



WORKING HOURS DEMAND OF TRANSPORTATION TASKS IN FOIL COVERED FIELD VEGETABLE PRODUCTION TECHNOLOGY

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Abstract

In the paper we present the up-to-date mechanized production technology of cucumber production with regard to the transportation tasks. By the presentation of the performance and working hours data of machines necessary for production, we are emphasizing the significant volume of transport tasks in the production technology of cucumber. In the present cucumber production technology the working hour demand of machine operations and material handling is about 4,5 hours/tonne, besides a calculated average yield of about 12 t/ha. It can be stated on the basis of the results that the total working hour demand of the machines amounts 54 hours per hectare, which include the volume of transport and material handling tasks in value of 17 hours/ha. Special attention is to be paid to the machine operations like foil tunnel preparation, picking and planting which the most time demanding ones are representing about 9, 10 and 20 % of the total machine working hours. It is worth mentioning that time demand of transport and material handling takes the highest value, about 33 % of the total shift hours of production technology.

Keywords

foil covered field cucumber production, logistic, mechanisation, working hours demand, machine cost, material handling

1. Introduction

The subject of the present study is the mechanized production of field vegetables developing rapidly in the last years [1, 2].

The cucumber is one of the most important vegetable crops in Hungary. The home consumption and the exported quantity is also remarkable. Regarding the production area and the quantity produced pickled cucumber is the most significant in Hungary. The production area is roughly 3-4 thousand hectares.

The most important link in the chain of production and distribution is the solid inland processing industrial background which is essential for the export of fresh products as well [3, 4].

By the presentation of the performance and economic data of machines necessary for production, we are emphasizing the significant volume of transport tasks in the production technology of pickling gherkins. [5, 6]

2. Material and method*Presentation of the Production Technology*

The machine technology of production is presented on the basis of Table 1. The table shows the operations, the machine applied for the certain operation, and the power category of the power machine connected to it. Table 2 shows the shift performance of the connected machines. Some of the economic data are also included: the price of the working machine and the power machine in the year 2014, the operational cost of the same per shift hour together with the operational cost of the connected machines [7].

The Major Machines of the Production Technology

The technology is based on drop irrigation, soil-cover cultivation method for which ridge forming machine type HORTUS HPD-165 and foil and tube layer type AF1 is used. In order to further early ripening and crop safety plant covering foil tubes can be prepared by the machine type AFF-1000.

For harvesting picking machines type STIEGER with picking belt are used by which crop can be harvested on the same territory 2-3-times a week without causing treading damage to the vegetation. [8]

The machine is – subject to framing – attended by 16-28 hand picking workers working in a lying position in order to avoid treading the vegetation. The collecting belt of the machine mounted on a tractor collects and forwards the cucumber into the trailer pulled by the power machine. According to measurements, the structure of the machine creates an appropriate position for the picking workers and fulfils the tasks of transport within the field at the same time [9].

3. Results and discussion

The results of the economic survey of cucumber production on a 20 hectare area are shown in Table 3. Apparently, the machine working time necessary for the cultivation of the 20 hectare growing area in case of connected machines has been stipulated related to the individual operations. Based on this, the direct operational cost of the connected machines can be easily calculated by multiplying the direct operational cost of the machine per shift hour (Table 2) with the effective working time. As a result, the cost of the individual operations related to 20

hectare growing area has been defined the total production costs of cucumber production on 20 hectares and also the specific cost per hectare has been determinate. The costs of field cucumber production and harvesting are specified in the Table 3.

It can be stated on the basis of the results that the operational cost of the working machines (11.196 EUR) is the half of the power machines (22.567 EUR). The total operational cost amounts to 33.763 EUR, 1688 EUR per hectare.

Table 1. The machine technology of production of foil covered field cucumber production

Operations	Type of machine applied in the technology	
	working machine	power machine
Stubble ploughing	Kühne 770-7,2 disc harrow	140 kW tractor
Medium deep loosing	RÁBA 10-14/5	140 kW tractor
Spreading organic manure	AGRO 65 TSZ tandem	60 kW tractor
Fertilizer transport	MBP 6,5 R	60 kW tractor
Spreading of fertilizer	Tornado 5	70 kW tractor
Deep ploughing	Kühne 720-7/6-16-M-TJ	140 kW tractor
Fertilizer transport	MBP 6,5 R	60 kW tractor
Spreading of fertilizer	Tornado 5	70 kW tractor
Ploughing processing	S-2 H/M	140 kW tractor
Seed bed preparation	Lemken Korund 600 K	140 kW tractor
Levelling the surface	Kühne KH - 5,6 S	60 kW tractor
Ridge bed preparation	Hortus HPD-165	70 kW tractor
Mulching, hauling in the hosepipe	AF 1	70 kW tractor
Water supply	DETK-115 tanker	60 kW tractor
Transport of plantlets	MBP - 6,5	60 kW tractor
Planting	Fedele Mario	70 kW tractor
Preparation of foil tunnel	AFF-1000	70 kW tractor
Irrigation	Nadir	
Spray mixture transport (12x)	DETK-115 tanker	70 kW tractor
Spraying (12x)	Gambetti GB E. 1500/16 v	60 kW tractor
Picking	Steiger	70 kW tractor
Transport	MBP - 6,5 – 2 pcs	60 kW tractor
Transport following pre-grading	HL 92.02 road	Trailer

