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The Annual Maintenance Costs of Draft Horses as a Part of Fixed Costs in Horse-Powered Agriculture: A Case Study from Požega, Croatia †

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Abstract: The aim of this research is to estimate the fixed costs of the maintenance of draft horses in a low-input farm. Research has revealed that in the investigated case, the fixed costs of maintenance of three draft mares were EUR 5115.39 annually, with human working hours having the greatest share of 73.6%. Income from sales of foals partially offsets the total fixed costs, thus virtually lowering the costs to the level of EUR 1215.39 annually. At the investigated farm (operating on 1.3 ha of arable field crops), the fixed costs per worked arable area were very high, amounting 934.92 EUR/ha, mainly because of little total arable area worked. The theoretical capacity of horse-powered farming with three mares historically was 15 ha, and at such an area, the fixed costs per hectare would fall to the acceptable level of 81 EUR/ha. However, the acceptance of horse-powered farming could face much hesitance, mainly because it is a labor-intensive way of farming, far from the attitudes of modern people. Personal inner transformation might help make this option more attractive.

Keywords: low-input farming; animal work; fixed costs; personal inner transformation

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1. Introduction

In the light of need for lesser reliance on fossil energy resources, as well as for lesser environmental impact, horse-powered farming might offer a fairly sustainable option. Namely, draft horses are being fueled with fodder, which comprises organic compounds rich in energy captured from recent photosynthesis [1]. Moreover, this fodder is produced close to the place of consumption, most often at the same farm where it is utilized, thus avoiding distant transport. Technology for producing the fodder is quite simple and cheap, as are the horse-drawn implements used in traditional farming. Horse-powered agriculture also offers the benefits of lessening soil compaction, which has become a serious problem in arable farming [2], thus helping farmers to recover the soil capacity for water accumulation and improve the drought resistance and soil fertility [3]. Despite the obvious attractiveness of animal-powered farming, there are many economic issues unknown to modern decision makers in the farming sector. Among the issues certainly are the fixed costs, in this case related to the maintenance of draft horses on an annual basis. These costs include the feed costs, watering, housing (shelter and fencing), and care. The aim of this research is to reveal the fixed costs of draft horse maintenance in a small family farm near Požega, Croatia.

2. Materials and Methods

Data for conducting this research have been obtained by on-farm observations of horse feeding, care, and work, and from the records of the investigated family farm near Požega

(in the hilly region of the central Slavonia, Croatia). The farm constantly (in the long run) keeps three mares of the Croatian Heavy Draft Horse Breed (average body weight of about 650 kg/head), and raises three foals each year. Foals are being sold each year after weaning (at the age of 7 months) as a source of income or, in some circumstances, are kept on the farm for the replacement of an old mare (rarely). Mares on the farm usually give a draft force for powering the field agrotechnical operations on the entire 1.3 ha of arable land (for soil preparation, seeding and the cultivation of oats, maize, and green-manure crops, like crimson clover and brassicas), for transport of hay and manure and, on some occasions, for pulling a carriage in wedding procession. Forages fed to horses come from the nearby abandoned grasslands and lucerne crop (hay for winter feeding and fresh green herbage for summer feeding), at virtually no cost, since the use of the meadow and lucerne was free, whilst the oats come from their own oats crop. The costs of mowing the meadow, hay gathering, baling and transport of bales amounted for total of 13 EUR/220 kg round bale in the year 2022, which equals 0.052 EUR/kg of hay. The meadow gives between 38 and 60 bales of hay annually, depending on the year. The cost of the oats is assumed to be equal to the average market price during period from the last harvest to the forthcoming harvest in July 2023, which was 0.30 EUR/kg. The cost of working hours of the farmer is assumed to be equal to the per-hour net Croatian average salary (1094 EUR/month, with 21 working days of 8 h per day [4]), which amounts for 6.51 EUR/hour. The average Eurodiesel fuel price was assumed to be 1.40 EUR/l.

