.

Thus, the use of the auto-contour heder leads to additional costs of 145.3 lei ha^{-1}, 3.7% higher than the conventional heder at a harvested area of 110 ha an^{-1} (*figure 8*).

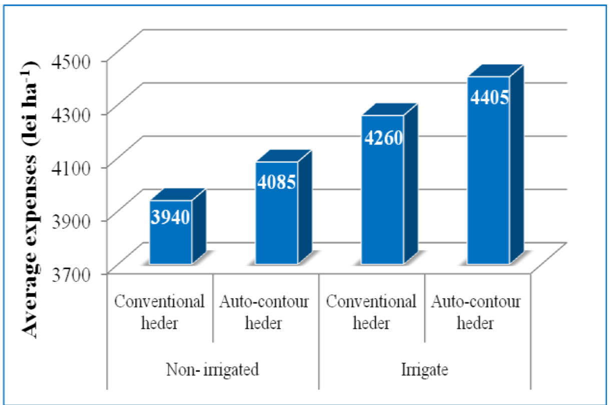

Figure 8 **Average expenses**

The additional revenue obtained by the auto-contour heder is represented by the reduction of the losses compared to the conventional heder. They recorded values of 401.7 lei ha^{-1} in the non-irrigated system and 445.3 lei ha^{-1} in the irrigated system, with 9.6% and 8.3% respectively than the conventional heder (*figure 9*).

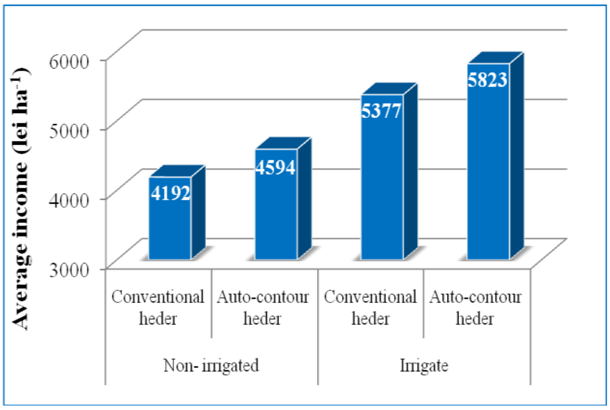

Figure 9 **Average income**

The use of the flexible heder is justified by the profit increase of 256.4 lei ha^{-1} in non-irrigated system and 300.0 lei ha^{-1} to the irrigated system. These values indicate an increase of 101.2% and 26.8% respectively against the conventional heder (*figure 10*).

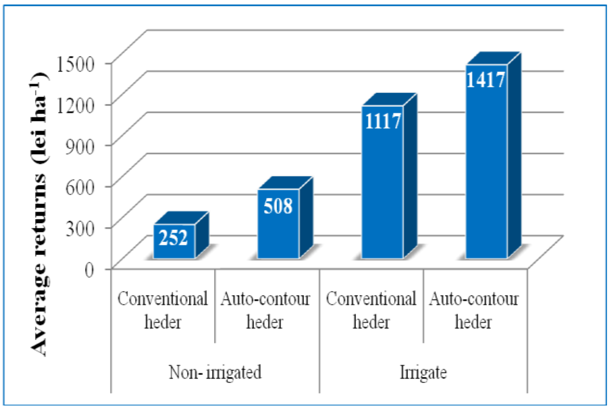

Figure 10 **Average returns**

Additional expenses due to the use of auto-contour heder produce an additional profit of 6.0 lei per 100 lei spent in non-irrigated system and 5.9 lei per 100 lei spent in irrigated system.

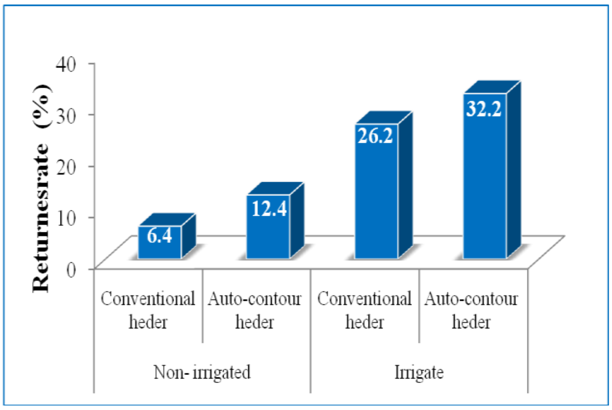

Figure 11 **Returnes rate**

The conditions under which the profit rate for using the conventional heder in the non-irrigated system is 26.2% and 6.4% in the irrigated system, the use of this type of heder proves to be appropriate for a harvested area of 110 ha an-1. Increasing the harvested area to the maximum production capacity will increase the efficiency of using this aggregate (*figure 11*).

CONCLUSION

As a conclusion we can see that all the major manufacturers of agriculture come help farmers to make them work as easy and enjoyable. Continuous development of machines for harvesting was done and will continue to diminish production losses, in order to encourage farmers to cultivate areas inaccessible in terms of uniformity of land, leading eventually to increase profit, which we can say is an impetus for most farmers.

Analysis of the results indicated that in case of soya crop the use of auto-contour heder is more profitability compared to the conventional one, especially in the case of irrigated crops, and yield was higher with 950 kg ha^{-1} of grain than with non-irrigated crop.

The auto-contour heder was more profitable with 256 lei ha^{-1} irrigation and 300 lei ha^{-1} in non-irrigated conditions and more efficient with 6% (both irrigated and non-irrigated) compared to the conventional one.

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