Table 2. The basic economic data of the operations of cucumber production

Operations:	Shift performance (ha / hour)	Price of		Direct cost of operation		
		working machine	power machine	working machine	power machine	total
	(th EUR)		(EUR/hour)			
Stubble ploughing	3	19	141	10	29	39
Medium deep loosing	1,2	3,6	141	3	29	32
Spreading organic manure	0,7	7,1	65	4	16	19
Fertilizer transport	4	6	65	2	16	18
Spreading of fertilizer	4	9,6	72	6	19	26
Deep ploughing	1,5	8,3	141	6	29	36
Fertilizer transport	4	6	65	2	16	18
Spreading of fertilizer	4	9,6	72	6	19	26
Ploughing processing	4,8	7,4	141	7	29	37
Seed bed preparation	4	14	141	9	29	39
Levelling the surface	3,8	5,7	65	4	16	19
Ridge bed preparation	0,4	10	72	12	19	31
Mulching, hauling in the hosepipe	0,25	4,3	72	3	19	22
Water supply	0,9	6,8	65	4	16	20
Transport of plantlets	4	6	65	2	16	18
Planting	0,1	3,6	72	4	19	24
Preparation of foil tunnel	0,2	7,4	72	14	19	33
Irrigation	0,25	8,8	0	24	0	24
Spray mixture transport (12x)	4,8	6,8	72	4	19	23
Spraying (12x)	4,8	16	65	9	16	25
Picking	0,2	44	72	16	19	35
Transport		12	65	4	16	20
Transport following pre-grading		7,5	33	3	20	22

Table 3. The shift hours demand and the costs of the operations of foil covered field cucumber production on 20 ha

Operations	Machine working hours (h)	Cost of operation (EUR)
Stubble ploughing	6	284
Medium deep loosening	16	616
Spreading organic manure	28	672
Fertilizer transport	5	106
Spreading of fertilizer	5	153
Deep ploughing	13	553
Fertilizer transport	5	106
Spreading of fertilizer	5	153
Ploughing processing	4	176
Seed bed preparation	5	234
Levelling the surface	5	118
Ridge bed preparation	50	1958
Mulching, hauling in the hosepipe	80	2120
Water supply	22	531
Transport of plantlets	5	106
Planting	200	5773
Preparation of foil tunnel	100	4170
Irrigation	80	2388
Spray mixture transport (12x)	48	1351
Spraying (12x)	48	1503
Picking	100	4441
Transport	100	2407
Transport following pre-grading	150	3844
Technology - total	1.080	33763
Shift hour per hectare (sh/ha)	54	-
Cost per hectare (EUR/ha)	-	1688

The investment cost of the machines applied in the production technology is 510.396 EUR out of which the purchasing price of the working machines amounts to 197.300 EUR, which equals about 39 % of the total investment cost. The purchasing price of the power machines is 313.096 EUR, about 61 % of the total cost of machines.

In case of power machines it can be stated that one power machine with an engine capacity of 140 kW is needed for the hard cultivation works. The tasks of nutrients delivery, ridge-bed preparation, mulching, hauling the hosepipe, planting, foil tunnel preparation, plant protection, harvesting and tractor delivery are fulfilled by a 70 kW main and a 60 kW aid machine. A low-cost trailer can be used for the road transportation of the product. With this selection of power machines lower acquisition costs and a more effective utilization of power machines can be achieved [10].

Cucumber production on 20 ha demands 1080 shift hours of machine work, out of which the two lower capacity tractors represent a great proportion, about 800. In comparison to this the 44 shift hour performance of the high capacity power machine in the course of cultivation is negligible. Transport by tractor from the field (100 shift hour) and road transport by trailer to the processing plant (150 shift hour) is one of the most time-demanding operations.

Tasks like fertilizer transport, water supply, transport of plantlets, spray mixture transport takes only 85 shift hours on 20 hectares.

4. Conclusion

The machine work costs of field foil covered cucumber production compared to the production costs of other field vegetable varieties are high [11, 12].

The significant hand labour demand is characteristic of this product by planting as well as by the preparation of the foil tunnel but first of all by harvesting when the expert and quality work of 28 persons might as well be needed. A high quality final product can be ensured through hand picking, but it comes at a price. The picking personnel of 16-28 persons represents a remarkable loan cost.

In the present production technology the shift hour demand of machine operations and material handling is about 4,5 hours/tonne, besides a calculated average yield of about 12 t/ha.

It can be stated on the basis of the results that the total shift hour demand of the machines amounts 54 hours per hectare, which include the volume of transport and material handling tasks in value of 17 hours/ha.

Special attention is to be paid to the machine operations like foil tunnel preparation, picking and planting which the most time demanding ones are representing about 9, 10 and 20 % of the total machine working hours. It is worth mentioning that time demand of transport and material handling takes the highest value, about 33 % of the total shift hours of production technology.

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