3. Results

During the winter season (from mid-October to mid-March), the horses are kept in the winter coral, with a shelter near the farmer's home (a distance about 150 m) and, therefore, it took only one hour daily (Table 1) for the farmer to serve the fodder and water to the horses, and to take care of them (grooming, checking the fencing, checking their health). During the summer season (from mid-March to mid-October) the horses are kept in summer coral near the orchard, meadow, and small arable field of the farmer (the distance from farmer's home is about 2.5 km). During the summer period, the farmer needed two hours daily (Table 1) to get to the meadow or lucerne crop, to mow the fresh herbage, to load the herbage into a private van, to take and serve it to the horses, for watering, care for the horses, and for checks of the fencing.

Table 1. Daily consumption of fresh herbage, hay, and oats, working hours spent by the farmer, and the related monetary costs for the three mares (in winter) plus three foals (in summer).

	Winter Period			Summer Period		
Daily Consumption and Costs	**Total**	**Per Mare**	**Total EUR**	**Total**	**Per Mare and Foal**	**Total EUR**
Hay consumption (kg)	73	24	3.80			
Fresh green herbage (kg)				300	100	0.00
Oats consumption (kg)	6	2	1.80	6	2	1.80
Farmers working hours (h)	1	0.33	6.51	2	0.67	13.02
Diesel fuel for private van (l)				0.4	0.13	0.56
Total daily			12.11			15.38

The total costs during the summer period were much greater than during the winter period (Table 2), due to the longer period of summer feeding, and doubled the farmer's working time spent on serving the horses, mainly because of the time needed for everyday mowing and transporting the herbage to the summer coral.

Table 2. Annual consumption of fresh herbage, hay, and oats, working hours spent by the farmer, and the related monetary costs for the three mares (in winter) plus three foals (in summer).

	Winter Period			Summer Period		
Seasonal Consumption and Costs	**Total**	**Per Mare**	**Total EUR**	**Total**	**Per Mare and Foal**	**Total EUR**
Hay consumption (kg)	11,096	3699	576.99			
Fresh green herbage (kg)				63,900	21,300	0.00
Oats consumption (kg)	912	304	273.60	1278	426	383.00
Farmers working hours (h)	152	51	989.52	426	142	2773.00
Diesel fuel for private van (l)				85.2	28.4	119.28
Total seasonal			1840.11			3275.28
Total annual			5115.39			

The farmer's working hours resulted in the greatest share in the total annual costs of three draft mares' maintenance (Figure 1), followed by cost of oats, hay, and diesel fuel.

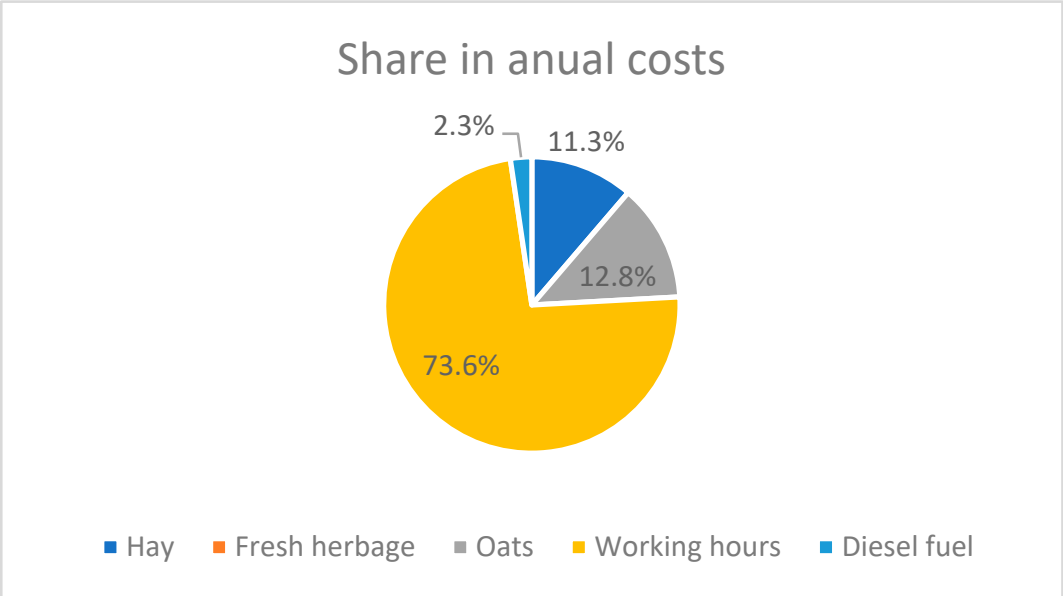

Figure 1. The share of various costs in the total annual cost of maintenance of the three draft mares.

The income from the foals depends on the sex of the foals. Namely, males are sold for 1000 EUR/head, whilst females for 1600 EUR/head. Under the assumption that the ratio of male: female is 1:1, then the average income per foal would be 1300 EUR/head, which totals EUR 3900 annually per three mares. The income from the sales of foals partially offsets the total annual costs of keeping the draft mares, so the rest of EUR 1215.39 should be charged to the use of the mares in field work, i.e., agrotechnical operations. On the investigated farm, these three draft mares give the draft power for cultivating 1.3 ha of arable land, thus giving an average fixed cost of 934.92 EUR/ha. This can be deemed as relatively high when compared to the average value of field arable crops, like maize, wheat, and oats (between 1000 and 3000 EUR/ha), but in the case of the studied farm, it is because the farm operates on a small area. Under the assumption that a well-trained pair of horses can give power to up to 15 ha of field crops, the fixed costs diminish with an increase in the farm size, down to 81 EUR/ha for a farm size of 15 ha (Figure 2).

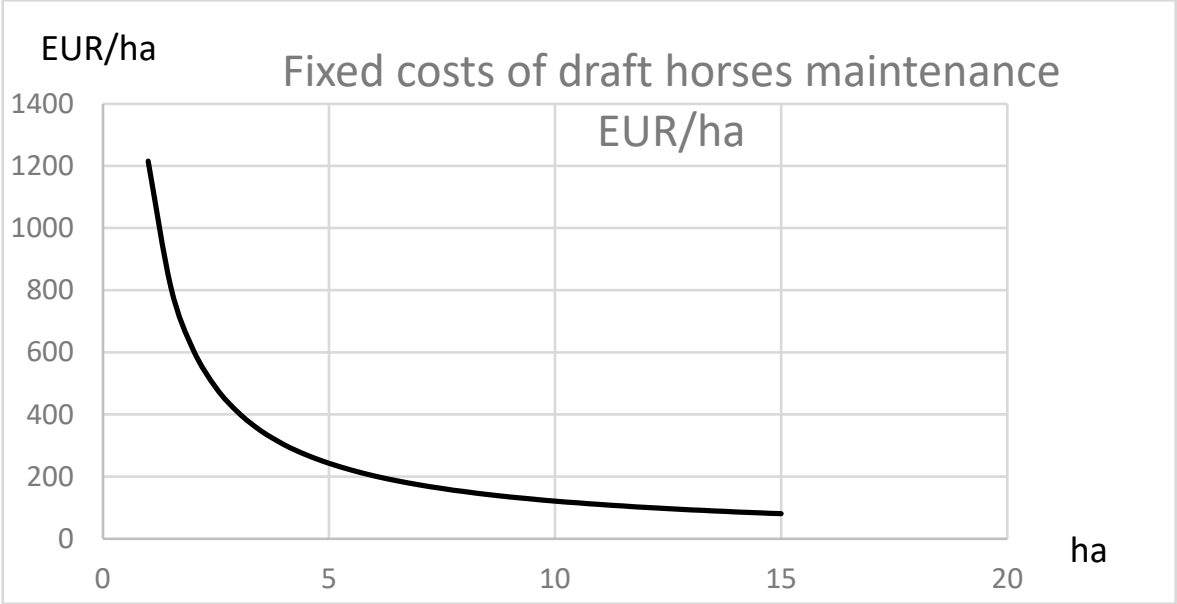

Figure 2. Projected fixed cost per ha, depending on the farm size.

4. Discussion

Despite the fact that fixed costs can be lowered to an acceptable level with an increase in the farm's arable area (up to the historical maximum of 15 ha per pair of draft horses), the acceptance of horse-powered farming could face much hesitance, mainly because it is a labor-intensive way of farming, far from the attitudes of modern people. Personal inner transformation [5] might help make this option more attractive.

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